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NAS WHITING FIELD
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FEASIBILITY STUDY FOR SITE 16 OPEN DISPOSAL AND BURNING AREA NAS WHITING FIELD

3/1/2001

HARDING LAWSON ASSOCIATES

FEASIBILITY STUDY

SITE 16, OPEN DISPOSAL AND BURNING AREA

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

UNIT IDENTIFICATION CODE: N60508
CONTRACT NO.: N62467-89-D-0317/116

MARCH 2001

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA 29418

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FEASIBILITY STUDY
SITE 16, OPEN DISPOSAL AND BURNING AREA

NAVAL AIR STATION WHITING FIELD
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USEPA ID No.: FL2170023244

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March 2001

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/116 are complete and accurate and comply with all requirements of this contract.

DATE: March 15, 2001

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(DFAR 252.227-7036)

The evaluations and professional opinions rendered in this planning document describing the feasibility study for Site 16, Naval Air Station Whiting Field, Milton, Florida, were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document is not intended to be used for construction of the selected alternative.

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FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, and/or disposal of hazardous materials. Through accidental spills or leaks or as a result of and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by current 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 Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

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

The IR program is conducted in several stages as follows:

- preliminary assessment (PA),
- site inspection (SI) (formerly the PA and SI steps were called the initial assessment study under the NACIP program),
- remedial investigation and feasibility study, and
- remedial design and remedial action.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. 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 CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (843) 820-5574.

TABLE OF CONTENTS

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

CHAPTER	TITLE	PAGE NO.
1.0	INTRODUCTION	1-1
1.1	THE CERCLA FS PROCESS.	1-2
1.2	PURPOSE.	1-3
1.3	ENVIRONMENTAL CONDITIONS.	1-4
1.4	RI SUMMARY.	1-7
2.0	REMEDIAL ACTION OBJECTIVES	2-1
2.1	APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.	2-1
2.1.1	Chemical-Specific ARARs	2-2
2.1.2	Location-Specific ARARs	2-2
2.1.3	Action-Specific ARARs	2-2
2.1.4	To Be Considered Criteria	2-5
2.2	IDENTIFICATION OF RAOs.	2-5
2.3	VOLUME OF CONTAMINATED MEDIA	2-11
2.4	IDENTIFICATION OF GENERAL RESPONSE ACTIONS.	2-11
3.0	REMEDIAL ACTION ALTERNATIVES	3-1
3.1	IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES	3-1
3.2	REMEDIAL ALTERNATIVES.	3-4
3.2.1	Alternative 1: No Action	3-4
3.2.2	Alternative 2: Land Use Controls	3-4
3.2.3	Alternative 3: Soil Cover and LUCs	3-4
3.2.4	Alternative 4: Limited Soil Removal and LUCs	3-5
4.0	ETAILED ANALYSIS OF ALTERNATIVES	4-1
4.1	DETAILED ANALYSIS FOR ALTERNATIVE 1: NO ACTION	4-1
4.1.1	Detailed Description of Alternative 1	4-1
4.1.2	Technical Criteria Assessment of Alternative 1	4-2
4.2	DETAILED ANALYSIS FOR ALTERNATIVE 2: LAND USE CONTROLS (LUCs)	4-4
4.2.1	Detailed Description of Alternative 2	4-4
4.2.2	Technical Criteria Assessment of Alternative 2	4-4
4.3	DETAILED ANALYSIS FOR ALTERNATIVE 3: SOIL COVER AND LUCs.	4-6
4.3.1	Detailed Description of Alternative 3	4-6
4.3.2	Technical Criteria Assessment of Alternative 3	4-7
4.4	DETAILED ANALYSIS FOR ALTERNATIVE 4: LIMITED SOIL REMOVAL AND LUCs.	4-9
4.4.1	Detailed Description of Alternative 4	4-9
4.4.2	Technical Criteria Assessment of Alternative 4	4-11

TABLE OF CONTENTS (Continued)

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

CHAPTER	TITLE	PAGE NO.
5.0	COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES	5-1
5.1	OVERALL APPROACH TO COMPARATIVE ANALYSIS.	5-1
5.1.1	Threshold Criteria	5-1
5.1.2	Primary Balancing Criteria	5-1
5.1.3	Modifying Criteria	5-1
5.2	COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVE.	5-2
5.2.1	Comparison of Threshold Criteria	5-2
5.2.2	Comparison of Primary Balancing Criteria	5-2
5.2.3	Modifying Criteria	5-3
5.3	SOIL VOLUME SENSITIVITY ANALYSIS.	5-3

REFERENCES

APPENDICES

Appendix A: Navy's Request for Site-Specific Soil Cleanup Goal for Arsenic at Disposal Sites at NAS Whiting Field

Appendix B: Florida Department of Environmental Protection's Response and Acceptance of the Site-Specific Soil Cleanup Goal for Arsenic for Disposal Sites at NAS Whiting Field

Appendix C: Volume Estimates for Contaminated Media

Appendix D: Cost Calculations for Remedial Alternatives

Appendix E: Response to Agency Comments

LIST OF FIGURES

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Figure	Title	Page No.
1-1	Location of RI/FS Sites at NAS Whiting Field	1-5
1-2	Site 16, General Features	1-6

LIST OF TABLES

Table	Title	Page No.
2-1	Synopsis of Federal and State ARARs and Guidance	2-3
2-2	Summary of Contaminants Exceeding ARARS and TBCs in Surface Water	2-5
2-3	Summary of Chemicals Exceeding ARARs and TBCs in Surface Soil	2-7
2-4	Summary of Chemicals Exceeding ARARs and TBCs in Subsurface Soil	2-10
2-5	Summary of Remedial Action Objectives for Site	2-11
3-1	Identification and Screening of Remedial Technologies	3-2
3-2	Development of Remedial Alternatives	3-6
4-1	Criteria for Evaluation of Remedial Action Alternatives	4-2
4-2	Cost Summary Table, Alternative 1: No Action	4-3
4-3	Cost Summary Table, Alternative 2: Land Use Controls	4-5
4-4	Cost Summary Table, Alternative 3: Soil Cover and LUCs	4-9
4-5	Cost Summary Table, Alternative 4: Limited Soil Removal and LUCs	4-12
5-1	Soil Volume Cost Sensitivity Analysis	5-3

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable or relevant and appropriate requirement
BEI	Bechtel Environmental Inc.
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/s	centimeters per second
COC	chemicals of concern
CT	central tendency
ECOPC	ecological contaminant of potential concern
ELCR	excess lifetime cancer risk
ERA	ecological risk assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FGGC	Florida Groundwater Guidance Concentration
FS	feasibility study
FSCG	Florida Soil Cleanup Goal
GCTL	groundwater cleanup target level
GIR	General Information Report
HHCOPC	human health chemical of potential concern
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates
IR	Installation Restoration
IRA	interim remedial action
JP-5	jet propellant
LUC	land-use control
LUCIP	Land-Use Control Implementation Plan
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
OSHA	Occupational Safety and Health Act
PCB	polychlorinated biphenyls
ppm	parts per million

GLOSSARY (Continued)

RA	remedial action
RAO	remedial action objective
RBC	risk based concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SCTL	soil cleanup target level
SVOC	semivolatile organic compound
TBC	to be considered
TCL	target compound list
TRPH	total petroleum recoverable hydrocarbon
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yard

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a feasibility study (FS) for Site 16, Open Disposal and Burning Area, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS is being completed under contract number N62467-89-D-0317-116. The FS report for Site 16 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (ABB Environmental Services, Inc. [ABB-ES], 1998a) and Remedial Investigation (RI) report (HLA, 2000) to present the results of the overall RI/FS for the site. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 16.

Investigations at NAS Whiting Field, a facility listed on the National Priorities List, are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300). The investigations at the facility are being conducted under the Navy's Installation Restoration (IR) program, which is designed to identify and abate or control contaminant migration resulting from past operations at naval installations while working within the aforementioned regulatory framework. SOUTHNAVFACENGCOM is the agency responsible for the Navy's IR program in the southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through preliminary assessment, site inspection, RI/FS, and remedial response selection.

The goals of the RI/FS are (1) to assess the extent, magnitude, and impact of contamination at the sites, (2) to qualitatively and quantitatively assess the risk posed to human health and the environment by site-related contamination, and (3) to develop remedial alternatives that address threats to human health and/or the environment. The first two elements have been discussed in the GIR and RI reports; the remaining element will be presented and discussed in this FS Report.

The GIR provides information common to all sites at NAS Whiting Field, such as

- facility information and history,
- description of physical characteristics of the facility (climatology, hydrology, soil, geology, and hydrogeology),
- summary of previous investigations,
- summary of the field investigations activities conducted during the RI,
- baseline risk assessment (BRA) methodology for both human health and ecological receptors, and
- a summary of the facility-wide background evaluation.

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics, for conducting a BRA, and for collecting physical measurements and chemical analytical data necessary for remedial alternative evaluation in the FS. The RI provides the basis for determining whether or not remedial action is necessary. The RI Report for Site 16 at NAS Whiting Field provides the following information:

- a site description and a summary of previous investigations for Site 16;
- a summary of the field investigation methods used during the RI at the sites;
- a site-specific data quality assessment;
- an assessment of the extent, magnitude, and impact of contamination at the sites; and
- a qualitative and quantitative assessment of risks to human health and the environment.

The FS, described in more detail later in this chapter, uses the results of the RI and the information presented in the GIR to identify remedial action objectives (RAOs) and to develop, screen, and evaluate potential remedial alternatives. The FS is prepared in accordance with the following regulations and guidance documents: CERCLA, as amended by SARA (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the NCP (40 CFR, Part 300); and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (RI/FS Guidance) (USEPA, 1988).

The remaining sections in this chapter describe the FS process for CERCLA sites (Section 1.1), present how this process is applied to NAS Whiting Field sites (Section 1.2), and provide the conceptual understanding of Site 16 environmental conditions as of the completion of the RI report (Section 1.3).

1.1 THE CERCLA FS PROCESS.

The development of remedial alternatives for CERCLA sites consists of developing RAOs and then identifying applicable technologies and developing those technologies into remedial alternatives to meet the RAOs. The NCP requires that a range of alternatives be presented in the FS to the maximum extent practicable.

The first step in the FS process is to develop RAOs that specify the contaminants, media of interest, exposure pathways, and preliminary remedial goals that permit a range of alternatives to be developed. The preliminary remedial goals are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs), when available, site-specific risk-based factors, or other available information.

Once RAOs are identified, general response actions for each medium of interest are developed. General response actions typically fall into the following categories: no action, containment, excavation, extraction, treatment, disposal, or other actions, singular or in combination, that may be taken to satisfy the RAOs for the site.

The next step in the FS process is to identify and screen applicable technologies for each general response action. This step eliminates those technologies that cannot be implemented technically. Those technologies that pass the screening phase are then assembled into remedial alternatives. Remedial alternatives are then described and analyzed in detail using seven criteria described in the NCP, including

- overall protection of human health and the environment;
- reduction of toxicity, mobility, or volume of contaminants through treatment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- short-term effectiveness;
- implementability; and
- economics (i.e., cost).

Alternatives are evaluated against two additional factors after State participation and the public comment period for the FS:

- State acceptance, and
- community acceptance.

The results of the detailed analyses (for the first seven criteria) are summarized and compared in a comparative analysis. The alternatives are compared with each other against several criteria, including the following:

Threshold criteria:

- protection of human health and the environment; and
- attainment of Federal and State human health and environmental requirements identified for the site.

Primary Balancing criteria:

- cost effectiveness;
- use of permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable; and
- preference for treatment that reduces toxicity, mobility, or volume of contaminants as a principal element.

These criteria are used because SARA requires them to be considered during remedy selection. Modifying criteria, which include State and community acceptance, are also evaluated. State acceptance is evaluated when the State reviews and comments on the draft FS report and a proposed plan is then prepared in consideration of the State's comments. Community acceptance is evaluated based on comments received on the FS and proposed plan during a public comment period. This evaluation is described in a responsiveness summary in the Record of Decision (ROD).

The entire FS process provides the technical information and analyses that form the basis for a proposed remedial action plan (proposed plan) and subsequent ROD that documents the identification and selection of the remedy.

1.2 PURPOSE.

The purpose of the FS report is to document the results of the study that includes developing RAOs to address contaminated media at the site and developing, screening, and evaluating potential remedial alternatives to meet these objectives. The FS was based on the results and conclusions of the RI completed for the site, and the information presented in the GIR. Information presented in these reports will not be repeated in this FS Report.

The FS report for Site 16 was developed in accordance with the NCP. The NCP states that the U.S. Environmental Protection Agency (USEPA) expects containment technologies will generally be appropriate for waste (e.g., landfills) that pose a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). Additionally, the USEPA expects physical and/or thermal treatment to be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (Section 300.430[a][1][iii][A]).

Therefore, the purpose of the FS report is not to present all the possible variations and combinations of remedial actions that could be taken at the site, but to present distinctly different alternatives representing a range of opportunities for meeting the RAOs. It is expected that these different alternatives can be adjusted during the proposed plan and decision process, and to a lesser extent during detailed design, to accomplish RAOs in a manner similar to the initially proposed alternative. The FS report also does not present information on alternatives that fail to meet the RAOs, except for a no action alternative, which provides a baseline for comparison of all alternatives.

The following components are considered in identifying appropriate remedial action for Site 16:

- ***Remedial Action Objectives.*** RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals for the site.

- ***Applicable Technologies.*** Technologies applicable for addressing contaminated media at the site are identified and screened. Technologies that cannot be implemented are eliminated.

- ***Remedial Alternatives.*** Technologies that pass the screening phase are assembled into remedial alternatives.

- ***Detailed Analysis.*** Selected remedial alternatives are described and evaluated using seven of the nine criteria outlined in the NCP.

- ***Comparative Analysis.*** Remedial alternatives identified for Site 16 are compared against each other using threshold and primary balancing criteria.

Upon completion of the FS Report, a Proposed Plan will be developed. The Proposed Plan will identify the preferred remedial alternative for Site 16. This document will be written in community-friendly language and will be made available for public comment. Upon receipt of public comments, responses to these comments will be developed in a responsiveness summary and the ROD will be prepared. The ROD will document the chosen alternative for the site and will include the responsiveness summary as an appendix. Once the ROD is signed, the chosen remedial alternative will be implemented.

1.3 ENVIRONMENTAL CONDITIONS.

Site 16 is an approximately 12-acre parcel located in the southwestern part of the facility, directly west of the South Air Field (Figures 1-1 and 1-2). The site is currently forested with planted pine trees. The land surface slopes gently to the west at an average grade of five percent.

For over 20 years (1943-1965), this area served as the primary waste disposal area for the facility. There were two large pits into which general refuse plus waste from aircraft operation and maintenance were disposed. Aviation wastes included paints, solvents, waste oil, hydraulic fluid, and wastewater from paint stripping and other operations. Estimated annual disposal volumes were 3,000 to 4,000 tons (Geraghty and Miller, 1985). To reduce the volume of waste, diesel fuel was used to ignite the waste.

According to the U. S. Department of Agriculture (USDA) (1980), the surface soil at Site 16 is classified as Troup loamy sand with some Lakeland sand. The Troup has a thick sandy surface layer overlying a loamy red subsoil to a depth of 40 to 80 inches below land surface (bls).

The topography of Site 16 slopes toward Clear Creek, which is located 450 feet west of the site. Although overland transport of surface water runoff towards Clear Creek is possible, most of the on-site rainfall infiltrates directly into ground due to erosion control measures and the porous nature of the sandy soil at Site 16.

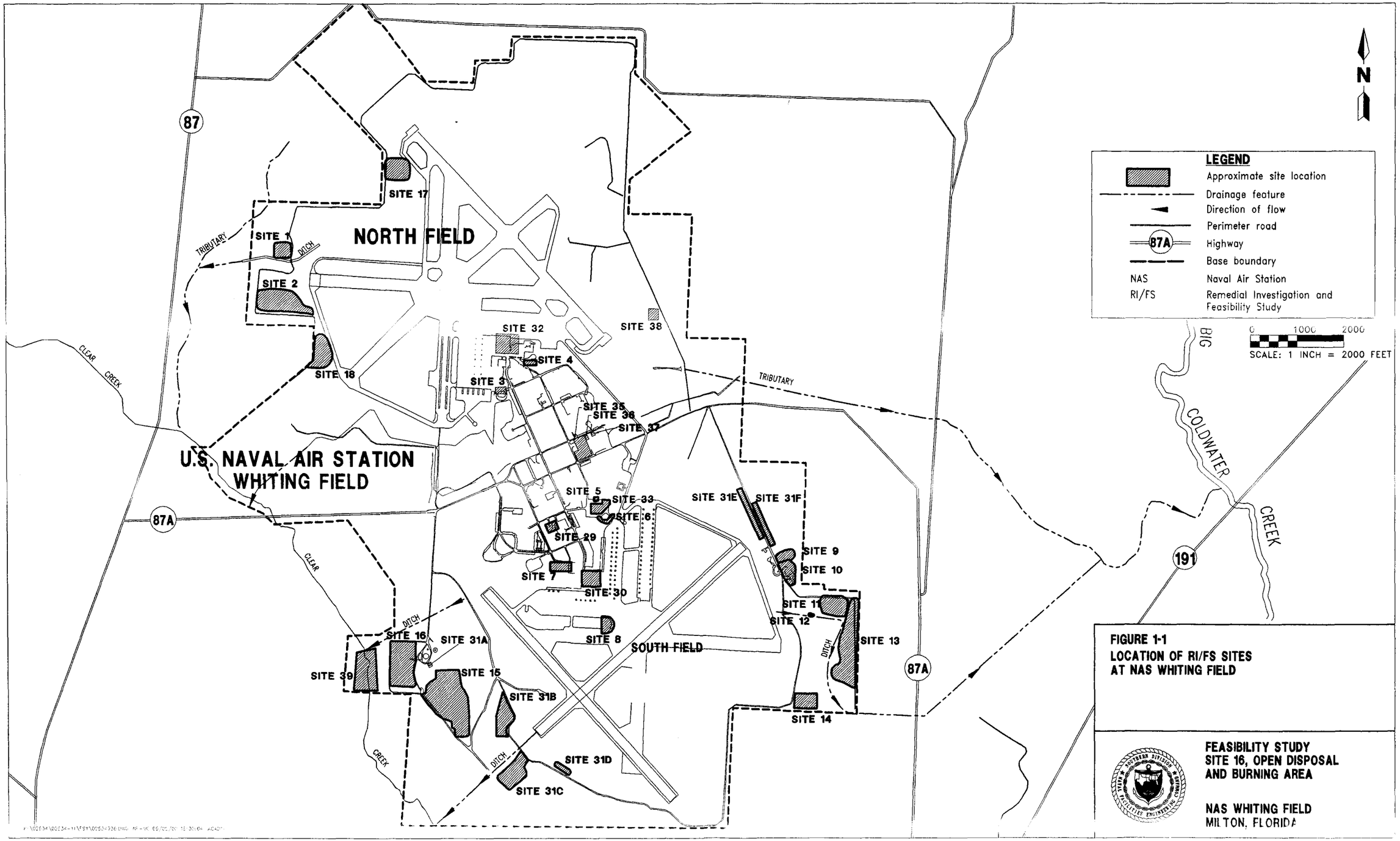

FIGURE 1-1
LOCATION OF RI/FS SITES
AT NAS WHITING FIELD

FEASIBILITY STUDY
SITE 16, OPEN DISPOSAL
AND BURNING AREA

NAS WHITING FIELD
MILTON, FLORIDA

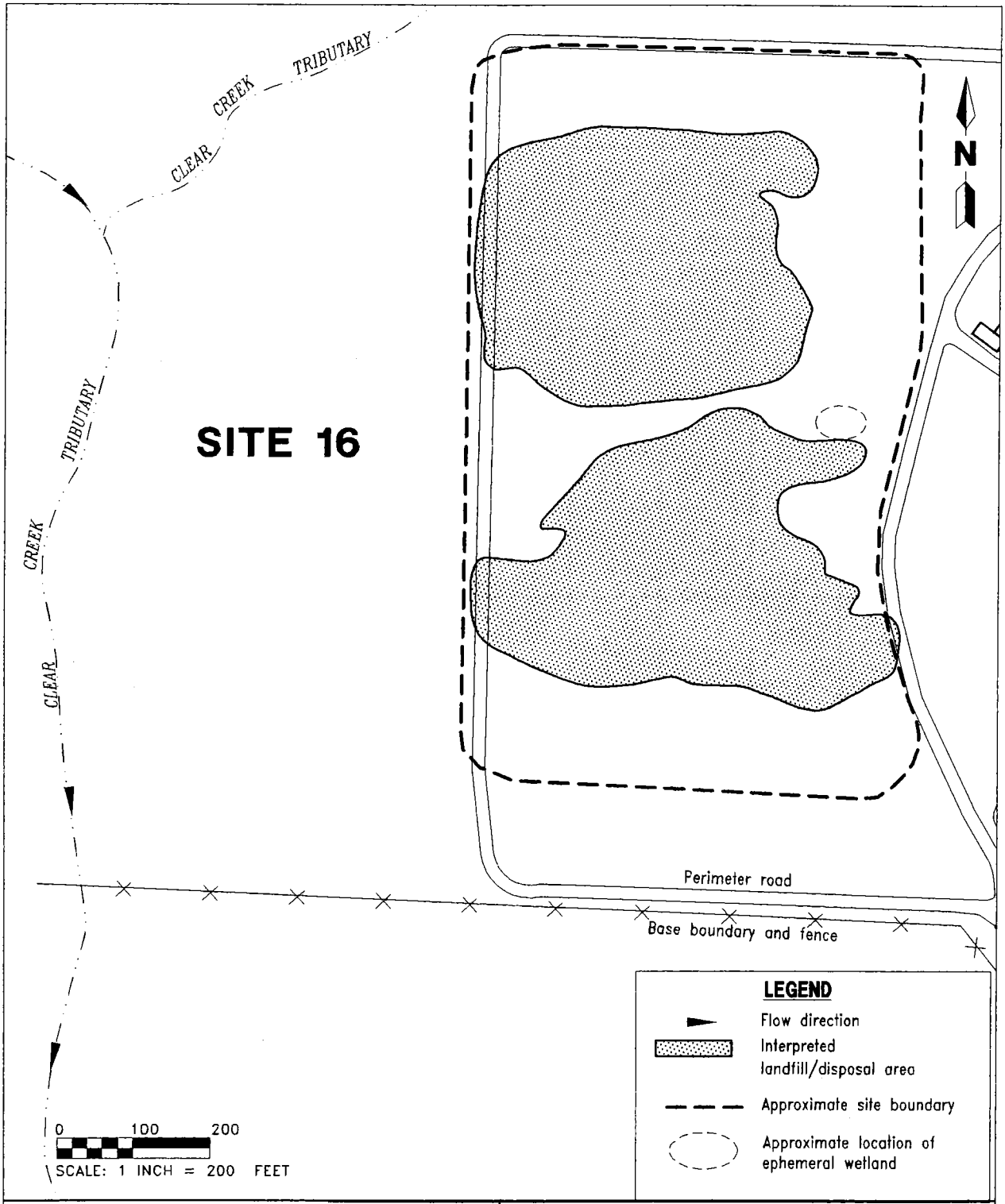

FIGURE 1-2
GENERAL FEATURES

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FEASIBILITY STUDY
SITE 16, OPEN DISPOSAL AND BURN AREA

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

1.4 RI SUMMARY.

The final RI report was submitted by HLA in December 1999. The conclusions listed below from the RI are pertinent to the development of this FS for soils.

- Geophysical survey results suggested the presence of two separate large areas of geophysical anomalies indicating general disposal areas rather than trenched fill areas. Smaller geophysical anomalies present east of the site are interpreted to represent random disposal areas rather than points of controlled fill.

- Ten test pits were excavated at the locations of geophysical anomalies at Site 16. Materials encountered during test pit excavations include construction debris, metallic debris, and aircraft parts.

- Methane and volatile organic compounds (VOCs) were detected during the soil gas survey conducted at Site 16. The highest soil gas concentrations (exceeding 5,000 parts per million [ppm] methane) were reported near the northeastern boundary of the southern landfill boundary.

- Two VOCs, 14 semivolatile organic compound (SVOCs), 6 pesticides, and 2 polychlorinated biphenyl (PCB) compounds were detected in 30 surface soil samples. None of the VOCs, detected in surface soils, exceeded regulatory limits.

- The SVOCs, benzo(g,h,i)perylene and dibenzo(a,h)anthracene, exceeded the Region III risk-based concentration (RBCs). Two SVOCs, benzo(a)pyrene and benzo(g,h,i)perylene, exceeded the industrial cleanup target levels for Florida. Benzo(a)pyrene and dibenzo(a,h)anthracene and exceeded the industrial soil cleanup target levels (SCTLs) for Region III RBCs. Benzo(a)pyrene and benzo(b)fluoranthene exceed the U.S. Environmental Protection Agency (USEPA) Region III RBCs and Florida residential cleanup target levels for surface soil.

- Dieldrin was detected in two samples at concentrations exceeding the residential SCTL for Florida and for USEPA Region III RBC. No other pesticides or PCBs were detected at concentrations that exceeded either Florida or Federal standards.

- Twenty-three inorganic analytes and cyanide were detected in the 30 surface soil samples. Eighteen inorganic analytes exceeded the background screening values for surface soil. Beryllium, iron, and lead exceeded the Florida residential SCTLs. Arsenic and beryllium exceeded the residential values for the Florida SCTLs and the USEPA Region III RBCs. Arsenic also exceeded the USEPA Region III RBC and the Florida industrial SCTL.

- Seven VOCs, 11 SVOCs, and 4 pesticides compounds were detected in the five Site 16 subsurface soil samples. None of the detected concentrations of VOCs, SVOCs, or pesticides exceeded the USEPA Region III RBCs for industrial-use soils.

- Twenty inorganic analytes were detected in the five subsurface soil samples. Eight analytes (calcium, chromium, iron, manganese, potassium, vanadium, zinc, and cyanide) were detected at concentrations exceeding the background screening values. None of these inorganics exceeded industrial standards for either the Florida SCTLs or USEPA Region III RBCs.

- Arsenic was detected in all five subsurface soil samples at concentrations ranging from 1.5 to 15.1 milligrams per kilogram (mg/kg). Three of the five environmental samples and the duplicate sample exceeded the industrial SCTL for Florida (3.7 mg/kg) and the USEPA Region III RBC (3.8 mg/kg).

- Lead was detected in all five subsurface soil samples at concentrations ranging from 6.8 to 766 mg/kg. Lead concentrations exceeded the industrial values for the USEPA Region III RBCs (400 mg/kg) in two samples, but were below Florida industrial SCTLs.

- The human health risk assessment identified 8 polynuclear aromatic hydrocarbons (PAHs) (benzo(a)-anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), 1 pesticide (dieldrin) and 10 inorganic analytes (aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and vanadium) as human health chemical of potential concerns (HHCPCs) for surface soil at Site 16. Three inorganic analytes (arsenic, iron, and lead) were identified as HHCPCs for subsurface soil at Site 16.

- The total excess lifetime cancer risk (ELCR) at Site 16, associated with ingestion of soil by a hypothetical future resident, current and hypothetical future trespasser, and hypothetical future occupational worker, exceeded Florida's target risk level of concern (1×10^{-6}) due primarily to carcinogenic PAHs and arsenic.

- Noncancer risk levels for soil, subsurface soil, and surface water meet the USEPA and FDEP target hazard index (HI) of one.

- The surface water ELCR for hypothetical future residents exceeds Florida's target level of concern due to beryllium. It should be noted, however, that this ELCR is based only on one sample.

- The central tendency risks from surface soil and surface water to a hypothetical current and future trespasser, and a hypothetical future occupational worker (soil only) met the Florida level of concern (1×10^{-6}) for Site 16. Central tendency residential risks remain slightly above the FDEP target levels.

- The ecological risk assessment selection of ecological contaminant of potential concerns (ECPCs) for the surface soil samples collected at Site 16 include thirteen SVOCs (carbazole, bis(2-ethylhexyl)phthalate, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno (1,2,3-cd) pyrene, phenanthrene, and pyrene), one PCB (Aroclor-1254), one pesticide (dieldrin), and ten inorganic constituents (aluminum, barium, cadmium, copper, lead, manganese, mercury, silver, vanadium, and zinc).

- ECPCs selected for the surface water sample collected from the ephemeral wetland at Site 16 include seven inorganic analytes (aluminum, barium, beryllium, iron, lead, manganese, and zinc).

- Risks were identified for terrestrial wildlife resulting from exposure to ECPCs in surface soil; therefore, reductions in the survivability, growth, and reproduction of wildlife receptor populations at Site 16 may occur.

- Reduction in terrestrial plant and soil invertebrate biomass used as forage material was evaluated by comparing exposure concentrations for surface soil with toxicity benchmarks. Based on this comparison, it is unlikely that plant and invertebrate biomass or plant cover availability would be reduced such that small mammal and bird populations at Site 16 would be affected.

2.0 REMEDIAL ACTION OBJECTIVES

This section presents the goals and objectives for remedial action at Site 16 providing the basis for selecting appropriate RAOs and, subsequently, identifying remedial technologies and developing alternatives to address contamination at the site. To establish these objectives, ARARs are first identified (Section 2.1). Next, RAOs are defined based on consideration of ARARs, the results and conclusions of the RI, the risk assessment, and other criteria (Section 2.2). Next, the volume of contaminated media for Site 16 is presented (Section 2.3). Finally, general response actions, appropriate for technology identification, are discussed (Section 2.4). The information presented in this chapter will be used to identify appropriate remedial technologies for the sites (presented in Chapter 3.0).

2.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

ARARs are Federal and State human health and environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with State ARARs that are more stringent than Federal ARARs, legally enforceable, and consistently enforced statewide.

The NCP defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements.

> Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal or State environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. State standards that may be applicable are only those which (1) have been identified by the State in a timely manner, (2) are consistently enforced, and (3) are more stringent than Federal requirements.
>
> Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements under Federal and State environmental and facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, or remedial action, address situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

"Applicability" is a legal determination of jurisdiction of existing statutes and regulations, whereas "relevant and appropriate" is a site-specific determination of the appropriateness of existing statutes and regulations. Therefore, relevant and appropriate requirements allow flexibility not provided by applicable requirements in the final determination of cleanup levels. Once a requirement is identified as an ARAR, the selected remedy must comply with ARARs, even if the ARAR is not required to assure protectiveness. The general relevant and appropriate requirements apply only to actions at the site. Applicable requirements apply to both on- and off-site remedial actions.

Other requirements "to be considered" (TBC) are Federal and State nonpromulgated advisories or guidance that are not legally binding and do not have the status of potential ARARs (i.e., they have not been promulgated by statute or regulation). However, if there are no specific ARARs for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

Under the description of ARARs set forth in the NCP and SARA, State and Federal ARARs are categorized as:

- chemical-specific (i.e., governing the extent of site remediation with regard to specific contaminants and pollutants);
- location-specific (i.e., governing site features such as wetland, floodplains, and sensitive ecosystems and pertaining to existing natural and manmade site features such as historical or archaeological sites); and
- action-specific (i.e., pertaining to the proposed site remedies and governing the implementation of the selected site remedy).

During the detailed analysis of remedial alternatives, each alternative will be analyzed to determine its compliance with ARARs. Chemical-, location-, and action-specific ARARs are discussed in the following subsections, and presented in Table 2-1.

2.1.1 Chemical-Specific ARARs

Chemical-specific requirements are standards that limit the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual cleanup levels or the basis for calculating such levels. The State of Florida has promulgated SCTLs under Florida Administrative Code (FAC) 62-777 (FDEP, 1999).

2.1.2 Location-Specific ARARs

Location-specific ARARs govern site features (e.g., wetland, floodplains, wilderness areas, and endangered species) and manmade features (e.g., places of historical or archaeological significance). These ARARs place restrictions on concentrations of hazardous substances or the conduct of activities based solely on the site's particular characteristics or location.

As stated in the RI (HLA, 2000), no State or federally listed rare, threatened, or endangered species or species of concern are known to inhabit Site 16 (Nature Conservancy, 1997). Furthermore, Site 16 is not located within the 100-year flood plain or known to contain areas of historical or archeological significance. Therefore, location-specific ARARs do not apply to Site 16.

2.1.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based limitations controlling activities for remedial actions. Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the detailed analysis of remedial alternatives. During the detailed analysis of alternatives, each alternative will be analyzed to determine compliance with action-specific ARARs.

Certain action-specific ARARs include permit requirements. Under CERCLA Section 121(e), permits are not required for remedial actions conducted entirely on site at Superfund sites. This permit exemption applies to all administrative requirements, including approval of or consultation with administrative bodies, documentation, record keeping, and enforcement. However, the substantive requirements of these ARARs must be attained.

Table 2-1
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the National Hazardous Substance and Contingency Plan Regulations (40 Code of Federal Regulations [CFR], Section 300.430)	Discusses the types of institutional controls to be established at CERCLA sites.	**Applicable.** These regulations may be used as guidance in establishing appropriate institutional controls at Site 16.	Action-specific
Occupational Safety and Health Act (OSHA) Occupational Safety and Health Standards (29 CFR Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	**Applicable.** These requirements apply to all response activities conducted in accordance with the National Contingency Plan. During the implementation of any remedial alternative for Site 16, compliance with these regulations must be attained.	Action-specific
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste (40 CFR, Part 261)	Defines those solid wastes that are subject to regulation as hazardous wastes.	**Relevant and Appropriate.** Any alternative that would excavate and dispose of soil offsite would be sampled and analyzed for hazardous characteristics as defined by 40 CFR Part 261.	Action-specific
RCRA Regulations, Standards Applicable to Transporters of Hazardous Wastes (40 CFR Part 263)	Establishes the responsibilities of the generators and transporters of hazardous waste in the handling, transportation, and management of that waste. To avoid duplicative regulation, USEPA has expressly adopted certain DOT regulations governing the transportation of hazardous waste.	**Relevant and Appropriate.** For excavation and offsite disposal alternatives, the hazardous material would need to be handled, manifested, and transported to a permitted offsite disposal facility in compliance with these regulations.	Action-specific
RCRA Regulations, Releases from Solid Waste Management Units (40 CFR, Part 264, Subpart F)	Contains general groundwater monitoring requirements. Establishes detection and compliance monitoring programs that apply to owners and operators of solid waste units.	**TBC.** For capping alternatives, these regulations provide guidance for establishing and conducting a groundwater monitoring program at sites contaminated with RCRA wastes.	Guidance
Hazardous Materials Transportation Act Regulations (49 CFR Parts 171-179)	USDOT provides requirements for packaging, labeling, manifesting, and transporting hazardous materials. Similar requirements are found in 40 CFR Part 263.	**Relevant and Appropriate.** For excavation and offsite disposal alternatives, the hazardous material would need to be handled, manifested, and transported to a permitted offsite disposal facility in compliance with these regulations	Action-specific

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 16, Open Disposal and Burning Area
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
USEPA Region III Risk-Based Concentrations (RBCs), October 1997	Provides risk-based concentrations from ingestion or exposure to chemicals in soil, tap water, ambient air, and fish consumption.	**Relevant and Appropriate.** The chemicals detected at Site 16 are screened against these standards for selection of chemicals concern and developing RAOs.	Chemical-specific
Florida Surface Water Standards (FAC, Chapter 62-302)	This rule classifies Florida surface waters into five classes based on designated uses and establishes ambient water quality criteria for listed pollutants.	**Relevant and Appropriate.** Site 16 contains a surface depression where seasonal ponding occurs. Even if the surface water does not pose a risk to human health or ecological receptors, the rule would be used if surface water monitoring was required.	Chemical-specific, action-specific
Florida Rules on Hazardous Waste Warning Signs (FAC, Chapter 62-736)	Requires warning signs at National Priorities List (NPL) sites to inform the public of the presence of potentially harmful conditions.	**Applicable.** This requirement is applicable for sites that are on the NPL.	Action-specific
Florida Contaminant Cleanup Criteria Rule (FAC, 62-777)	Establishes soil and groundwater cleanup criteria	**Relevant and Appropriate**. The soil cleanup target levels should be considered when evaluating RGOs.	Chemical Specific

Notes: ARAR = applicable or relevant and appropriate requirement.
USEPA = U.S. Environmental Protection Agency.
TBC = to be considered guidance materials.

2.1.4 To Be Considered Criteria

As previously stated, TBCs are Federal and State nonpromulgated advisories or guidance that are not legally binding and do not have the status of being a potential ARAR (i.e., have not been promulgated by statute or regulation). However, if there are no specific regulatory requirements for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

2.2 IDENTIFICATION OF RAOs.

RAOs are defined in the CERCLA RI/FS guidance manual as media-specific goals that are established to protect human health and the environment and are typically based on chemicals of concern, exposure routes, and receptors present or available at the site. RAOs are developed to ensure compliance with ARARs. RAOs for Site 16 will be identified by consideration of ARARs, the RI and the risk assessment (RA).

Groundwater. Groundwater at NAS Whiting Field has been identified as a separate site (Site 40) and if necessary, groundwater will be investigated and remediated separately from Site 16.

Surface Water. No VOCs, SVOCs, pesticides or PCBs were detected in the surface water sample collected at Site 16. Eleven inorganic analytes were detected in the surface water sample collected at Site 16. Beryllium exceeded the Florida surface water cleanup target level value. Aluminum was detected at a concentration (758 micrograms per liter [µg/l]) exceeding the Florida GCTL of 200 µg/l (Table 2-2).

Table 2-2
Summary of Contaminants Exceeding ARARS and TBCs in Surface Water

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

Location Identifier:	16-W-001	Florida Surface Water Cleanup Target Level	Florida Groundwater Cleanup Target Level
Inorganic Analytes (µg/l)			
Aluminum	758	13	200
Beryllium	0.21 J	0.13	4

[1] Marine surface water criteria used.

Notes: Chapter 62-302.530, Florida Administrative Code.

µg/l = micrograms per liter.
J = estimated value.

Risk was evaluated for the current and future land-use scenario. The cancer risks associated with exposure to surface water (ingestion and dermal contact) are 1×10^{-6} for an aggregate (combined adult and adolescent) trespasser. Receptors cancer risk values are less than the USEPA acceptable cancer risk range of 1×10^{-4} to 1×10^{-6} and at FDEP's target risk of 1×10^{-6}. The noncancer risks associated with surface water ingestion and dermal contact under a hypothetical current land use (adolescent trespasser and adult trespasser) are below USEPA's and FDEP's target HI of 1.

The cancer risks associated with exposure to surface water ingestion and dermal contact under hypothetical future land use are 1×10^{-6} for an aggregate trespasser (combined adult and child) and 2×10^{-6} resident (combined adult and child). All of these hypothetical future receptors risk are below or at the USEPA acceptable cancer risk range but the future resident risk exceeds the Florida target carcinogenic level of

concern of 1×10^{-6}. However, it should be noted that ephemeral pond is only in existence during periods of heavy rainfall and does not exist year round.

Surface Soil. Chemical-specific ARARs and TBCs for surface soil were considered when identifying RAOs based on ARARs. Table 2-3 provides a summary of the detected concentrations for chemicals of concern (COCs) at Site 16 and their respective Florida SCTLs and USEPA Region III RBCs.

No VOCs detected in surface soils exceeded regulatory limits. The SVOCs, benzo(g,h,i)perylene and dibenzo(a,h)anthracene, exceeded the Region III RBCs. Two SVOCs, benzo(a)pyrene and benzo(g,h,i)-perylene, exceeded the industrial cleanup target levels for Florida. Benzo(a)pyrene and dibenzo(a,h)anthr-acene also exceeded the industrial standards for Region III RBCs. Benzo(a)pyrene and benzo(b)fluoranthene exceed the USEPA Region III RBCs and Florida residential cleanup target levels for surface soil.

Dieldrin was detected in two samples at concentrations exceeding the residential SCTL for Florida and for USEPA Region III RBC. Eighteen inorganic analytes exceeded the background screening values for surface soil. Beryllium, iron, and lead exceeded the Florida residential SCTLs. Arsenic and beryllium exceeded the residential values for the Florida SCTLs and the USEPA Region III RBCs. Arsenic also exceeded the USEPA Region III RBC and the Florida industrial SCTL.

The human health risk assessment (HHRA) evaluated risks to current and future users of the site. The risks posed to trespassers, occupational workers, site maintenance workers, and excavation workers based on exposure to surface soil via direct contact, ingestion, or inhalation of particulates are below the USEPA target risk range and the FDEP risk threshold.

For the current land-use scenario, the cancer risks associated with exposure to surface soil (ingestion, dermal contact, and fugitive dust inhalation) are 2×10^{-6} for an aggregate (combined adult and adolescent) trespasser, and 4×10^{-7} for a site maintenance worker. Both receptor's cancer risk values are at or below the USEPA acceptable cancer risk range of 1 in 10,000 to 1 in 1,000,000, although the hypothetical trespasser exceeds the FDEP target level of concern (1×10^{-6}). The noncancer risks associated with surface soil ingestion, dermal contact, and fugitive dust inhalation under hypothetical current land use (adolescent trespasser, adult trespasser, and site worker) are below USEPA's target HI of 1.

The cancer risks associated with exposure to surface soil ingestion, dermal contact, and fugitive dust inhalation under hypothetical future land use are 2×10^{-5} for an aggregate resident (combined adult and child), 2×10^{-6} for an aggregate trespasser (combined adult and adolescent), 3×10^{-6} for an occupational worker, 4×10^{-7} for a site maintenance worker, and 1×10^{-7} for an excavation worker under hypothetical future land use. All of these hypothetical future receptor risks are within or below the USEPA acceptable cancer risk range; however, the hypothetical future residential, trespasser, and occupational worker receptor risk exceeds the Florida level of concern of 1×10^{-6} (due to carcinogenic PAHs and arsenic).

Based on the results of the HHRA, an RAO to address exposure to arsenic and PAHs in soils at Site 16 was identified.

> **RAO 1:** Reduce human health risks associated with exposure to surface soil containing contaminants greater than action levels.

Based on establishment of this site-specific cleanup goal for arsenic at Site 16, NAS Whiting Field, and as shown in Table 2-3, the establishment of a chemical-specific RAO for arsenic is not necessary.

Table 2-3
Summary of Chemicals Exceeding ARARs and TBCs in Surface Soil

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection[1]	Reporting Limits Range	Detected Concentrations Range[2]	Mean of Detected Concentrations[3]	Background Screening Values[4]	USEPA Region III RBCs Residential/ Industrial[5]	Soil Cleanup Target Levels for Florida Residential/ Industrial/Leachability[6]
Semivolatile Organic Compounds (µg/kg)							
Benzo(a)anthracene	4/20	350 to 420	56 to 2,300	668	ND	[7]870/7,800	1,400/5,000/3,200
Benzo(a)pyrene	5/20	350 to 840	71 to 3,100	746	ND	[7]87/780	100/500/8,000
Benzo(b)fluoranthene	4/20	350 to 840	86 to 3,600	1,084	ND	[7]870/7,800	1,400/4,800/10,000
Benzo(k)fluoranthene	3/20	350 to 420	73 to 3,200	1,204	ND	[7]8,700/78,000	15,000/52,000/25,000
Carbazole	1/17	350 to 420	97	97	ND	[7]32,000/290,000	53,000/190,000/600
Chrysene	5/20	350 to 420	54 to 3,200	741	ND	[7]87,000/780,000	140,000/450,000/77,000
Dibenzo(a,h)anthracene	2/20	350 to 420	110 to 700	405	ND	[7]87/780	100/500/30,000
Indeno(1,2,3-cd)pyrene	4/20	350 to 420	62 to 1,900	573	ND	[7]870/7,800	1,500/5,300/28,000
Pesticides and PCBs (ug/kg)							
Dieldrin	8/20	3.6 to 21	2.5 to 130	31	ND	[7]40/360	70/300/4
Inorganic Compounds (mg/kg)							
Aluminum	20/20	40	1,890* to 18,600	8,724	15,848	[8]7,800/200,000	72,000/--/SPLP[10]
Arsenic	20/20	2	0.7* to 12.1	2.8	3.2	70.43/3.8	0.8/[11]4.62/29
Barium	20/20	40	4.45* to 257	36.8	23.2	[8]550/14,000	110/87,000/1,600
Cadmium	17/20	0.61 to 1	0.21 to 7.6	1.3	0.58	[8]3.9/100	75/1,300/8
Chromium	20/20	2	3.2 to 29.2	10.6	11	[8]23/610	210/420/38
Copper	19/20	5	2.9 to 202	34.1	9.4	[8]310/8,200	110/76,000/SPLP[10]
Iron	20/20	20	1,390* to 48,900	9,240	8,832	[8]2,300/61,000	23,000/480,000/SPLP[10]
Lead	20/20	0.6 to 1	4.4 to 759	110	11.4	[9]400	400/920/SPLP[10]
Manganese	20/20	3	5.25* to 372	129	392	[8]160/4,100	1,600/22,000/SPLP[10]
Vanadium	20/20	10	3.3* to 28.9	15.8	21.8	[8]55/1,400	15/7,400/980

See notes at end of table

Table 2-3 (Continued)
Summary of Chemicals Exceeding ARARs and TBCs in Surface Soil

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

[1] Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed (excluding rejected values).
[2] Value indicated by an asterisk is the average of a sample and its duplicate. If the target analyte is not detected in either the environmental sample or associated duplicate, the value used for the nondetection is one-half the reporting limit.
[3] The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected; it includes a single value for an environmental sample and associated duplicate. The arithmetic mean does not include those environmental samples in which the analyte was not detected.
[4] The background screening value for organics is the mean detected concentration and will not be used for screening purposes in the risk assessment. The background screening value for inorganics is two times the mean detected background concentration and will be used for screening purposes in the risk assessment.
[5] USEPA Region III RBC Table (October 1, 1998).
[6] Soil Cleanup Target Levels for Chapter 62-777, Florida Administrative Code (FDEP, 1999).
[7] The values correspond to a human cancer risk level of 1 in 1,000,000.
[8] The calculated values correspond to a noncancer hazard quotient of 0.1.
[9] Office of Solid Waste and Emergency Response Directive No. 9355.4-12, Revised Interim Recommended Soil Cleanup for CERCLA and RCRA Sites (USEPA, 1994c).
[10] Leachability values may be derived using the SPLP test to calculate site-specific soil cleanup target levels or may be determined using the toxicity characteristic leaching procedure in the event oily wastes are present.
[11] FDEP-approved site-specific soil cleanup target level for arsenic at covered landfill sites (Appendix K).

Notes: USEPA = U.S. Environmental Protection Agency.
RBC = risk-based concentration.
mg/kg = milligrams per kilogram.
Bold = indicates analyte exceeded cleanup target level.
* = average of a sample and its duplicate.
-- = criteria not available.

As Site 16 and several other sites at NAS Whiting Field are disposal sites, the Navy requested that the FEDP consider a site-specific SCTL for arsenic because the fill and cover material obtained at NAS Whiting Field included subsurface soil which contained elevated arsenic levels. The Navy recommended a SCTL for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16) of 4.62 milligrams per kilogram. This request is included as Appendix A of this report.

The FDEP responded to this request in a letter dated April 27, 1998 (FDEP 1998a). The FDEP concurred with the recommendation for the site-specific SCTL for arsenic at NAS Whiting Field disposal sites given the following conditions:

- In the future, the disposal sites will be used for activities that involve less than full-time contact with surface soil at the site. These activities could include parks, recreation areas, or agricultural sites.
- The Navy will incorporate these land-use considerations into a Land-Use Control (LUC) Agreement.
- The SCTL for arsenic will not be used at any other site without prior FDEP approval.

The ERA summary suggests only sublethal risks (i.e., reductions in growth and reproduction) to small herbivorous mammals are predicted. These risks are likely associated with ingestion of cadmium and zinc in surface soil and food items that have bioaccumulated these inorganic constituents. Therefore, an RAO to address exposure to cadmium and zinc was identified.

> **RAO 2:** Reduce ecological risks associated with exposure to surface soil containing contaminants greater than action levels.

Subsurface Soil. Chemical-specific ARARs and TBCs for subsurface soil were considered when identifying RAOs. Table 2-4 provides a summary of the detected concentration for COCs in subsurface soil at Site 16 .

Five subsurface soil samples were collected from five different test pits at Site 16. Each soil sample was analyzed for TCL VOCs, SVOCs, pesticides, PCBs, TAL metals, and cyanide. Twenty inorganic analytes were detected in the five subsurface soil samples. Eight analytes (calcium, chromium, iron, manganese, potassium, vanadium, zinc, and cyanide) were detected at concentrations exceeding the background screening values. None of these inorganics exceeded industrial standards for either the Florida SCTLs or USEPA Region III RBCs.

The cancer risks associated with exposure to subsurface soil ingestion, dermal contact, and fugitive dust inhalation under hypothetical future land use is 2×10^{-7} for an excavation worker under hypothetical future land use. Hypothetical future receptor risk is below the USEPA and FDEP acceptable cancer risk levels. The noncancer risks associated with subsurface soil ingestion, dermal contact, and fugitive dust inhalation under future land use for a hypothetical excavation worker are below USEPA's and FDEP's target HI of 1.

Arsenic was detected in all five subsurface soil samples at concentrations ranging from 1.5 to 15.1 milligrams per kilogram (mg/kg). Three of the five environmental samples and the duplicate sample exceeded the industrial SCTL for Florida (3.7 mg/kg) and the USEPA Region III RBC (3.8 mg/kg). Lead was detected in all five subsurface soil samples at concentrations ranging from 6.8 to 766 mg/kg. Lead concentrations exceeded the industrial values of the SCTLs and the USEPA Region III RBC (400 mg/kg) in two samples.

An RAO to address exposure to arsenic and lead was identified.

Table 2-4
Summary of Chemicals Exceeding ARARs and TBCs in Subsurface Soil

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection[1]	Range of Detection Limits	Range of Detected Concentrations[2]	Mean of Detected Concentrations[3]	Background Screening Values[4]	USEPA Region III RBCs Industrial[5]	Soil Cleanup Target Levels for Florida Residential/Industrial/Leachability[6]
Inorganic Analytes (mg/kg)							
Antimony	3/5	2.4 to 12	2.5 to 6.7	5	4.4	[8]82	26/240/5
Arsenic	5/5	2	1.5 to 15.1	7.2	6.2	[7]3.8	0.8/[12]4.62/29
Barium	5/5	40	20 to 175*	77.6	15.8	[8]14,000	110/87,000/1,600
Cadmium	3/5	0.67 to 1	2.4 to 9	6.7	0.92	[8]100	75/1,300/8
Copper	5/5	5	4.8 to 3,620	759	8.8	[8]8,200	110/76,000/SPLP[11]
Iron	5/5	20	6,670 to 74,800	29,412	18,100	[8]61,000	23,000/480,000/SPLP[11]
Lead	5/5	1	6.8 to 766	286	8.4	[9]400	400/920/SPLP[11]
Vanadium	5/5	10	19 to 65.4*	31.3	45	[8]1,400	15/7,400/980

[1] Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed (excluding rejected values).
[2] If the target analyte is not detected in either the environmental sample or associated duplicate, the value used for the nondetection is one-half the reporting limit.
[3] The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected; it includes a single value for an environmental sample and associated duplicate. The arithmetic mean does not include those environmental samples in which the analyte was not detected.
[4] The background screening value for organics is the mean detected concentration and will not be used for screening purposes in the risk assessment. The background screening value for inorganics is two times the mean detected background concentration and will be used for screening purposes in the risk assessment.
[5] Source: USEPA Region III RBC Table (October 1, 1998).
[6] Source: Soil Cleanup Target Levels for Chapter 62-777, Florida Administrative Code (Florida Department of Environmental Protection [FDEP], 1999).
[7] The values correspond to a human cancer risk level of 1 in 1,000,000.
[8] The calculated values correspond to a noncancer hazard quotient of 0.1.
[9] Office of Solid Waste and Emergency Response Directive No. 9355.4-12, Revised Interim Recommended Soil Cleanup for CERCLA and RCRA sites (USEPA, 1994c).
[10] Values based on hexavalent form of chromium.
[11] Leachability values may be derived using the SPLP test to calculate site-specific soil cleanup target levels or may be determined using the toxicity characteristic leaching procedure in the event oily wastes are present.
[12] FDEP-approved site-specific soil cleanup target level for arsenic at covered landfill sites (Appendix K).

Notes: USEPA = U.S. Environmental Protection Agency.
RBC = risk-based concentration.
mg/kg = milligrams per kilogram.
* = average of sample and duplicate.
Bold indicates analyte exceeded cleanup target level.
-- = criteria not available.
ND = not detected.

RAO 3: Reduce risks to an excavation worker associated with exposure to subsurface soil containing contaminants greater than action levels.

Summary of RAOs. Three RAOs have been established for Site 16. Table 2-5 lists these RAOs.

Table 2-5
Summary of Remedial Action Objectives for Site

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Remedial Action Objective	Description
1	Reduce human health risks associated with exposure to surface soil containing contaminants greater than action levels.
2	Reduce ecological risks associated with exposure to surface soil containing contaminants greater than action levels.
3	Reduce risks to an excavation worker associated with exposure to subsurface soil containing contaminants greater than action levels.

2.3 VOLUME OF CONTAMINATED MEDIA.

Three RAOs are identified at Site 16. Surface soil samples collected at Site 16 contained arsenic and PAHs at concentrations greater than the Florida's residential and industrial SCTLs. Volume calculations for limited soil removal are presented in Appendix C.

2.4 IDENTIFICATION OF GENERAL RESPONSE ACTIONS.

General response actions describe potential medium-specific measures that may be employed to address the RAO. Potential response actions for CERCLA sites include the following general response categories:

- no action
- limited action
- containment
- treatment (either *in situ* or *ex situ*)
- disposal

3.0 REMEDIAL ACTION ALTERNATIVES

The approach and rationale leading to the development of remedial alternatives for Site 16 are presented in this chapter. The development of remedial alternatives for CERCLA sites consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives that accomplish the RAOs identified in Chapter 2.0.

The NCP requires that a range of remedial alternatives be considered and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those that eliminate the need for long-term management to those that reduce toxicity, mobility, or volume of contaminants. The range of alternatives considered in this FS include technologies from the following categories:

- no action
- limited action
- containment
- treatment
- disposal

In the following sections, technologies that contribute to achieving the RAO is identified and evaluated. Next, alternatives are developed using the selected technologies. A detailed evaluation of remedial alternatives is presented in Chapter 4.0.

3.1 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES.

The purpose of this section is to identify and screen appropriate technologies for assembly into remedial alternatives that address the RAO identified for Site 16. Each technology is then screened based on site- and waste-limiting characteristics.

Site characteristics considered during this process included the following:

- site geology, hydrogeology, and terrain;
- availability of space and resources necessary to implement the technology; and
- presence of special site features (e.g., wetlands, forest areas, floodplains, or endangered species).

Based on the review of site characteristics, no special site features or characteristics exist at Site 16 that would preclude any remedial technology from implementation.

The following waste characteristics were also considered:

- contaminated media,
- types and concentrations of waste constituents, and
- physical and chemical properties of the waste (e.g., volatility, solubility, and mobility).

Table 3-1 presents and screens the remedial technologies applicable for addressing the RAO. The technology screening process reduces the number of potentially applicable technologies by evaluating the applicability of each technology to site- and waste-limiting factors. Technologies deemed ineffective or not implementable (such as physical or chemical treatment technologies) were eliminated from Table 3-1. The remaining technologies are assembled into remedial alternatives in Section 3.2.

Currently, COCs in soil are not known to be leaching into groundwater nor does groundwater pose a principal threat to human health and the environment. However, several alternatives propose to manage COCs in soil through limited action or containment. For these alternatives, long-term groundwater monitoring may be necessary. Because groundwater assessment and monitoring will be presented under a facility-wide groundwater RI/FS designated Site 40, groundwater monitoring will not be included as a component in any

Table 3-1
Identification and Screening of Remedial Technologies

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
No Action				
No action	No remedial actions are taken at Site 16. Five-year site reviews would be required.	Applicable.	Applicable.	Retained. This alternative is retained for a baseline for comparison with other alternatives as required by CERCLA.
Five-year site reviews	Under CERCLA, if wastes are left on a site after closure, the site should be reviewed every 5 years.	Applicable.	Applicable.	Retained. This alternative is retained based on the CERCLA requirement that if wastes remain on site after closure, a review of the site must be completed every 5 years.
Limited Action				
Land-use controls (LUC)	Use of LUC documents to maintain the site for non-residential purposes.	Applicable.	Applicable.	Retained. This alternative is retained because it would achieve RAO 1.
LUC Implementation Plan (LUCIP)	Identifies each LUC objective for Site 16 and specifies actions required to achieve those objectives (i.e, install fencing, post warning signs). LUCIP includes a description of the disposal history and the status of the site conditions during inspections and sampling and analysis, if required.	Applicable.	Applicable.	Retained. This component would achieve RAO 1.
Containment				
Soil Cover	Development of a closure plan for site monitoring and maintenance. Plan includes a description of the disposal history, status of the site conditions during inspections and sampling, and effectiveness of the cover design.	Applicable.	Applicable.	Retained. This component would achieve RAOs 1, 2, and 3.

See notes at end of table.

Table 3-1 (Continued)
Identification and Screening of Remedial Technologies

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
Containment (Continued)				
Groundwater Monitoring	Sampling and analysis of the upgradient, downgradient, and crossgradient wells at Site 16 to assess whether COCs in surface soil are leaching into groundwater over time.	Applicable.	Not applicable. COCs in soil are not leaching into groundwater.	Eliminated. Groundwater monitoring will be addressed separately on a facility-wide basis (designated Site 40).
Soil Stabilization	Soils are mixed with an additive, such as a reactive chemical or concrete, to bind specific analytes chemically or physically with soil particle. This technology eliminates migration of contaminants from soil. The process can be performed *in situ* or *ex situ*.	Applicable.	Applicable.	Eliminated. This alternative would not achieve the RAOs, and significant arsenic migration from Site 16 is not expected.
Disposal				
Excavate Soil	Surface soil is excavated to a depth of 2 feet in contaminated areas.	Applicable. Site is accessible for removal or excavation activities.	Applicable. Constructed soil cover and underlying limited soil have been identified where soil containing COCs above action levels would be removed.	Retained. Would achieve RAOs, and reduce risks to human health and ecological receptors.
Offsite Soil Disposal:				
RCRA Subtitle D Solid Waste Landfill	Excavated soil is sampled and analyzed for waste classification. Soil is transported to a non-hazardous, solid waste landfill based on analytical results from excavated soil.	Applicable.	Applicable. Analytical results from the RI indicate that the soil would not be classified as hazardous.	Retained. Would achieve RAOs, and reduce risks to human health and ecological receptors.
RCRA Subtitle C Hazardous Waste Landfill	Excavated soil is sampled and analyzed for waste classification. Soil is transported to a hazardous, solid waste landfill based on analytical results from excavated soil.	Applicable.	Not Applicable. Analytical results from the RI indicate that the soil would not be classified as hazardous.	Eliminated.

Notes: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
RAO = remedial action objective.

alternatives for this FS. However, groundwater actions will not interfere with any of the proposed soil remedial alternatives.

3.2 REMEDIAL ALTERNATIVES.

Remedial technologies that passed the technology screening are assembled into alternatives that meet the RAOs. Table 3-2 presents the alternative development for Site 16. The alternatives were developed to address closure of the open disposal and burning area in accordance with ARARs.

Based on the applicable technologies identified in the preceding section, four remedial alternatives were developed. These alternatives are options under the no action, limited action, disposal, and general response action categories. The no action alternative was developed to provide a baseline for comparison with other alternatives (USEPA, 1988).

3.2.1 Alternative 1: No Action

The NCP requires the development of the no action alternative to provide a baseline for comparison against other remedial alternatives. This alternative does not involve the implementation of any remedial technologies to treat wastes. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. The 5-year site review typically involves an administrative review of site records. For this FS, Alternative 1 would include 5-year reviews for a period of 30 years. A period of 30-years was chosen for costing purposes only. The alternatives developed for Site 16 are discussed in the following subsections.

3.2.2 Alternative 2: Land Use Controls

Alternative 2 consists of activities necessary to maintain LUCs at the Site 16, Open Disposal and Burning Area:

- land-use controls
- 5-year site reviews.

LUCs, such as documents that restrict the use of the land in the vicinity of a site and place regulatory controls on excavation of soil, would be drafted, implemented, and enforced in compliance with local regulations as a part of this alternative. The LUCs will be placed on the parcel of land encompassing the disposal site, including a typical buffer zone, as is currently used at other sites in the State.

Once the buffer zone has been established warning signs will be posted to discourage trespassing. Finally, any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years (CERCLA Section 121(c)).

3.2.3 Alternative 3: Soil Cover and LUCs

One containment alternative was developed for Site 16 and consists of all components of Alternative 2 with the addition of a soil cover component. Containment alternatives require no treatment of contaminated materials.

Under this alternative, a cover system would be constructed over the former disposal sites to reduce the infiltration of precipitation, control surface water runoff, and minimize potential direct contact risks. Minimizing infiltration from precipitation and surface water reduces contaminant leaching from soil and landfill wastes to groundwater. The cover design would be in accordance with USEPA guidance for hybrid-landfill closure provided in *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b).

Prior to cover placement, the site would be cleared, grubbed, and graded and any debris piles would be removed. To minimize storm water infiltration and cap erosion, the soil cover would be graded. The soil cover would consist of clean fill placed and compacted in 6-inch lifts to a minimum thickness of 18 inches. Six inches of topsoil would then be placed on top of the clean fill for a total cover thickness of 24 inches. Once in place, the soil layer would be fertilized and seeded to promote vegetative cover.

During the construction phase of this alternative, temporary erosion control measures would remain in place until a vegetative cover was established. Post-closure monitoring and maintenance of the installed soil cover system would be required until the cover system stabilized. This monitoring program would include visual inspections and maintenance of the vegetative cover. For cost estimating purposes, inspection and monitoring is estimated for a period of 30 years after closure. Finally, LUCs and 5-year reviews would be implemented as previously discussed. The 5-year site reviews will assess the need for continued landfill monitoring.

3.2.4 Alternative 4: Limited Soil Removal and LUCs

A second disposal alternative developed for Site 16 consists of all components of Alternative 2 with the addition of off-site disposal of the limited surface soil contamination.

Four areas at Site 16 contain arsenic and PAH in surface soils at concentrations exceeding industrial criteria. The four areas will also address the ecological risks due to cadmium and zinc identified in Chapter 2.0. Prior to soil removal one composite sample would be collected from each of the four areas to characterize the soil for off-site disposal. After the soil is taken to off-site disposal areas, the excavation area would be backfilled with clean fill and topsoil. The fill material and topsoil would be transported from a nearby off-site borrow source using dump trucks and tractor-trailers. The backfill would be spread across each excavated area using a bulldozer. Once in place, the soil layer would be seeded. In addition, LUCs and 5-year reviews would be implemented as previously discussed. The 5-year site review would assess the need for continued monitoring.

Table 3-2
Development of Remedial Alternatives

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Alternative	Description of Key Components
Alternative 1: No action	Five-year site reviews.
Alternative 2: Land Use Controls (LUCs)	Land-Use Controls Five-year site reviews.
Alternative 3: Soil Cover and LUCs	LUCs Site Clearing and Grubbing. Sample and analyze excavated soil for waste classification. Placement of clean soil. Establish vegetative cover. Five-year site reviews.
Alternative 4: Limited Soil Removal and LUCs	LUCs Excavate soil. Sample and analyze excavated soil for waste classification. Confirmatory sampling of open excavation areas. Backfill excavation with clean fill. Establish vegetative cover. Five-year site reviews.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This chapter presents detailed analyses of alternatives for Site 16 at NAS Whiting Field. A detailed analysis is performed to provide decision makers with sufficient information to select the appropriate remedial alternative for a site. The detailed analysis has been conducted in accordance with CERCLA Section 121, the NCP, and USEPA RI/FS Guidance (USEPA, 1988). The detailed evaluation of each remedial alternative includes the following:

- a detailed description of the alternative, emphasizing the applications of the technology or actions proposed for each alternative; and
- a detailed analysis of the alternative against seven of the nine CERCLA criteria.

The remedial alternatives are examined with respect to the requirements stipulated by CERCLA and factors described in the USEPA's *Guidance for Conducting RI/FS Under CERCLA* (USEPA, 1988). The nine criteria from the RI/FS Guidance document are

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, and volume of contaminants through treatment,
- short-term effectiveness,
- implementability,
- cost,
- State acceptance, and
- community acceptance.

This FS presents evaluation of the first seven criteria in the alternative evaluation process. Table 4-1 outlines the specific elements considered for these seven criteria.

Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS Report have been received from the State. Therefore, State comments will be addressed in the Final FS, and a summary of State acceptance of this FS will be included in the Final FS Report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

4.1 DETAILED ANALYSIS FOR ALTERNATIVE 1: NO ACTION.

Alternative 1 is a no action alternative. Under this alternative, no actions would be taken to address contamination at the site. A description of this alternative is presented in Subsection 4.1.1 and a technical assessment of this alternative is presented in Subsection 4.1.2.

4.1.1 Detailed Description of Alternative 1

In accordance with the NCP, the no-action alternative is used as a baseline for comparison against other alternatives. Because hazardous substances, pollutants, or contaminants would be left in place at Site 16, this alternative would include 5-year site reviews. Under this alternative, soil would remain in place, thus allowing natural processes to reduce the concentrations of organic COCs; however, concentrations of inorganic COCs (arsenic) would not be reduced. No other additional remedial or institutional controls would

be implemented under this alternative. There would be no restrictions on land-use types; therefore, the site could be used for residential, industrial, or commercial uses.

Table 4-1
Criteria for Evaluation of Remedial Action Alternatives

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Factors	Criteria to Consider
Overall protection of human health and the environment	How risks are eliminated, reduced, or controlled. Short-term or cross-media effects.
Compliance with ARARs	Compliance with chemical-specific ARARs. Compliance with location-specific ARARs. Compliance with action-specific ARARs.
Long-term effectiveness and permanence	Magnitude of residual risk. Adequacy of controls. Reliability of controls.
Reduction of mobility, toxicity, and volume of contaminants through treatment	Treatment process and remedy. Amount of hazardous materials destroyed or treated. Reduction of mobility, toxicity, or volume through treatment. Irreversibility of treatment. Type and quantity of treatment residual.
Short-term effectiveness	Protection of community during remedial action. Protection of workers during remedial action. Environmental effects. Time until RAOs are achieved.
Implementability	Ability to construct technology. Reliability of technology. Ease of undertaking additional remedial action, if necessary. Coordination with other agencies.
Cost	Capital cost. Operation and maintenance cost. Total present worth of alternative.

Notes: ARAR = applicable or relevant and appropriate requirement.
RAO = Remedial Action Objective.

Five-Year Site Reviews. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. It is assumed, for this FS, that these reviews would occur over a 30-year period. These reviews would consist of evaluating changes to site conditions at the site (e.g., construction, demolition, change in potential receptors, migration pathways, qualitative risks, etc.) to assess whether or not human health and the environment continue to be protected by the alternative. The appropriateness of this alternative would then be compared to other remedial alternatives to confirm that it is still the most appropriate selection.

4.1.2 Technical Criteria Assessment of Alternative 1

This subsection provides the technical criteria assessment of Alternative 1 against the seven criteria.

Overall Protection of Human Health and the Environment. This alternative would provide no additional protection to human or ecological receptors who may be exposed to soil at Site 16. If this alternative were selected, 5-year site reviews would be instituted. No adverse short-term or cross-media effects are anticipated with this no-action alternative.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, Florida GCTLs, or Florida SCTLs) in the short term. Eventually, this alternative may comply with ARARs if natural processes including physical, chemical, and biological changes in the soil and groundwater reduce contaminant concentrations. However, this alternative would not comply with ARARs for arsenic concentrations in soil.

Long-term Effectiveness and Permanence. LUCs are not part of the alternative; therefore, human and ecological risks due to exposure to site soils would not be addressed via this alternative. Therefore, these risks would remain over a period of time until natural processes reduce the contaminant concentrations and reduce the mobility of the contaminants, or other LUCs are implemented.

Administrative actions proposed in this alternative (e.g., 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative, but would not provide a permanent remedy for the site. Administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Although treatment is not included in this alternative, this alternative may provide some reduction in PAH toxicity through natural degradation processes. No reduction in inorganic toxicity is anticipated; however arsenic can form low solubility metal arsenates. This alternative would not provide a reduction in contaminant mobility or volume because active mitigation of contaminant mobility or reduction in volume is not proposed. On the other hand, treatment residuals would not be produced if this alternative were implemented.

Short-term Effectiveness. This alternative would not reduce ecological and human health risks in the short term because no land-use restrictions or active treatment would be implemented.

This alternative would not comply with RAOs in the short term because the only means of contaminant reduction is natural degradation processes for PAHs. No reduction in inorganic concentrations would be anticipated. This alternative does not pose a threat to workers through exposure to contaminated soil because remedial construction activities are not proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as 5-year site reviews are easily implemented.

Cost. The present worth cost of Alternative 1 is presented on Table 4-2. The cost includes 5-year site reviews over a 30-year monitoring period. A 30-year period was chosen because RI/FS guidance suggests using this timeframe when contaminants are left onsite. The total present worth cost of Alternative 1 is $19,000. Cost estimates are presented in Appendix D.

Table 4-2
Cost Summary Table, Alternative 1: No Action

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Operation and Maintenance Cost (O&M) (per event)	
5-year site review	$5,000
Total O&M cost (per event)	$5,000
Total O&M cost (present worth of semi-annual O&M for 30 years)	$17,000
Contingency (10 percent)	$2,000
Total cost Alternative 1: no action	$19,000

Notes: Cost are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on present worth costs.

4.2 DETAILED ANALYSIS FOR ALTERNATIVE 2: LAND USE CONTROLS (LUCs).

Alternative 2 consists of LUC actions to limit the exposure to surface soil at Site 16. A description of this alternative is presented in Subsection 4.2.1 and a technical assessment of this alternative is presented in Subsection 4.2.2.

4.2.1 Detailed Description of Alternative 2

Under this alternative, LUCs would be implemented to provide protection of human receptors. LUCs would involve the use of institutional controls that would restrict the use of the land in the vicinity of Site 16. LUCs would place regulatory controls on the excavation of soil or similar activities that have the potential to disturb the site soil or increase the likelihood of exposure to the site soil.

The LUCs would be placed on a parcel of land slightly larger than the boundaries of Site 16. This would ensure that an appropriate buffer zone is created and maintained between the disposal areas and other areas of NAS Whiting Field. Warning signs stating restricted access would be posted to discourage trespassing.

LUCs would remain in place until the level of contamination at the sites has been adequately addressed. As part of this alternative, a quarterly site inspection program would be established to insure that compliance with the agreed upon LUCs is maintained. The results of these inspections would be summarized in quarterly reports and an annual report provided to appropriate parties. The inspection and reporting activities would be performed as long as the LUCs are in place. The following components would be included as part of this alternative:

- LUCs
- 5-year site reviews

LUCs. Under new USEPA Region IV guidance (USEPA, 1998), the use of LUCs as a remedy for contaminated sites requires the development of an LUC Assurance, provided in the Memorandum of Agreement (MOA) dated November 1999, and an LUC Implementation Plan (LUCIP). These two documents detail the actions required when LUCs are selected as a remedy for a site.

The LUCIP is then developed for each site where LUCs are necessary on the facility. The LUCIP would include details regarding additional required activities, such as quarterly and annual inspection and reporting for the specific area. These activities are required as part of the LUC agreement to insure compliance, while the LUCs for the sites are in effect. Further, as LUCs will remain in effect until the contamination at the sites has been adequately addressed, the activities identified in the LUCIP will also remain in effect until such time that the contamination present at the sites has been adequately addressed.

5-Year Site Reviews. Refer to Subsection 4.1.1 for a detailed description of these reviews.

4.2.2 Technical Criteria Assessment of Alternative 2

This subsection presents the technical criteria assessment of Alternative 2.

Overall Protection of Human Health and the Environment. Human receptors would be protected if this alternative were implemented. Regulatory controls (i.e., LUCs) would prohibit potential future residents from exposure to the site because residential use of the site would be restricted under the proposed LUCs. However, this alternative would not provide protection for ecological receptors at the site.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, FSCTLs) in the short term. Eventually, this alternative may comply with ARARs for PAHs if natural processes in the soil reduce organic contaminant concentrations. Reduction of inorganic concentrations are not expected; therefore, ARARs would not be achieved.

Long-term Effectiveness and Permanence. Naturally occurring processes, such as biological activity, may reduce organic contaminant concentrations (PAHs) in the soil over the long term but would not reduce inorganic concentrations. The risks presented to the future resident based on exposure to surface soil at the site would be addressed via the LUCs. The long-term effectiveness and permanence of these controls will be controlled by the facility.

Administrative actions proposed in this alternative (e.g., LUCs and 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative. These administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Although treatment is not included in this alternative, this alternative may provide some reduction in PAH toxicity through natural degradation processes. No reduction in inorganic toxicity is anticipated. This alternative would not provide a reduction in contaminant mobility or volume because active mitigation of contaminant mobility or reduction in volume is not proposed. On the other hand, treatment residuals would not be produced if this alternative were implemented.

Short-term Effectiveness. This alternative would reduce ecological and human health risks in the short term by reducing the potential exposure to Site 16 soil by human receptors. Furthermore, the threat to trespassers is considered to be minimal. Access to the base is restricted and continued operation of the base is expected. Additionally, the site is remote (i.e. far from base housing). However, this alternative does not address ecological risks in the short term.

This alternative does not pose a threat to workers through exposure to contaminated soil because no construction activities are proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as LUCs, and 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 2 is presented on Table 4-3. Both the LUCs and 5-year site reviews were costed over a 30-year monitoring period. A 30-year period was chosen because RI/FS guidance suggests using this timeframe where COCs remain onsite. The total present worth cost of Alternative 2 is $135,000. Cost estimates are presented in Appendix D.

Table 4-3
Cost Summary Table, Alternative 2: Land Use Controls

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Total direct cost	$12,000
Operation and Maintenance Cost (O&M) (per event)	
5-year site review	$ 5,000
Inspection/Reporting	$7,000
Total O&M cost (per event)	$ 12,000
Total O&M cost (present worth of semi-annual O&M for 30 years)	$111,000
Total Direct and O&M	$123,000
Contingency (10 percent)	$12,000
Total cost Alternative 2: LUCs	$135,000

Note: Costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on percent worth costs.

4.3 DETAILED ANALYSIS FOR ALTERNATIVE 3: SOIL COVER AND LUCs.

Alternative 3 consists of constructing a soil cover in accordance with Chapter 62-701.600, FAC (Florida Landfill Closure regulation) at Site 16. A description of this alternative is presented in Subsection 4.3.1 and a technical criteria assessment of this alternative is presented in Subsection 4.3.2.

The design criteria presented in this section are intended for cost comparison purposes only and are not intended to be final design specifications. If Alternative 3 is the selected remedy for Site 16, it is recommended that land surveying, additional field sampling, and geotechnical testing be completed prior to preparing design plans and specifications. Final design plans and specifications would be prepared in accordance with Chapter 62-701.600, FAC, and sealed by a Florida-registered Professional Engineer.

4.3.1 Detailed Description of Alternative 3

Alternative 3 is designed to address closure of the disposal areas and exposure to surface soil at Site 16. The selected landfill cover design for Alternative 3 is primarily based on the Florida landfill closure regulation (Chapter 62-701.600, FAC). This regulation was used to develop appropriate criteria for a soil cover design and to formulate a cost estimate for the detailed evaluation of this alternative. The following components would be included as part of this alternative:

- LUCs
- Site preparation, clearing, and grubbing
- Soil cover design
- Surface water drainage
- Post-closure care
- Five-year site reviews

LUCs and Site Closure Plan. Refer to Alternative 2 for a description of LUCs. The Site LUC Plan would consist of a closure report, closure design plan, and closure operation plan in accordance with Chapter 62-701.600, FAC.

Site Preparation, Clearing, and Grubbing. A stockpile area, with a 12-inch-thick gravel base, would be installed at the site and would be large enough to provide sufficient volume for several days of filling and grading operations associated with this alternative. An area adjacent to the stockpile area would be prepared with a 12-inch-thick gravel base to be used as a parking area for construction- support trailers and heavy equipment. Equipment mobilized to the site would include earth-moving equipment such as backhoes, front-end loaders, bulldozers, and dump trucks.

Approximately 25 percent of the site is assumed to be covered by trees; a sparse layer of groundcover covers the remainder of the site. Pine trees, shrubs, and other vegetation will be cleared with a trackhoe or other type of excavation equipment to provide a cleared surface for placement of the landfill cover. Small brush and vegetation will be chopped and spread over the landfill surface. Large trees will be disposed as yard-waste at an appropriate mulching or tree recycling facility, or chipped and spread over the landfill surface prior to construction of the soil cover.

Soil Cover. The primary intent of the landfill cover is to limit direct contact exposure to site soil. As a result, the soil cover will be approximately 24 inches thick and consist of an 18-inch thick barrier soil layer and 6-inch topsoil for vegetative cover per Chapter 62-701.600, FAC. This barrier layer will be placed and compacted in 6-inch lifts to ensure proper compaction and cover stability. A fine-grained, low-permeable soil layer (33,840 yd^3) will be obtained from an off-site borrow source. The borrow soil will be tested to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 standard units (su).

This soil will be compacted with a sheepsfoot or smooth roller to achieve a structurally stable surface. The final compacted soil layer will consist of a minimum of 2 feet soil cover. Only minimal modification of the existing topography will be performed.

A final 6-inch layer of topsoil (11,280 yd^3) will be placed over the compacted soil to support vegetative growth. The soil will be obtained from an off-site borrow source to provide the adequate soil composition required to stimulate and support natural vegetation. The soil will be tested to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 su.

Selected seed and fertilizer will be placed on the vegetative support layer to establish vegetation. Hay will be used to protect the seed and fertilizer during initial development. Post-closure care will include provisions to stimulate growth. The vegetative cover will minimize erosion by developing root systems within the vegetative support layer that overlies the compacted soil cover material. The vegetation will also provide evapotranspiration of moisture contained in the soil cover, which will increase the cover's structural stability.

Surface Water Drainage. Natural surface water drainage that exists at the site will be maintained to the maximum extent possible. The final topographic surface and permeability of the landfill cover will allow drainage which emulates current conditions closely (e.g., internal drainage).

Post-Closure Care. Post-closure care will consist of the activities listed below, performed on an annual basis for a period of 30 years after cover construction.

- Visually inspecting, seeding, watering, and otherwise maintaining the vegetation on the surface of the closed landfill.

- Visually inspecting the landfill cover for signs of wear or discontinuities, such as seeps, pits, cracks, or other imperfections that may compromise the cover's structural integrity.

Groundwater monitoring is not included in post-closure care as groundwater is being investigated on a facilitywide basis at NAS Whiting Field (designated Site 40). The need for groundwater monitoring will be assessed in the Site 40 RI for groundwater.

Five-Year Site Reviews. Refer to Alternative 1 for a description of this component.

4.3.2 Technical Criteria Assessment of Alternative 3

This subsection presents the technical criteria assessment of Alternative 3.

Overall Protection of Human Health and the Environment. Protection of human receptors would be provided by the implementation of this alternative in that a landfill cover and regulatory controls (i.e., LUCs) would prohibit potential human receptors from coming into contact with the soil at Site 16. This alternative would also provide protection for ecological receptors at the site; however, in doing so, this alternative would alter the native ecological habitat present at the site.

Compliance with ARARs. Landfill closure requirements under RCRA Subtitles C and D, as well as Florida Solid Waste Disposal Facilities Regulations, were referenced as appropriate concerning the soil cover design.

Worker safety standards will be maintained during construction activities to comply with ARARs. Dust control will be used to minimize the spread of wind-blown soil during site grading. A site-specific health and safety plan will be developed and implemented during all site activities. However, contact with landfill wastes is not anticipated during construction of the cover.

Five-year site reviews will be prepared to assess the effectiveness of the alternative.

Long-Term Effectiveness and Permanence. The construction of a soil cover will prevent human health risks posed by ingestion of surface soil and ecological risks to small mammals exposed to surface soil.

Alternative 3 can be viewed as a permanent method of reducing human health risks posed by ingestion of surface soil if the cover stability shows permanence after completion of the 5-year review. Similar to human health risk reduction, the soil cover will also be designed to prevent risks posed to ecological receptors. A vegetative cover will be placed over the compacted soil to allow growth of native vegetation. The vegetation will increase evapotranspiration and reduce cover erosion. The risk posed to local species by ingesting biota that contain contaminants in their tissue, or by directly ingesting surface soil that contains contaminants, will be eliminated by placement of the compacted soil.

Alternative 3 includes clearing and grubbing vegetation that currently exists on the landfills. Existing vegetation will be removed, and ecological diversity will be reduced at Site 16. This ecological loss is not permanent; new vegetation will be planted on the final cover to induce continued ecological growth. However, this new vegetation will consist of mostly grasses and small brush, which is not quite as diverse as the natural vegetation that currently exists (due to the removal of some trees). The clearing and grubbing of the existing vegetation can be viewed as a permanent long-term ecological impact.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Alternative 3 does not include treatment of contaminants, and does not physically or chemically alter contaminants contained in the landfills. Thus, this alternative does not reduce the toxicity and/or volume of contaminants through treatment. However, the cover design will effectively reduce the mobility of contaminants contained in surface soil by preventing the spread of wind-blown particulates. The cover will also prevent the uptake of contaminants contained in surface soil, which will prevent biomagnification of contaminants through the local ecological food chain.

Short-Term Effectiveness. During the clearing, grubbing, and grading of the site, fugitive dust will be generated. This dust may contain hazardous particulates that pose an inhalation risk to site workers. Dust suppression by the use of water trucks and hoses is included in this alternative to minimize these potential short-term risks. Site workers may be exposed to contaminated surface soil during construction activities. Appropriate PPE can be used to minimize this increased risk.

Alternative 3 will include clearing and grubbing vegetation that currently exists. Ecological species that depend upon the surface of the landfills for food and other natural resources will be impacted by the removal of existing vegetation. This detrimental impact is an adverse short-term impact that will be reversed upon the growth of new vegetation. Construction operations are expected to last for 2 months, and new vegetation will likely require years to mature. Thus, the short-term ecological impacts as a result of clearing and grubbing the site may be significant.

Implementability. Equipment and materials are readily available to construct the cover designed for Alternative 3. Site work will be completed within a 2-month period, and will require standard construction expertise. Because of the difficulty in obtaining borrow soil in the vicinity of the site, compacted soil will be obtained from a non-local borrow source. The lack of local borrow sources would result in additional transportation cost, but does not render the alternative infeasible.

Cost. The cost estimate for Alternative 3 is presented in Table 4-4 and detailed cost calculations are provided in Appendix D. This estimate is based on the preliminary design criteria presented in this section. If this alternative is selected, land surveying, additional field sampling, and geotechnical testing should be

performed during design to prepare a complete set of design plans and specifications. The total present worth cost of Alternative 3 is approximately $1,300,000.

Table 4-4
Cost Summary Table, Alternative 3: Soil Cover and LUCs

Feasibility Study
Site 16, Open Disposal And Burning Area
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Mobilization and site preparation	$50,000
Site clearing and grubbing	$42,000
Soil cover	$647,000
Dust control	$2,000
Site restoration	$24,000
Total direct cost	$797,000
Indirect Cost	
Health and safety (3 percent)	$23,000
Administration and permitting (3 percent)	$23,000
Engineering and design (10 percent)	$78,000
Construction support services (10 percent)	$78,000
Total indirect cost	$202,000
Total capital cost (direct + indirect)	$979,000
Operation and Maintenance (O&M) Cost (capitalized)	
Soil cover inspection and maintenance	$41,000
Land-use controls – Quarterly & Annual inspections and reporting	$135,000
5-year site review	$27,000
Total O&M cost (capitalized)	$203,000
Total capital and O&M costs	$1,182,000
Contingency (10 percent)	$118,000
Total cost Alternative 4: Site Closure and Capping	$1,300,000

Note: Line item costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on present worth costs.

4.4 DETAILED ANALYSIS FOR ALTERNATIVE 4: LIMITED SOIL REMOVAL AND LUCs.

Alternative 4 includes remedial actions to excavate four surface soil areas at Site 16 and dispose of the excavated soil at an FDEP-approved and permitted disposal facility. A description of this alternative is presented in Subsection 4.4.1 and a technical criteria assessment of this alternative is presented in Subsection 4.4.2.

4.4.1 Detailed Description of Alternative 4

Under this alternative, the top 2 feet of soil (from 4 areas) would be excavated, sampled and analyzed, transported and disposed at an approved offsite disposal facility. Based on the low COC concentrations in

surface soil during the RI, the excavated soil would most likely be suitable for disposal at a Subtitle D (non-hazardous, solid waste) facility. Excavation and offsite disposal of the contaminated surface soil would eliminate COC exposure to humans and ecological receptors in Site 16 soil.

The following components of this alternative include:

- LUCs
- mobilization and site preparation
- excavation and stockpiling surface soil
- soil sampling and analysis
- transportation and offsite disposal
- site restoration
- Five-year site reviews

These activities are discussed in the following sections.

LUCs Refer to Alternative 2 for a description of this component.

Excavating and Stockpiling of Soil The four areas will be excavated to a depth of 2 feet below surface and stockpiled for waste characterization. The excavation areas are shown in Appendix A and total approximately 1,600 ft^2. The total volume of soil removed is approximately 120 yds^3. If additional contaminated areas are discovered based on confirmatory sampling of the open excavations, then they would be excavated for disposal. The additional soil volume that may be required for removal is addressed in Section 5.3, Soil Volume Sensitivity Analysis.

Soil Sampling and Analysis A soil sampling and analysis plan would be developed for two reasons: (1) to characterize the excavated soil for offsite disposal and (2) to confirm COC removal from the open excavation areas. To meet FDEP and USEPA guidance for soil disposal, composite samples would be collected. To meet offsite disposal requirements, stockpiled soil samples would be analyzed for hazardous waste characteristics (TCLP metals, SVOCs). In addition, composite soil samples would be collected from the bottom of the open excavation areas to confirm contaminant removal. Confirmatory soil samples would be collected and analyzed for COCs (i.e., inorganics and PAHs).

Transportation and Offsite Disposal Based on the relatively low concentrations of COCs in surface soil (Table 2-2), it was assumed that the excavated soil would be characterized as nonhazardous and would be disposed of in a nonhazardous, solid waste landfill (RCRA Subtitle D Landfill). Excavated soil would be loaded onto DOT-approved transport vehicles or rolloff containers (22 ton load capacity) and transported to an FDEP-approved Subtitle D landfill.

Site Restoration and Demobilization Once contaminated soil has been removed, the excavation area would be backfilled with clean fill and topsoil. Appropriate sampling will be completed to ensure the fill material is free of any chemicals of concern above action levels. The fill material and topsoil would be transported from a nearby offsite borrow source using dump trucks and tractor trailers. The material would be spread across the excavated areas using a front- end loader. Once the excavation areas have been backfilled, the areas would be seeded and fertilized to promote vegetative growth. Hay would be used to protect the seed and fertilizer during initial development. Decontamination water generated during implementation of this alternative would be sampled and either discharged on the ground at Site 16 or transported to the NAS Whiting Field FOTW for treatment. The storage trailer, heavy equipment, miscellaneous equipment and tools used during the implementation of this alternative would be demobilized.

Five Year Site Reviews Since COCs in soil would remain in areas above industrial SCTLs, 5-Year site reviews would be conducted to assess the effectiveness of this alternative. Refer to Alternative 1 for a description of this component.

4.4.2 Technical Criteria Assessment of Alternative 4

This subsection presents the technical criteria assessment of Alternative 4.

Overall Protection of Human Health and the Environment. This alternative would minimize human and ecological exposure to COCs in Site 16 surface soil because the soil areas would be excavated and disposed offsite. Soil, where concentrations of COCs are above the FDEP industrial SCTLs, would be removed from the site and the resulting excavation would be backfilled with clean fill. As a result, risks posed to human and ecological receptors by exposure to contaminated surface soil would be minimized.

Compliance with ARARs. It is expected that source excavation, transportation and disposal, and backfilling activities would comply with ARARs (see Section 2.1).

Worker safety standards will be maintained during remedial activities to comply with ARARs. A site-specific health and safety plan will be developed and implemented during all site activities.

Long-Term Effectiveness and Permanence. This alternative is expected to provide long-term effectiveness and permanence by excavation and offsite disposal of contaminated surface soil. A five-year site review will be used to assess changes in site conditions to ensure long-term effectiveness and permanence. Alternative 4 can be viewed as a permanent method of reducing human health and ecological risks posed by ingestion of contaminated surface soil by excavation and removal of soil areas.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Disposal of the excavated surface soil within an approved landfill would not reduce the toxicity, mobility, or volume of the waste because active treatment of the soil would not occur. However, the toxicity, mobility, and volume of waste would be reduced onsite for Site 16 surface soil because the waste would be transported and disposed at an approved offsite disposal facility.

Short-Term Effectiveness. Through implementation of this alternative, there would be an immediate reduction in risk to human health and the environment. During excavation and soil handling activities, site workers would wear appropriate personal protective equipment (PPE) for protection against exposure to site-related contaminants.

This alternative would also ensure the protection of non-site workers and trespassers immediately after backfilling the excavation with clean fill.

Implementability. This alternative is easily implementable. Equipment and materials are readily available for excavation and removal activities. Site work would be completed within a 2-month period, allowing for a 28-day turnaround time (TAT) for analytical results. If an expedited remedial action is required, this alternative can be completed within 2 to 4 weeks using an expedited TAT for analytical results.

Cost. The cost estimate for Alternative 4 is presented in Table 4-5 and detailed cost calculations are provided in Appendix D. O&M activities include a 5-year review and quarterly/annual reporting and inspections for a 30-year monitoring period. The total present worth cost of Alternative 4 is approximately $201,000.

Table 4-5
Cost Summary Table, Alternative 4: Limited Soil Removal and LUCs

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land Use Controls	$12,000
Mobilization	$3,000
Site Preparation & Clearing and Grubbing	$7,000
Excavating and Stockpiling Surface Soil	$7,000
Soil Sampling and Analysis	$6,000
Offsite Transportation and Disposal (Subtitle D Landfill)	$7,000
Site Restoration and vegetative support layer	$6,000
Total direct cost	$48,000
Indirect Cost	
Health and safety (3 percent)	$1,000
Administration and permitting (3 percent)	$1,000
Engineering and design (10 percent)	$5,000
Construction support services (10 percent)	$5,000
Total indirect cost	$12,000
Total capital cost (direct + indirect)	$60,000
Operation and Maintenance (O&M) Cost (capitalized)	
Land-use controls - Quarterly & Annual Inspections and Reporting	$105,000
5-year site review	$17,000
Total O&M cost (capitalized)	$123,000
Total Capital and O&M costs	$183,000
Contingency (10 percent)	$18,000
Total Cost Alternative 4: Limited Soil Removal and LUCs	$201,000

Note: Costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on present worth costs.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial alternatives for Site 16 were developed in Chapter 3.0 and were individually evaluated in Chapter 4.0 using seven technical criteria. For comparative purposes, these criteria are grouped into the following categories:

- threshold criteria,
- primary balancing criteria, and
- modifying criteria.

This chapter presents a comparison of remedial alternatives with respect to these criteria. This comparison is intended to provide technical information required for supporting the selection of a preferred alternative for Site 16. It is anticipated that modifying criteria (i.e. State and community acceptance) will be used in conjunction with the information presented herein to select an appropriate remedial alternative for Site 16. The remainder of this chapter presents this comparison.

5.1 OVERALL APPROACH TO COMPARATIVE ANALYSIS.

As presented in Chapter 4.0, remedial alternatives were developed to accomplish the RAO identified for the site. The 3 sets of criteria identified above are used to streamline the comparison between alternatives while ensuring compliance with the RAO. Components of these criteria are described below.

5.1.1 Threshold Criteria

Because the selected remedy must be protective of human health and the environment, as well as comply with ARARs, the following two threshold criteria are essential:

- overall protection of human health and the environment, and
- compliance with ARARs.

An individual assessment of each alternative with respect to these criteria was presented in Chapter 4.0. An overall comparative analysis of alternatives using threshold criteria is presented in Section 5.2.

5.1.2 Primary Balancing Criteria

Primary balancing criteria consist of the following 5 components:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability; and
- cost.

These criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring their implementability and cost-effectiveness. An individual assessment of each alternative with respect to these criteria is presented in Chapter 4.0. An overall comparative analysis of alternatives using primary balancing criteria is presented in section 5.2.

5.1.3 Modifying Criteria

The final two criteria are as follows:

- State acceptance, and
- community acceptance.

Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS Report have been received from the State. Therefore, State comments will be addressed in the Final FS, and a response to State comments will be included in the Final FS Report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

Based on this information, an evaluation of modifying criteria is not included in this FS.

5.2 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVE.

This section provides a comparative analysis for remedial alternatives for Site 16 with respect to the criteria described in Section 5.1.

5.2.1 Comparison of Threshold Criteria

The remedial alternatives for Site 16 were first compared to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

Alternative 1 does not provide a means of restricting future land use of the area. Therefore, this alternative does not protect potential future residents from environmental conditions at the site. Alternative 1 would not achieve the RAOs established for Site 16.

The implementation of Alternative 2 would provide a measure of continued protection of human health and the environment because the alternative includes LUCs. In this manner, Alternative 2 would achieve the RAOs established for the site and would also achieve ARARs. However, the LUCs would need to restrict both residential and industrial use of the site.

Alternative 4 would remove contaminated soils from Site 16 and establish LUCs. This would achieve ARARs and the RAOs established for the site. Alternative 3 would also provide a measure of continued protection of human health and the environment because the alternative includes LUCs (including LUCIP) after the placement of soil cover to eliminate surface soil exposure.

5.2.2 Comparison of Primary Balancing Criteria

A comparison is made between alternatives with respect to five criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume of contaminants through treatment; short-term effectiveness; implementability; and cost.

For long-term effectiveness, Alternatives 1,2, and 3 will not reduce concentrations of inorganic contaminants through natural mechanisms. Alternative 4 would provide long-term effectiveness by removing surface soil where COC concentrations exceed action levels (industrial SCTLs) established in the RAOs.

Alternative 4 would also reduce the volume of contaminated soil at Site 16. Alternative 4 is the only alternative where off-site disposal of contaminated soil would reduce the toxicity and volume on site. Alternatives 1, 2, and 3 would not reduce the toxicity or mobility of contaminants at the site because these alternatives do not involve treatment of contaminants in media at the site.

The implementability of Alternatives 1, 2, 3, and 4 would be relatively easy. For Alternatives 2, 3, and 4, LUCIP would need to be developed.

The relative present-worth costs are shown below for each alternative. In accordance with USEPA guidance the costs for Alternative 1, 2, 3, and 4 are based on a 30-year timeframe.

- Alternative 1: $19,000
- Alternative 2: $135,000
- Alternative 3: $1,300,000
- Alternative 4: $201,000

As expected, Alternative 1, the no-action alternative, has the lowest estimated overall cost. Alternative 2 involves LUCs (restrict both residential and industrial use of site) and quarterly/annual inspections and reporting over 30 years and is the next lowest cost. Alternatives 3 incorporates all the components (and costs) of Alternative 2 (with restrictions to use the site for industrial use only) with soil cover, and Alternative 4 includes limited soil removal followed by LUCs (with restrictions to use site for industrial use only).

5.2.3 Modifying Criteria

As stated in Subsection 5.1.3, an evaluation of modifying criteria will not be included in this FS.

5.3 SOIL VOLUME SENSITIVITY ANALYSIS.

If Alternative 4 is selected, there is a degree of uncertainty in identifying the boundaries of the four locations that exceed action levels prior to implementing the alternative. Two options are available to address this uncertainty. First, additional soil sampling using a sampling grid may be implemented as an interim measure to better delineate the site for contaminated soil areas (using standard statistical methods). Second, a soil volume sensitivity analysis may be conducted by estimating total soil volume that may need to be excavated. The first option is beyond the scope of this FS; however, the second option is summarized in Table 5-1.

Table 5-1
Soil Volume Cost Sensitivity Analysis

Feasibility Study
Site 16, Crash Crew Training Area
Naval Air Station Whiting Field
Milton, Florida

Alternative 4: Number of Areas	Sensitivity to Baseline Limited Area	Total Soil Volume (cubic yards)	Approximate Total Cost
4	Baseline	116	$ 201,000
8	2 × baseline	232	$ 236,000
16	4 × baseline	464	$ 310,000

The detailed cost estimates for each scenario are presented in Appendix D. As the number of contaminated areas increase (Table 5-1), the total volume and total cost increase. Based on existing data collected during the RI, it is reasonable to assume that the total soil volume above action levels would be within these limits.

REFERENCES

ABB Environmental Services, Inc. (ABB-ES). 1998a. *Remedial Investigation and Feasibility Study, General Information Report, Naval Air Station Whiting Field, Milton, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

ABB-ES. 1995. Remedial Investigation and Feasibility Study, Technical Memorandum No. 3, Soil Assessment, *Naval Air Station Whiting Field, Milton, Florida.* Final report prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

Florida Department of Environmental Protection (FDEP), Florida Administrative Code (F.A.C) Chapter 62-701, 1994. *Florida Landfill Final Closure Regulations* (May).

FDEP, Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C, 1999 (July).

Harding Lawson Associates (HLA). 2000. *Remedial Investigation Report, Site 16, Open Disposal and Burning Area, Naval Air Station Whiting Field, Milton, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina.

Nature Conservancy/Florida Natural Areas Inventory. 1997. "Rare Plant, Rare Vertebrate, and Natural Community Survey of NAS Whiting Field..." Final Report, sub-agreement (N624067-95-RP00236) to the 1995 Cooperative Agreement between DoD and the Nature Conservancy.

U.S. Department of Agriculture. 1980. *Soil Survey of Santa Rosa County, Florida.* Soil conservation Service. Washington, D.C.

U.S. Environmental Services Protection Agency (USEPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final.* Office of Solid Waste and Emergency Response. Washington, D.C. (October).

USEPA. Region IV. 1998. *Assuring Land Use Controls at Federal Facilities.* Memorandum from Jon D. Johnston, Chief of Federal Facilities Branch to the Region IV Federal Facilities Branch.

APPENDIX A

NAVY'S REQUEST FOR SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC AT DISPOSAL SITES AT NAS WHITING FIELD

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

At Naval Air Station (NAS) Whiting Field, nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet bls and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However, in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as the "Industrial Use Soil Cleanup Goal." This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including Sites 1, 2, 9, 10, 11, 13, 14, 15, and 16, and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented in Table A-1. As indicated on the table, the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 milligrams per kilogram.

Table A-1
Summary of Arsenic Detected in Surface and Subsurface Background Soil Samples

Feasibility Study
Sites 9 and 10, Waste Fuel Disposal Pit, and Southeast Open Disposal Area (A)
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection Surface Soil Samples[1]	Mean of Detected Concentrations Surface Soil Samples[2]	Frequency of Detection Subsurface Soil Samples[1]	Mean of Detected Concentrations Subsurface Soil Samples[2]	Frequency of Detection Surface and Subsurface Soil Samples[1]	Mean of Detected Concentrations Surface and Subsurface Soil Samples[2]	Surface and Subsurface Soil Background Screening Concentration (modified Industrial Use Cleanup Goal)
Inorganic Analytes (mg/kg)							
Arsenic	15/15	1.54	14/14	3.14	29/29	2.31	4.62

[1] Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: mg/kg = milligram per kilogram.

DRAFT

Table A-2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples to Florida Soil Cleanup Goals

Feasibility Study
Sites 9 and 10, Waste Fuel Disposal Pit, and Southeast Open Disposal Area (A)
Naval Air Station Whiting Field
Milton, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Soil Cleanup Goals for Florida (Residential)[1]	Soil Cleanup Goals for Florida (Industrial)[1]	Modified Industrial Use Cleanup Goal[2]
Inorganic Analyte (mg/kg)						
Arsenic	0.52	6.3	2.31	0.8	3.7	4.62

[1] Source: FDEP Memorandum from John Ruddell, Director Division of Waste Management, to District Directors and Waste Program Administrators. Subject: Applicability of Soil Cleanup Goals for Florida, January 19, 1996.
[2] The modified Industrial Use Cleanup Goal for arsenic is twice the mean of detected concentrations in the surface and subsurface soil samples.

Notes: mg/kg = milligram per kilogram.

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APPENDIX B

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S RESPONSE AND ACCEPTANCE OF THE SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC FOR DISPOSAL SITES AT NAS WHITING FIELD

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

April 27, 1998

Ms. Linda Martin
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, PO Box 190010
North Charleston, SC 29419-9010

file: arsenic1.doc

RE: Request for Site-Specific Arsenic Soil Cleanup Levels: Covered Landfill Sites, NAS Whiting Field

Dear Ms. Martin:

I have reviewed the request for approval of a site-specific Soil Cleanup Goal for arsenic at the "covered landfill sites" at NAS Whiting Field from Mr. Gerald Walker, ABB Environmental Services, dated April 22, 1998 (received April 22, 1998). Based on the prior presentation to Department Staff and the summary information furnished in the letter and the attached Appendix I, the request is granted to utilize a site-specific Soil Cleanup Goal for arsenic of 4.62 mg/kg at Sites 1, 2, 9, 10, 11, 12, 13, 14, 15 and 16., with the following conditions:

1. The sites may be utilized for activities that involve less than full-time contact with the site. This may include, but is not limited to, a.) parks b.) recreation areas that receive heavy use (such as soccer or baseball fields) or, c.) agricultural sites where farming practices result in moderate site contact (approximately 100 days/year, or less).

2. The Navy must assure adherence to the land use by incorporating the site and conditions in a legally binding Land Use Contol agreement.

3. The above Soil Cleanup Goal shall not be utilized at any other site without specific Department approval.

If you have questions or require further clarification, please contact me at (904) 921-4230.

Sincerely,

James H. Cason, P.G.
Remedial Project Manager

APPENDIX C

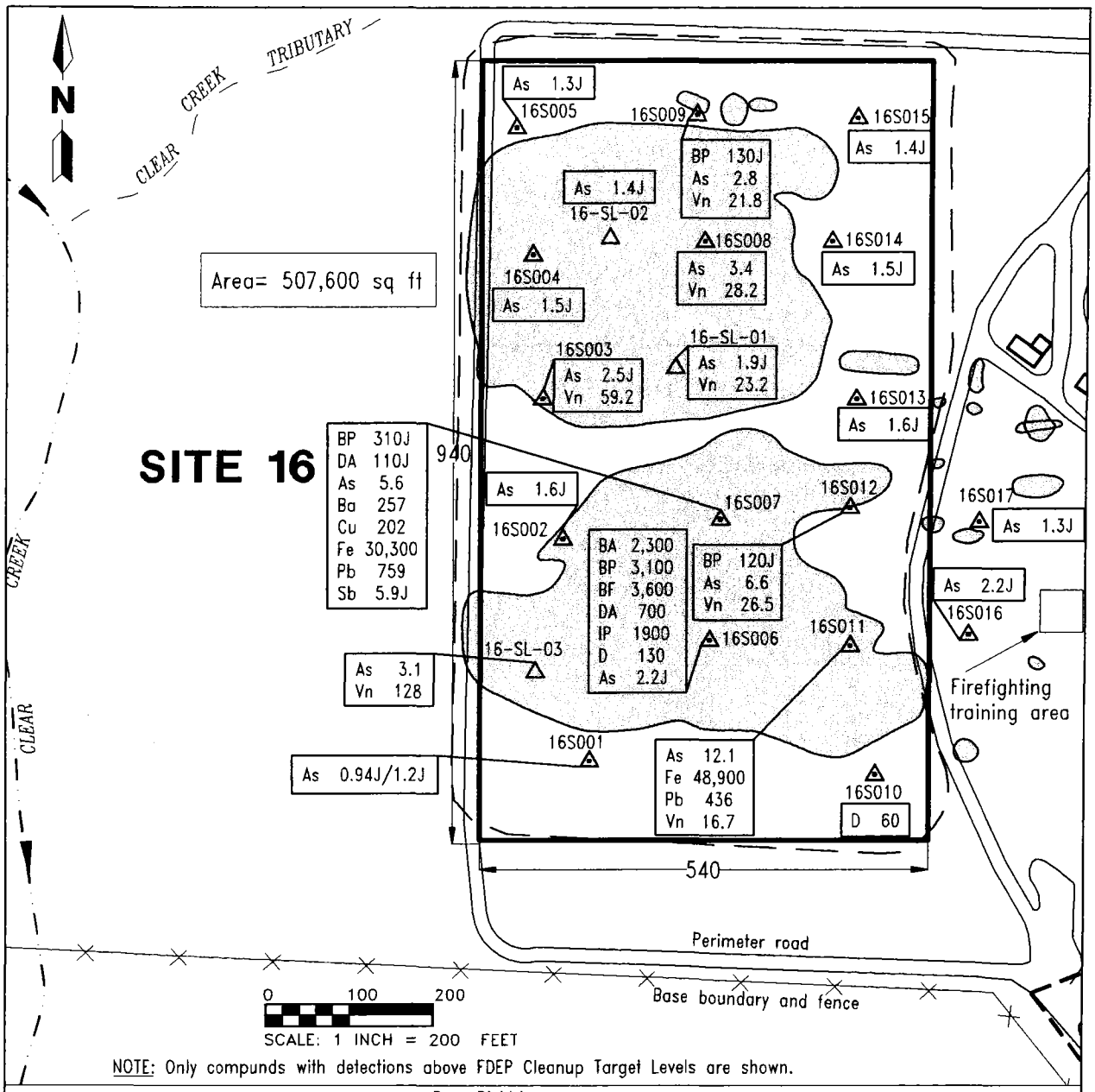
VOLUME ESTIMATES FOR CONTAMINATED MEDIA

FEASIBILITY STUDY - NAS WHITING FIELD SITE, 16

ALTERNATIVE 3: SOIL COVER AND LUCS

VOLUME REQUIRED FOR 2' THICK SOIL COVER OVER ENTIRE SITE

Material	Area (sq. ft)	Thickness (ft.)	Volume (cu. yd.)	Bulk Factor (20% x Vol)	Total Volume (cyd)	Unit Cost ($/cyd)	Total Cost ($)
Common Fill	507,600	1.5	28,200	5,640	33,840		
Topsoil	507,600	0.5	9,400	1,880	11,280		
				TOTAL	45120		



NOTE: Only compunds with detections above FDEP Cleanup Target Levels are shown.

LEGEND

BA	Benzo(a)anthracene
BP	Benzo(a)pyrene
BF	Benzo(b)fluoranthene
DA	Dibenzo(a,h)anthranene
IP	Indeno(1,2,3-cd)pyrene
Sb	Antimony
D	Dieldrin
As	Arsenic
Ba	Barium
Cu	Copper
Fe	Iron
Pb	Lead
Vn	Vanadium

Interpreted landfill/disposal area

Approximate site boundary

16-SL-01 △ Remedial investigation Phase IIA surface soil sample location and designation

16S013 △ Remedial investigation Phase IIB surface soil sample location and designation

SOIL COVER AREA
ALTERNATIVE 3

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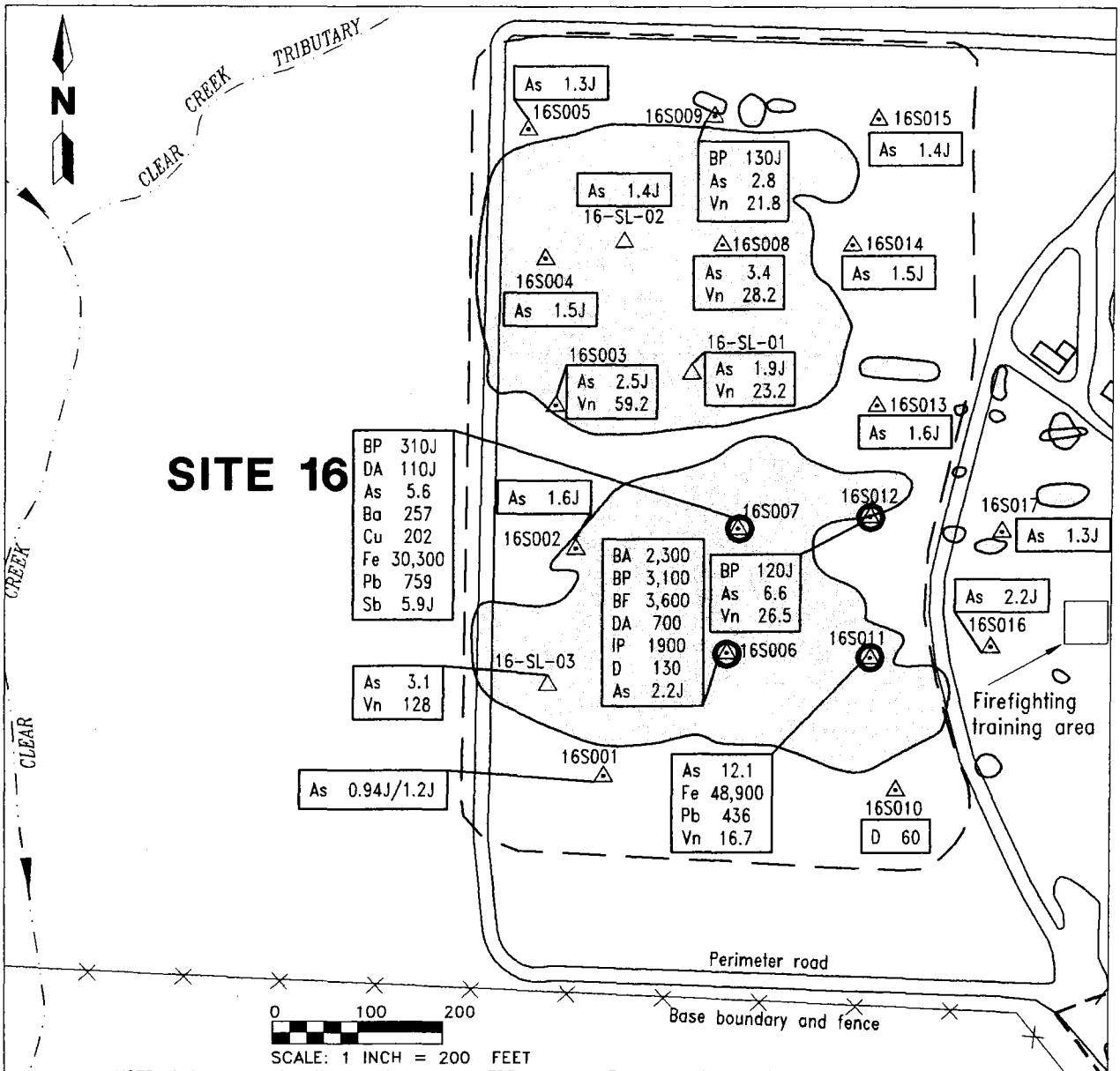
FEASIBILITY STUDY
SITE 16, OPEN DISPOSAL AND BURNING AREA

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

FEASIBILITY STUDY - NAS WHITING FIELD SITE, 16
ALTERNATIVE 4: LIMITED SPOT SOIL REMOVAL
BACKFILL VOLUME REQUIRED FOR EXCAVATED AREAS

MATERIAL	HOT SPOT LOCATIONS	SURFACE AREA (sq.ft.)	DEPTH (ft.)	VOLUME (cft)	VOLUME (cyd)	VOLUME (w/20% COMPACTION) (cyd)	UNIT COST ($/cyd)	TOTAL COST ($)
Common Fill	4	400	1.5	2400	89	107		
Topsoil	4	400	0.5	800	30	36		
		TOTAL			**119**	**142**		**$0**



NOTE: Only compunds with detections above FDEP Cleanup Target Levels are shown.

LEGEND

BA	Benzo(a)anthracene
BP	Benzo(a)pyrene
BF	Benzo(b)fluoranthene
DA	Dibenzo(a,h)anthranene
IP	Indeno(1,2,3-cd)pyrene
Sb	Antimony
D	Dieldrin
As	Arsenic
Ba	Barium
Cu	Copper
Fe	Iron
Pb	Lead
Vn	Vanadium

Interpreted landfill/disposal area

Limited soil

Approximate site boundary

16-SL-01 △ Remedial investigation Phase IIA surface soil sample location and designation

16S013 △ Remedial investigation Phase IIB surface soil sample location and designation

LIMITED SOIL REMOVAL AREAS, ALTERNTIVE 4

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FEASIBILITY STUDY
SITE 16, OPEN DISPOSAL AND BURNING AREA

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

APPENDIX D

COST CALCULATIONS FOR REMEDIAL ALTERNATIVE

ALTERNATIVE #1: NO ACTION, SITE 16

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$5,310*
Present Worth of 5-year costs at i=6%				*$17,352*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$17,352**
CONTINGENCY @ 10 PERCENT				**$1,735**
TOTAL COST OF ALTERNATIVE #1				**$19,087**

ALTERNATIVE #2: LAND USE CONTROLS, SITE 16

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$5,310*
Present Worth of 5-year costs at i=6%				*$17,352*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$17,352**
Land Use Controls (LUCs)				
Direct Costs				
Survey Plat	1	lump sum	$2,500.00	$2,500
Land Use Restriction Fees (Filling, Legal, etc.)	1	lump sum	$5,000.00	$5,000
Land Use Implementation Plan:				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	40	hrs	$60.00	$2,400
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total Direct Costs for Land Use Controls				**$11,950**
Annual Operation and Maintenance (O&M) Costs				
Quarterly Inspection				
Senior Scientist	0	hrs	$90.00	$0
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$320.00	$320
Quarterly Reporting				
Senior Scientist	8	hrs	$90.00	$720
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$1,000.00	$1,000

Annual Reporting				
Senior Scientist	2	hrs	$90.00	$180
Mid-level Engineer	8	hrs	$60.00	$480
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$250.00	$250
Total Annual Operation and Maintenance Costs				$6,790
Present Worth of Land Use Control costs at i=6%				*$93,464*
TOTAL LAND USE CONTROLS COSTS				**$105,414**
COST OF ALTERNATIVE #2				**$122,766**
CONTINGENCY @10 PERCENT				**$12,277**
TOTAL COST OF ALTERNATIVE #2				**$135,043**

ALTERNATIVE # 3: SOIL COVER AND LUCS, SITE 16

	Quantity	Unit	Unit Cost	Total Cost
DIRECT COSTS				
Land Use Controls (LUCs - See Alternative # 2				**$12,000**
Equipment Delivery (Mobilization)				
Front End Loader	2	LS	$1,000.00	$2,000
Dozer	2	LS	$1,000.00	$2,000
Grad-all	2	LS	$1,000.00	$2,000
Dump Truck (15 cyd)	6	LS	$250.00	$1,500
Water Truck	2	LS	$250.00	$500
Backhoe	4	LS	$500.00	$2,000
Pressure Washer	2	LS	$250.00	$500
Equipment	1	LS	$2,500.00	$2,500
Site Preparation				
Storage Trailer	2	mon	$150.00	$300
Trailer Delivery, Setup, Removal	1	each	$300.00	$300
Telephone Service	2	mon	$50.00	$100
Electrical Hookup/Power	2	mon	$100.00	$200
Miscellaneous Equipment	1	LS	$2,500.00	$2,500
Labor (Site Preparation)				
Electrician (2 men @ 2 days @ 10 hrs/day)	40	hrs	$42.00	$1,680
Foreman (1 man @ 5 days @10 hrs/day)	50	hrs	$60.00	$3,000
Laborers (2 men @ 5 days @ 10 hrs/day)	100	hrs	$36.00	$3,600
Equipment and Disposal Costs (Site Preparation)				
Backhoe and Operator	3	days	$1,200.00	$3,600
Front End Loader and Operator	3	days	$700.00	$2,100
Micellaneous Tools	1	LS	$2,500.00	$2,500
Trans and Disposal - Concrete Debris	0	tons	$30.00	$0
Silt fencing	3200	lf	$5.00	$16,000
Signs	16	ea	$50.00	$800
Mobilization and Site Preparation				**$49,680**
Clearing and Grubbing				
Foreman (2 wk @ 50 hrs/wk)	100	hrs	$60.00	$6,000
Grubbing, Removal and Stockpile (Labor Included)	8	acres	$3,500.00	$28,000
Transport and Disposal (Grub and Stumps)	250	tons	$30.00	$7,500

Clearing and Grubbing				**$41,500**
Soil Cover - 12 Acres				
Grade Site (2 Dozers and Operators)	20	dy	$1,650.00	$33,000
Common Fill - minimum 1.5' layer, Purchase & Hau	33840	cy	$10.00	$338,400
Common Fill - min. 1.5' layer, Spread & Compact	33840	cy	$2.00	$67,680
Site Superintendant (8.0 wks @ 50 hrs/wk)	400	hr	$60.00	$24,000
Topsoil - 6" layer, Purchase & Haul	11280	cy	$10.00	$112,800
Topsoil - 6" layer, Spread	11280	cy	$6.00	$67,680
Soil Cover				**$643,560**
Dust Control				
Water Truck and Driver	4	wk	$550.00	$2,200
Dust Control				**$2,200**
Site Restoration				
Fertilize, Seed, Mulch	12	acres	$2,000.00	$24,000
Site restoration				**$24,000**
TOTAL DIRECT COSTS				**$772,940**
INDIRECT COSTS				
Health and Safety (@3% of Direct Costs)				$23,188
Administrative Fees (@3% of Direct Costs)				$23,188
Engineering and Design (@10% of Direct Costs)				$77,294
Construction Support Services (@10% of Direct Costs)				$77,294
TOTAL INDIRECT COSTS				**$200,964**
TOTAL CAPITAL COSTS = Direct Costs + Indirect Costs				**$973,904**

OPERATION AND MAINTENANCE COSTS (annual)

Soil Cover Inspection and Maintenance (Annual)				
Replacement of Soil	15	ton	$20.00	$300
Dump Truck and Driver	1	dy	$1,250.00	$1,250
Laborers (2 @ 2dy @ 10 hrs/day)	40	hr	$36.00	$1,440
Subtotal Cost				$2,990
Present Worth (capitalized @ 6%, 30 years)				**$41,157**

5-Year Site Review (see Alternative #1)	
Total LOE	$7,800
Total ODCs	$360
Subtotal Cost	$8,160
Present Worth (capitalized @ 6%, 30 years)	**$26,665**
Land Use Controls - Quarterly and Annual Inspection and Reporting (see Alt. #2)	
Total LOE	$12,100
Other Costs	$11,950
Present Worth (capitalized @ 6%, 30 years)	**$135,043**
TOTAL O&M COSTS (5-Year Reviews and LUCs)	**$202,865**
TOTAL CAPITAL COSTS AND O&M COSTS	**$1,176,769**
CONTINGENCY (@ 10%)	**$117,677**
TOTAL COST OF ALTERNATIVE #4	**$1,294,446**

ALTERNATIVE # 4: Limited Soil Removal and Land Use Controls, Site 16

	Quantity	Unit		Unit Cost		Total Cost
CAPITAL COSTS						
TOTAL DIRECT COSTS						
Mobilization						
Miscellaneous						
Storage Trailer	0	day	$	150.00	$	-
Trailer Delivery, Setup, Removal	0	each	$	300.00	$	-
Toilet/Water Cooler Service	0	day	$	50.00	$	-
Misc. Equipment	1	LS	$	250.00	$	250.00
Equipment (Mobilization)						
Dump Truck	1	each	$	500.00	$	500.00
Backhoe	1	each	$	500.00	$	500.00
Pressure Washer	1	each	$	250.00	$	250.00
Equipment (Mobilization)	1	LS	$	1,000.00	$	1,000.00
General Site Mobilization	1	LS	$	250.00	$	250.00
Mobilization					**$**	**2,750.00**
Soil Sampling						
Soil Sampling and Analysis (Waste Characterization)						
Sampling Plan						
Mid-level Engineer/Scientist	8	hrs	$	75.00	$	600.00
ODCs	1	LS	$	250.00	$	250.00
Sample Collection						
Associate Scientist	8	hrs	$	60.00	$	480.00
Technician	8	hrs	$	40.00	$	320.00
ODCs, Sample Equipment, Supplies	1	LS	$	200.00	$	200.00
Waste Characterization and Clean Fill Analysis						
Metals, VOCs	16	each	$	260.00	$	4,160.00
Soil Samping and Analysis					**$**	**6,010.00**
Site Preparation						
Labor (Site Preparation)						
Laborers (2 men @ 2 days @ 10 hrs/day)	40	hrs	$	36.00	$	1,440.00
Foreman (1 man @2 days @ 10 hr/day)	20	hrs	$	36.00	$	720.00
Equipment and Disposal Costs						
Backhoe and Operator	1	days	$	1,200.00	$	1,200.00
Miscellaneous Tools	1	LS	$	300.00	$	300.00
Transport and Disposal - Wood Debris	3	tons	$	69.00	$	207.00

Signs	4	each	$	50.00	$	200.00
Site Preparation					**$**	**4,067.00**
Clearing and Grubbing						
Foreman (2 days @ 10 hrs/day)	20	hrs	$	60.00	$	1,200.00
Grubbing, Removal, & Stockpile (Labor Incl)	1	LS	$	800.00	$	800.00
Transport and Disposal (Grub and Stumps)	1	LS	$	800.00	$	800.00
Clearing and Grubbing					**$**	**2,800.00**
Loading and Off-site Landfill Disposal (116 cy = 148 tons)						
Backhoe and operator	3	days	$	1,200.00	$	3,600.00
Laborers (3 @ 2 days @ 10 hrs/day)	40	hrs	$	40.00	$	1,600.00
Site Superintendent	30	hrs	$	60.00	$	1,800.00
RCRA Subtitle D (Solid Waste) Landfill						
Transportation and Disposal	148	tons	$	52.00	$	7,696.00
Loading and Off-site Landfill Disposal (148 tons)					**$**	**14,696.00**
Vegetative Support Layer						
Topsoil - 6" layer, Purchase & Haul	29	yd^3	$	16.00	$	464.00
Topsoil - 6" layer, Spread	29	yd^3	$	4.00	$	116.00
Common Fill - 0.5' - 2' bls - Purchase and haul	87	yd^3	$	10.00	$	870.00
Site Superintendent (3 day @ 10 hrs/day)	30	hrs	$	60.00	$	1,800.00
Vegetative Support Layer					**$**	**3,250.00**
Site Restoration						
Fertlize, Seed, Mulch	2000	Sq. Ft	$	1.00	$	2,000.00
Demob of Equipment	1	LS	$	200.00	$	200.00
Site Restoration					**$**	**2,200.00**
Land Use Controls - Direct Costs						
Total LOE for Implementation Plan					$	4,200.00
Total ODCs for Implementation Plan					$	250.00
Survey Plat					$	2,500.00
Land Use Controls Fees (Filing, Legal, Etc.)					$	5,000.00
Land Use Controls - Direct Costs					**$**	**11,950.00**
TOTAL DIRECT COSTS					**$**	**47,723.00**
INDIRECT COSTS						
Health and Safety (@ 3% of Direct Costs)					$	1,431.69

Administative Fees (@ 3% of Direct Costs)	$	1,431.69
Engineering and Design (@ 10% of Direct Costs)	$	4,772.30
Construction Support Services (@ 10% of Direct Costs)	$	4,772.30
TOTAL INDIRECT COSTS	**$**	**12,407.98**
TOAL CAPITAL COSTS - Total Direct Costs + Total Indirect Costs	***$***	***60,130.98***

OPERATION AND MAINTENANCE COSTS (ANNUAL)

5-Year Site Review (see Alternative #1)		
Total LOE	$	4,950.00
Total ODCs	$	360.00
Subtotal Cost	$	5,310.00
Present Worth (capitallized @ 6%, 30 years)	**$**	**17,352.00**
Land Use Controls - Quarterly and Annual Inspection and Reporting (See Alt #2)		
Total Direct Costs	$	11,950.00
O&M Present Worth (capitalized @ 6%, 30 years)	$	93,464.00
Total Costs for Land Use Controls	**$**	**105,414.00**
TOTAL O&M COSTS (Annual Monitoring, 5-Year Review, LUCs)	***$***	***122,766.00***
TOTAL CAPITAL COSTS & O&M COSTS	***$***	***182,896.98***
Contingency (@ 10%)	**$**	**18,289.70**
TOTAL COST OF ALTERNATIVE #4	***$***	***201,186.68***

8 Hot Spot Areas

ALTERNATIVE # 4: Limited Soil Removal and Land Use Controls, Site 16

	Quantity	Unit		Unit Cost		Total Cost
CAPITAL COSTS						
TOTAL DIRECT COSTS						
Mobilization						
Miscellaneous						
Storage Trailer	0	day	$	150.00	$	-
Trailer Delivery, Setup, Removal	0	each	$	300.00	$	-
Toilet/Water Cooler Service	0	day	$	50.00	$	-
Misc. Equipment	1	LS	$	250.00	$	250.00
Equipment (Mobilization)						
Dump Truck	1	each	$	500.00	$	500.00
Backhoe	1	each	$	500.00	$	500.00
Pressure Washer	1	each	$	250.00	$	250.00
Equipment (Mobilization)	1	LS	$	1,000.00	$	1,000.00
General Site Mobilization	1	LS	$	250.00	$	250.00
Mobilization					**$**	**2,750.00**
Soil Sampling						
Soil Sampling and Analysis (Waste Characterization)						
Sampling Plan						
Mid-level Engineer/Scientist	8	hrs	$	75.00	$	600.00
ODCs	1	LS	$	250.00	$	250.00
Sample Collection						
Associate Scientist	16	hrs	$	60.00	$	960.00
Technician	16	hrs	$	40.00	$	640.00
ODCs, Sample Equipment, Supplies	2	LS	$	200.00	$	400.00
Waste Characterization and Clean Fill Analysis						
Metals, VOCs	32	each	$	260.00	$	8,320.00
Soil Samping and Analysis					**$**	**11,170.00**
Site Preparation						
Labor (Site Preparation)						
Laborers (2 men @ 3 days @ 10 hrs/day)	60	hrs	$	36.00	$	2,160.00
Foreman (1 man @3 days @ 10 hr/day)	30	hrs	$	36.00	$	1,080.00
Equipment and Disposal Costs						
Backhoe and Operator	2	days	$	1,200.00	$	2,400.00

8 Hot Spot Areas

Miscellaneous Tools	2	LS	$	300.00	$	600.00
Transport and Disposal - Wood Debris	6	tons	$	69.00	$	414.00
Signs	8	each	$	50.00	$	400.00
Site Preparation					**$**	**7,054.00**
Clearing and Grubbing						
Foreman (3 days @ 10 hrs/day)	30	hrs	$	60.00	$	1,800.00
Grubbing, Removal, & Stockpile (Labor Incl)	2	LS	$	800.00	$	1,600.00
Transport and Disposal (Grub and Stumps)	2	LS	$	800.00	$	1,600.00
Clearing and Grubbing					**$**	**5,000.00**
Loading and Off-site Landfill Disposal (232 cy = 296 tons)						
Backhoe and operator	4	days	$	1,200.00	$	4,800.00
Laborers (3 @ 3 days @ 10 hrs/day)	90	hrs	$	40.00	$	3,600.00
Site Superintendent	30	hrs	$	60.00	$	1,800.00
RCRA Subtitle D (Solid Waste) Landfill						
Transportation and Disposal	296	tons	$	52.00	$	15,392.00
Loading and Off-site Landfill Disposal (296 tons)					**$**	**25,592.00**
Vegetative Support Layer						
Topsoil - 6" layer, Purchase & Haul	58	yd^3	$	16.00	$	928.00
Topsoil - 6" layer, Spread	58	yd^3	$	4.00	$	232.00
Common Fill - 0.5' - 2' bls - Purchase and haul	174	yd^3	$	10.00	$	1,740.00
Site Superintendent (4 day @ 10 hrs/day)	40	hrs	$	60.00	$	2,400.00
Vegetative Support Layer					**$**	**5,300.00**
Site Restoration						
Fertlize, Seed, Mulch	4000	Sq. Ft	$	1.00	$	4,000.00
Demob of Equipment	2	LS	$	200.00	$	400.00
Site Restoration					**$**	**4,400.00**
Land Use Controls - Direct Costs						
Total LOE for Implementation Plan					$	4,200.00
Total ODCs for Implementation Plan					$	250.00
Survey Plat					$	2,500.00
Land Use Controls Fees (Filing, Legal, Etc.)					$	5,000.00

8 Hot Spot Areas

Land Use Controls - Direct Costs	**$**	**11,950.00**
TOTAL DIRECT COSTS	**$**	**73,216.00**
INDIRECT COSTS		
Health and Safety (@ 3% of Direct Costs)	$	2,196.48
Administative Fees (@ 3% of Direct Costs)	$	2,196.48
Engineering and Design (@ 10% of Direct Costs)	$	7,321.60
Construction Support Services (@ 10% of Direct Costs)	$	7,321.60
TOTAL INDIRECT COSTS	**$**	**19,036.16**
TOAL CAPITAL COSTS - Total Direct Costs + Total Indirect Costs	*$*	*92,252.16*
OPERATION AND MAINTENANCE COSTS (ANNUAL)		
5-Year Site Review (see Alternative #1)		
Total LOE	$	4,950.00
Total ODCs	$	360.00
Subtotal Cost	$	5,310.00
Present Worth (capitallized @ 6%, 30 years)	**$**	**17,352.00**
Land Use Controls - Quarterly and Annual Inspection and Reporting (See Alt #2)		
Total Direct Costs	$	11,950.00
O&M Present Worth (capitalized @ 6%, 30 years)	$	93,464.00
Total Costs for Land Use Controls	**$**	**105,414.00**
TOTAL O&M COSTS (Annual Monitoring, 5-Year Review, LUCs)	*$*	*122,766.00*
TOTAL CAPITAL COSTS & O&M COSTS	*$*	*215,018.16*
Contingency (@ 10%)	$	21,501.82
TOTAL COST OF ALTERNATIVE #4	*$*	*236,519.98*

ALTERNATIVE # 4: Limited Soil Removal and Land Use Controls, Site 16

	Quantity	Unit		Unit Cost		Total Cost
CAPITAL COSTS						
TOTAL DIRECT COSTS						
Mobilization						
Miscellaneous						
Storage Trailer	0	day	$	150.00	$	-
Trailer Delivery, Setup, Removal	0	each	$	300.00	$	-
Toilet/Water Cooler Service	0	day	$	50.00	$	-
Misc. Equipment	1	LS	$	250.00	$	250.00
Equipment (Mobilization)						
Dump Truck	1	each	$	500.00	$	500.00
Backhoe	1	each	$	500.00	$	500.00
Pressure Washer	1	each	$	250.00	$	250.00
Equipment (Mobilization)	1	LS	$	1,000.00	$	1,000.00
General Site Mobilization	1	LS	$	250.00	$	250.00
Mobilization					**$**	**2,750.00**
Soil Sampling						
Soil Sampling and Analysis (Waste Characterization)						
Sampling Plan						
Mid-level Engineer/Scientist	8	hrs	$	75.00	$	600.00
ODCs	1	LS	$	250.00	$	250.00
Sample Collection						
Associate Scientist	32	hrs	$	60.00	$	1,920.00
Technician	32	hrs	$	40.00	$	1,280.00
ODCs, Sample Equipment, Supplies	2	LS	$	200.00	$	400.00
Waste Characterization and Clean Fill Analysis						
Metals, VOCs	64	each	$	260.00	$	16,640.00
Soil Samping and Analysis					**$**	**21,090.00**
Site Preparation						
Labor (Site Preparation)						
Laborers (2 men @ 5 days @ 10 hrs/day)	100	hrs	$	36.00	$	3,600.00
Foreman (1 man @3 days @ 10 hr/day)	50	hrs	$	36.00	$	1,800.00
Equipment and Disposal Costs						
Backhoe and Operator	3	days	$	1,200.00	$	3,600.00

16 Hot Spot Areas

Miscellaneous Tools	3	LS	$	300.00	$	900.00
Transport and Disposal - Wood Debris	12	tons	$	69.00	$	828.00
Signs	16	each	$	50.00	$	800.00
Site Preparation					**$**	**11,528.00**
Clearing and Grubbing						
Foreman (5 days @ 10 hrs/day)	50	hrs	$	60.00	$	3,000.00
Grubbing, Removal, & Stockpile (Labor Incl)	4	LS	$	800.00	$	3,200.00
Transport and Disposal (Grub and Stumps)	4	LS	$	800.00	$	3,200.00
Clearing and Grubbing					**$**	**9,400.00**
Loading and Off-site Landfill Disposal (464 cy = 592 tons)						
Backhoe and operator	7	days	$	1,200.00	$	8,400.00
Laborers (3 @ 7 days @ 10 hrs/day)	210	hrs	$	40.00	$	8,400.00
Site Superintendent	70	hrs	$	60.00	$	4,200.00
RCRA Subtitle D (Solid Waste) Landfill						
Transportation and Disposal	592	tons	$	52.00	$	30,784.00
Loading and Off-site Landfill Disposal (296 tons)					**$**	**51,784.00**
Vegetative Support Layer						
Topsoil - 6" layer, Purchase & Haul	116	yd^3	$	16.00	$	1,856.00
Topsoil - 6" layer, Spread	116	yd^3	$	4.00	$	464.00
Common Fill - 0.5' - 2' bls - Purchase and haul	348	yd^3	$	10.00	$	3,480.00
Site Superintendent (6 day @ 10 hrs/day)	60	hrs	$	60.00	$	3,600.00
Vegetative Support Layer					**$**	**9,400.00**
Site Restoration						
Fertlize, Seed, Mulch	8000	Sq. Ft	$	1.00	$	8,000.00
Demob of Equipment	4	LS	$	200.00	$	800.00
Site Restoration					**$**	**8,800.00**
Land Use Controls - Direct Costs						
Total LOE for Implementation Plan					$	4,200.00
Total ODCs for Implementation Plan					$	250.00
Survey Plat					$	2,500.00
Land Use Controls Fees (Filing, Legal, Etc.)					$	5,000.00

16 Hot Spot Areas

Land Use Controls - Direct Costs	**$**	**11,950.00**
TOTAL DIRECT COSTS	**$**	**126,702.00**
INDIRECT COSTS		
Health and Safety (@ 3% of Direct Costs)	$	3,801.06
Administative Fees (@ 3% of Direct Costs)	$	3,801.06
Engineering and Design (@ 10% of Direct Costs)	$	12,670.20
Construction Support Services (@ 10% of Direct Costs)	$	12,670.20
TOTAL INDIRECT COSTS	**$**	**32,942.52**
TOAL CAPITAL COSTS - Total Direct Costs + Total Indirect Costs	***$***	***159,644.52***
OPERATION AND MAINTENANCE COSTS (ANNUAL)		
5-Year Site Review (see Alternative #1)		
Total LOE	$	4,950.00
Total ODCs	$	360.00
Subtotal Cost	$	5,310.00
Present Worth (capitallized @ 6%, 30 years)	**$**	**17,352.00**
Land Use Controls - Quarterly and Annual Inspection and Reporting (See Alt #2)		
Total Direct Costs	$	11,950.00
O&M Present Worth (capitalized @ 6%, 30 years)	$	93,464.00
Total Costs for Land Use Controls	**$**	**105,414.00**
TOTAL O&M COSTS (Annual Monitoring, 5-Year Review, LUCs)	***$***	***122,766.00***
TOTAL CAPITAL COSTS & O&M COSTS	***$***	***282,410.52***
Contingency (@ 10%)	**$**	**28,241.05**
TOTAL COST OF ALTERNATIVE #4	***$***	***310,651.57***

APPENDIX E

RESPONSE TO AGENCY COMMENTS

Response to EPA Review Comments
Site 16, Open Disposal and Burning Area
Draft Feasibility Study

1. **Cover Page**. The EPA ID number should be included on the cover page both inside and outside.

   Response: The EPA ID number will be added to the cover page and the report title page.

2. **Glossary, Page –viii-**. The abbreviation "BRA" defined as "baseline risk assessment" should be included in the glossary. In the definition for "LUCIP", change the word "Installation" to "Implementation". The definition for "RA" should be "remedial action" instead of "risk assessment". These abbreviations should be changed throughout the document, accordingly, wherever they occur.

   Response: As suggested by the reviewer, the abbreviation "BRA" for "baseline risk assessment" will be included. Also "CPC" will be changed to "COPC". In the definition for "LUCIP", the word "Installation" will be replaced by "Implementation". The report will be revised to reflect "RA" means "remedial action" and not risk assessment. These abbreviations will be changed throughout the document.

3. **Section 1.0, Page 1-1**. Change the word "Priority" to "Priorities" in the first sentence of the second paragraph.

   Response: The word "Priority" will be changed to "Priorities" in the first sentence of the second paragraph.

4. **Section 1.4, Page 1-7**. In the sixth bulleted item, change "SCTL" to "standards".

   Response: SCTL will be replaced by the word "standards".

5. **Section 2.2, Page 2-6, Surface Soil**. In the second paragraph, change "SCTLs" to "standards".

   Response: SCTL will be replaced by the word "standards".

6. **Section 3.2.3, Page 3-5**. In the second sentence of the third paragraph, change "Ant" to "And".

   Response: The word "Ant" will be replaced by the word "And".

7. **Table 4-3, Page 4-6**. This table should be moved so it occurs in the description of Alternative 2.

   Response: Table 4-3 will be moved to follow after it is referenced in the text.

8. **Section 4.4.1, Page 4-10, Site Restoration and Demobilization**. This section should address the need to sample fill material to insure it is free of COCs above actions levels.

   Response: Appropriate text will added to reflect the fill material will be sampled to insure it is free of COCs above action levels.

9. **Section 5.2.2, Page 5-2**. In the second sentence of the fourth paragraph, change "an LUCAP and LUCIP" to "a LUCIP". The third sentence of the fourth paragraph should be deleted, as it is speculative.

   Response: The words "an LUCAP and LUCIP" will be replaced by "a LUCIP". Also, the 3rd sentence of the 4th paragraph will be deleted.

Response to FDEP Comments on Feasibility Study for Site 16, Open Disposal and Burning Area NAS Whiting Field, Milton, Florida

1. I am not sure that use of the term, "hot spot" is really applicable at this stage of the evaluationprocess. To me, using that term implies knowledge (primarily through more complete delineation of the contaminant in question) that a contaminant is very limited in spatial distribution. Please recognize that we may not have the actual knowledge to properly apply the term. In many cases, the proper term to be applied would be "limited soil" as opposed to "hot spot". We will have to use our professional judgement. In other documents, such as the Proposed Plan, since it is a public-oriented document, I prefer that we not use the term "hot spot" at all.

   Response: As recommended by the reviewer, the term "hot spot" in the FS report will be replaced with "limited soil".

2. Page 2-5, Section 2.2, surface water discussion: "value" should replace "vale".

   Response: Text will be corrected as suggested by the reviewer.

3. Page 2-6, discussion of RAO 1: the first paragraph, continuing over to Page 2-9, should be rewritten to include a better explanation that the sites included in the site-specific direct exposure industrial/commercial SCTL (the proper term) are what were generally termed the "covered landfill" sites. They should not just be termed "disposal sites". You will remember that it was the act of covering the landfills that the Navy believes is the reason for much of the elevated arsenic in the surface soil. You may want to refer to my prior comment number three in my earlier letter concerning the Feasibility Study for Site 14, dated August 29, 2000.

   Response: The discussion of RAO1 will be rewritten as follows.

   Because Site 16 and several other sites at NAS Whiting Field are disposal sites, the Navy requested that the FDEP consider a site-specific direct exposure indusrtial/commercial SCTL for arsenic because the fill and cover material obtained at NASWF included subsurface soil containing elevated arsenic levels. The Navy recommended a SCTL for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16) of 4.62 milligrams per kilogram. This request is included as Appendix A of this report.

4. Page 3-4, Section 3.2.2, Land Use Controls: this section should be rewritten to reflect the actual stage of Land Use Controls at NASWF. A Memorandum of Agreement (MOA) is in effect. LUCAP is not the proper term to use when discussing a specific MOA. Speaking of the adopted MOA in the future tense ("would be drafted") should also not be done.

   Response: Section 3.2.2 will be revised to reflect the current status of the MOA. References to LUCAP will be deleted from the text.

5. Page 3-5, Section 3.2.4, Alternative 4: this is an instance where the use of "hot spot" should not occur. Please substitute "limited soil" in its place. In the second paragraph, I don't think TRPH is a problem at Site 16. Please confirm that this is the case.

   Response: The use of the term "hot spot" will be deleted and instead the term "limited soil" will be used in the FS report. The reviewer is correct: TRPH is not an issue at Site 16. Text will be revised appropriately to refelect this correction.

6. In the same paragraph as previously discussed in my intial remarks, please remember that the limited soil removal is recommended to address ecological risks and that additional soil sampling will be done (as has been properly noted in Table 3-2 and in Section 4-3).

   Response: Agree.

7. In Table 3-2, correct all references to LUCAP. Additionally, I don't think we should eliminate the possibility of additional soil delineation prior to excavation, rather than just specify excavation followed by confirmation.

   Response: All references to LUCAP will be deleted.

8. Page 4-4, Section 4.2.1 and Page 4-5, Section 4.2.2: correct the references to the LUCAP or explain that the process has been followed and the MOA (not LUCAP) for land use controls at NASWF has been signed.

   Response: References to LUCAP will be corrected. MOA will be referenced in the text.

9. Page 4-10, Sections 4.4 and 4.4.1: Substitute "limited soil" for the references to "hot spot". It appears that in Section 4.4.1, proper delineation and/or cofirmation sampling has not been provided for in that composite sampling for sonfirmation samples are proposed "from the bottom of the open excavation". I don't think that this is what should be accomplished; rather the samples should be taken from the sides of the excavation or, preferably, delineated sufficiently prior to excavation such that confirmation samples are not necessary. We can discuss the details, but sampling from the bottom of the open hole is not the way to show proper spatial removal of contaminants.

   Response: Section 4.4 will be revised to include sample collection from the walls of the excavation and the bottom of the pit.

10. Page 4-11, Section 4.4.2: this section begins to touch on my area of concern that was mentioned at the beginning of my letter, in that we need to begin thinking how we are going to determine when limited soil removal properly addresses the identified ecological conceerns at Site 16. We need to carefully consider our actions.

    Response: Agree.

11. Page 5-38: this figure should contain sufficient data to properly correlate the intent; for instance, the data presented do not reflect those locations where cadmium or zinc occur as related to ecological concerns. I recognize that we may not presently have enough data to fully depict all information for this project; however we should depict as much of the data that we can.

    Response: Figures presented in Appendix C will be revised to include human health and ecological contaminants of concern.