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NAS WHITING FIELD
5090.3a

FEASIBILITY STUDY FOR SURFACE AND SUBSURFACE SOILS AT SITES 3, 4, 6, 30, 32 AND 33 NAS WHITING FIELD FL

4/2/2001

TETRA TECH NUS

TETRA TECH NUS, INC.
800 Oak Ridge Turnpike, A-600 ▪ Oak Ridge, Tennessee 37830
(865) 483-9900 ▪ FAX: (865) 483-2014 ▪ www.tetratech.com

0401-E073

April 2, 2001

Commander, Southern Division, Naval Facilities Engineering Command
Department of the Navy
SOUTHNAVFACENGCOM
ATTN: Ms. Linda Martin, Code 1859
Remedial Project Manager
2155 Eagle Drive
North Charleston, SC 29419

Subject: Figure 5-1
Final Feasibility Study
For Surface and Subsurface Soil
Sites 3, 4, 6, 30, 32, and 33
NAS Whiting Field, Milton, Florida

Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0028

Dear Ms. Martin:

Figure 5-1 was inadvertently omitted from the Final Feasibility Study for Surface and Subsurface Soils at Sites 3, 4, 6, 30, 32, and 33, Naval Air Station Whiting Field in Milton, Florida, issued on 27 March, 2001. Please insert the attached Figure 5-1 following Page 5-8 in the Final Feasibility Report.

Copies of Figure 5-1 have been forwarded to the persons listed below on behalf of Southern Division, Naval Facilities Engineering Command for Naval Air Station Whiting Field.

Please call me at (865) 483-9900 if you have any questions or comments regarding this submittal.

Sincerely yours,

Phillip Ottinger

Phillip E. Ottinger
Task Order Manager

PEO:tko

Enclosure

c: Mr. Craig Benedikt, USEPA (1 copy)
Mr. Jim Cason, FDEP (2 copies)
Mr. Terry Hansen, Tetra Tech NUS (1 copy)
Mr. Jim Holland, NAS Whiting Field (2 copies)
Ms. Amy Twitty, CH2M Hill (1 copy)
Mr. Mark Perry (1 copy)
Ms. Debbie Wroblewski, Tetra Tech NUS (w/o enclosure)
File/Edb

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0301-E064

March 27, 2001

Commander, Southern Division, Naval Facilities Engineering Command
Department of the Navy
SOUTHNAVFACENGCOM
ATTN: Ms. Linda Martin, Code 1859
Remedial Project Manager
2155 Eagle Drive
North Charleston, SC 29419

Subject: Final Feasibility Study
For Surface and Subsurface Soil
Sites 3, 4, 6, 30, 32, and 33
NAS Whiting Field, Milton, Florida

Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0028

Dear Ms. Martin:

Tetra Tech NUS, Inc. is pleased to submit one copy of the Final Feasibility Study for Surface and Subsurface Soils at Sites 3, 4, 6, 30, 32, and 33, Naval Air Station Whiting Field in Milton, Florida.

Copies of the report have been forwarded to the persons listed below on behalf of Southern Division, Naval Facilities Engineering Command for Naval Air Station Whiting Field. A copy of the report has also been added to the Administrative Record maintained in the Oak Ridge, TN Tetra Tech NUS Office.

Please call me at (865) 483-9900 if you have any questions or comments regarding this submittal.

Sincerely yours,

Phillip Ottinger

Phillip E. Ottinger
Task Order Manager

PEO:tko

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File/Edb

Rev. 1
03/26/01

FEASIBILITY STUDY
FOR
SURFACE AND SUBSURFACE SOIL AT SITES 3, 4, 6, 30, 32, AND 33

Naval Air Station
Whiting Field
Milton, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888
Contract Task Order 0028

MARCH 2001

Rev. 1
03/26/01

FEASIBILITY STUDY
FOR
SURFACE AND SUBSURFACE SOIL AT
SITES 3, 4, 6, 30, 32, AND 33

NAVAL AIR STATION
WHITING FIELD
MILTON, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:

Tetra Tech NUS, Inc.
661 Anderson Drive
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CONTRACT NO. N62467-94-D-0888
CONTRACT TASK ORDER 0028

March 2001

PREPARED UNDER THE SUPERVISION OF:

Phillip Ottinger

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for

DEBBIE WROBLEWSKI
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

FOREWORD

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

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the 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. CERCLA and SARA 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 consists of Preliminary Assessment (PA) and Site Inspections (SIs), Remedial Investigation (RI) and Feasibility Study (FS), and Remedial Design and Remedial Action at sites where chemicals were allegedly spilled or disposed of. The PA and SI identify the presence of pollutants. The nature and extent of contamination as well as the selected remedial solutions are determined during the RI/FS. The Remedial Design and Remedial Action are performed to complete implementation of the solution.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection (formerly Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with Federal and state 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.

PROFESSIONAL ENGINEER CERTIFICATION

This document, *Feasibility Study for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, and 33, Naval Air Station Whiting Field, Milton, Florida*, has been prepared under the direction of a Florida Registered Professional Engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared for Naval Air Station Whiting Field, Milton, Florida, and should not be construed to apply to any other site.

Michael F. Albert
3/26/01

Tetra Tech NUS, Inc.
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ACRONYMS

APU	all-purpose universal
ARAR	applicable or relevant and appropriate requirement
AVGAS	aviation gasoline
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	chemical of concern
COPC	chemical of potential concern
CTE	Central Tendency Exposure
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FR	*Federal Register*
FS	feasibility study
GIR	General Information Report
GRA	general response action
HI	Hazard Index
HRS	Hazard Ranking System
IAS	initial assessment study
IR	Installation Restoration
LDR	land disposal restriction
LUC	land use control
LUCAP	LUC Assurance Plan
LUCIP	LUC Implementation Plan
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
NACIP	Naval Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
O&M	operations and maintenance
PA	Preliminary Assessment
PAH	polyaromatic hydrocarbon
PCE	tetrachloroethene
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PRG	preliminary remediation goal

ACRONYMS (Continued)

RA	risk assessment
RAO	remedial action objective
RBC	risk-based concentration
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RPO	representative process option
SARA	Superfund Amendments and Reauthorization Act
SCTL	Soil Cleanup Target Level
SI	Site Investigation
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SSL	soil screening level
SVOC	semivolatile organic compound
TBC	To Be Considered
TPH	total petroleum hydrocarbons
TSDF	Treatment, Storage, and Disposal Facility
UCL	Upper Confidence Limit
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

EXECUTIVE SUMMARY

A Feasibility Study (FS) has been conducted for Sites 3, 4, 6, 30, 32, and 33 at Naval Air Station Whiting Field in Milton, Florida, by the Southern Division, Naval Facilities Engineering Command, as part of the Department of Defense Installation Restoration (IR) program. The IR program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations. The Remedial Investigation (RI) Report (Tetra Tech NUS, 1999) was completed for Sites 3, 4, 6, 30, 32, and 33 in September 1999.

This FS report develops and evaluates potential remedies for surface and subsurface soil contamination for Sites 3, 4, 6, 30, 32, and 33. In this FS Remedial Action Objectives (RAOs) have been identified, Preliminary Remediation Goals (PRGs) have been developed, and remedial action alternatives to achieve those objectives have been identified and evaluated. The FS identifies and discusses the applicable or relevant and appropriate requirements, and presents a brief overview of the findings of the RI and the risk assessment in order to identify RAOs. For this FS, RAOs have been formulated based on the following criteria: (1) Unacceptable human health risks, (2) State of Florida Soil Cleanup Target Levels, and (3) U.S. Environmental Protection Agency Region III Risk Based Concentrations. Remedial technologies addressing site-specific considerations were identified and screened; those technologies passing the screening phase were then developed into remedial alternatives. A limited number of technologies were identified based on guidance established under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (40 *Code of Federal Regulations* 300). Assessment of groundwater and the leaching of soil at these sites will be performed as part of the ongoing Site 40 Basewide Groundwater Investigation.

This FS report contains the results of the identification, screening, and evaluation of remedial alternatives for surface and subsurface soil at the following sites:

- Site 3, Underground Waste Solvent Storage Area
- Site 4, North Aviation Gasoline (AVGAS) Tank Sludge Disposal Area
- Site 6, South Transformer Oil Disposal Area
- Site 30, South Field Maintenance Hangar
- Site 32, North Field Maintenance Hangar
- Site 33, Midfield Maintenance Hangar

Site 3 - Underground Waste Solvent Storage Area

Site 3 is located adjacent to Building 2941 and just north of the Paint Locker, Building 2987. The site includes an area where two 500-gallon underground metal tanks were used from 1980 to April of 1984 for the storage of waste solvents and residue generated from paint-stripping operations conducted at Building 2941. Wastes from the tanks were periodically pumped out for off-base disposal. In April of 1984, use of the underground tanks was discontinued and the two tanks were removed from the site. Site 3 also includes an area where an underground waste oil tank was located at the southwestern corner of Building 2941. This tank was used for storage of airframe, power plant, and ground support equipment liquid waste from 1968, and possibly earlier, until 1987. During expansion of the hardstand in 1987, this tank was reportedly removed.

The Chemical of Concern (COC) for Site 3 is arsenic from the surface down to approximately 9 feet below ground surface (bgs). The areal extent of soil contamination at Site 3 is approximately 1,964 ft^2 of impacted surface soil and 21,363 ft^2 of impacted subsurface soil with an estimated volume of 145 yd^3 of impacted surface soil and 5,492 yd^3 of impacted subsurface soil.

The three alternatives for Site 3 represent a range of actions including no action, containment/limited action addressing principal threats, and an aggressive action which minimizes the need for long-term management. The three alternatives providing a range of treatment options for Site 3 are listed below.

- Alternative S3-1: No Action
- Alternative S3-2: Surface Soil (exceeding PRGs) Removal and Land Use Controls (LUCs)
- Alternative S3-3: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

Site 4 - North Aviation Gasoline (AVGAS) Tank Sludge Disposal Area

Site 4 is a former underground storage tank (UST) facility located north of Tow Lane at North Field. The former tank farm within the fenced North Field restricted area covers approximately 2.5 acres and is currently covered with grass. Site 4 contained nine 23,700-gallon steel tanks dating back to 1943 when NAS Whiting Field first began operations. Eight of the nine USTs at this site were used for AVGAS storage. Past use(s) of the ninth tank for anything other than storage of contaminated jet fuel is unknown. All USTs and associated piping were removed in 1992. There are no records of spills or leaks at Site 4, but petroleum contamination was observed when the USTs were removed.

The COCs for Site 4 are arsenic from the surface down to approximately 26 feet bgs and benzo(a)pyrene at approximately 35 feet bgs. The areal extent of soil contamination at Site 4 is approximately 2,513 ft^2 of

impacted surface soil and 21,441 ft^2 of impacted subsurface soil with an estimated volume of 186 yd^3 of impacted surface soil and 18,410 yd^3 of impacted subsurface soil.

The four alternatives for Site 4 represent a range of actions including no action, containment/limited action addressing principal threats, and an aggressive action which minimizes the need for long-term management. The four alternatives providing a range of treatment options for Site 4 are listed below.

- Alternative S4-1: No Action
- Alternative S4-2: Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S4-3: Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs
- Alternative S4-4: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

Site 6 - South Transformer Oil Disposal Area

Site 6 is located southeast of the midfield maintenance hangar, Building 1454. At Site 6, from the 1940s until 1964, transformers were reportedly drained into the grassed "0-2" ditch located approximately 500 feet southeast of the old transformer repair shop, Building 1478, and east of Building 1454. It is likely the dielectric fluid from the transformers was contaminated with polychlorinated biphenyls. Runoff from the grassed ditch drains in a northeasterly direction eventually into Big Coldwater Creek located approximately 2.3 miles east of the disposal site (Geraghty & Miller, 1984).

The COCs for Site 6 are benzo(a)pyrene and TPH from the surface down to approximately 4 feet bgs. The areal extent of soil contamination at Site 6 is approximately 20,100 ft^2 of impacted surface and subsurface soil with an estimated volume of 1,482 yd^3 of impacted surface soil and 1,482 yd^3 of impacted subsurface soil.

The four alternatives for Site 6 represent a range of actions including no action, containment/limited action addressing principal threats, and two aggressive actions which minimizes the need for long-term management. The four alternatives providing a range of treatment options for Site 6 are listed below.

- Alternative S6-1: No Action
- Alternative S6-2: Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S6-3: Soil Venting and LUCs
- Alternative S6-4: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

Site 30 - South Field Maintenance Hangar

Site 30 is located at the South Field Maintenance Hangar, Building 1406. The site includes Building 1406, the adjacent wash rack area, and the location of the abandoned waste oil tanks west of Building 1406. The South Field Maintenance Hangar was constructed in the middle 1940s to support maintenance service to training aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning. These activities generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids.

The COCs for Site 30 are arsenic from the surface down to approximately 19 feet bgs and TPH from the surface down to approximately 20 feet bgs. The areal extent of soil contamination at Site 30 is approximately 7,540 ft^2 of impacted surface soil and 13,335 ft^2 of impacted subsurface soil with an estimated volume of 558 yd^3 of impacted surface soil and 4,035 yd^3 of impacted subsurface soil.

The four alternatives for Site 30 represent a range of actions including no action, containment/limited action addressing principal threats, and an aggressive action which minimizes the need for long-term management. The four alternatives providing a range of treatment options for Site 30 are listed below.

- Alternative S30-1: No Action
- Alternative S30-2: UST Removal, Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S30-3: UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs
- Alternative S30-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

Site 32 - North Field Maintenance Hangar

Site 32 is located at the North Field Maintenance Hangar, Building 1424. The site includes Building 1424, the adjacent wash rack area, and the location of the abandoned waste oil tanks east of Building 1424. The North Field Maintenance Hangar was constructed in the middle 1940s to support maintenance service to training aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning. These activities generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids. Before Aircraft Intermediate Maintenance Department activities began, aircraft maintenance wastes from Hangar 1424 were reportedly sent to base landfills; however, spills and uncontrolled disposal of solvents at or near the sites of generation were common occurrences in the 1940s and 1950s.

The only COC for Site 32 is TPH from the surface down to 37 feet bgs. The areal extent of soil contamination at Site 32 is approximately 2,100 ft^2 of impacted surface soil and 2,100 ft^2 of impacted subsurface soil with an estimated volume of 156 yd^3 of impacted surface soil and 1,019 yd^3 of impacted subsurface soil.

The four alternatives for Site 32 represent a range of actions including no action, containment/limited action addressing principal threats, and an aggressive action minimizes the need for long-term management. The four alternatives providing a range of treatment options for Site 32 are listed below.

- Alternative S32-1: No Action
- Alternative S32-2: UST Removal, Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S32-3: UST Removal, Soil Venting and LUCs
- Alternative S32-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

Site 33 - Midfield Maintenance Hangar

Site 33 is located at the Midfield Maintenance Hangar, Building 1454. The site includes Building 1454 and the location of the abandoned waste oil tank north of Building 1454. The Midfield Maintenance Hangar was constructed in the middle 1940s to support maintenance service of assigned aircraft and line maintenance on transient aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning.

The COCs for Site 33 are arsenic from 2 feet bgs to approximately 27 feet bgs and TPH from approximately 5 feet bgs to 50 feet bgs. The areal extent of soil contamination at Site 33 is approximately 1,571 ft^2 of impacted subsurface soil with an estimated volume of 1,117 yd^3 of impacted subsurface soil.

The four alternatives for Site 33 represent a range of actions including no action, containment/limited action addressing principal threats, and an aggressive action minimizes the need for long-term management. The four alternatives that provide a range of treatment options for Site 33 are listed below.

- Alternative S33-1: No Action
- Alternative S33-2: UST Removal, LUCs
- Alternative S33-3: UST Removal, Soil Venting and LUCs
- Alternative S33-4: UST Removal, Subsurface Soil (exceeding PRGs) Removal and LUCs

1.0 INTRODUCTION

Tetra Tech NUS, Inc., under contract N62467-94-D-0888 to the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is submitting this Feasibility Study (FS) to address surface and subsurface soil at Sites 3, 4, 6, 30, 32, and 33 at Naval Air Station (NAS) Whiting Field, Milton, Florida. The impact of these soils on groundwater will be evaluated in the FS for Site 40, Basewide Groundwater. This FS is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (ABB-ES, 1998) and Remedial Investigation (RI) Report (Tetra Tech NUS, 1999) 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 addressing impacted soil at Sites 3, 4, 6, 30, 32, and 33.

The goals of the RI/FS are (1) to assess the extent, magnitude, and impact of contamination at the site; (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 addressing threats to human health and/or the environment. The first two goals have been discussed in the GIR and RI reports; the remaining goal will be presented and discussed in this FS report. For brevity, general information presented in the GIR and RI reports will not be repeated in the 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.
- Risk assessment (RA) methodology for both human health and ecological receptors.
- A summary of the facilitywide background evaluation.

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics, for conducting a baseline RA, 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 remedial action is necessary. The RI Report for Sites 3, 4, 6, 30, 32, and 33 at NAS Whiting Field provides the following information:

- Site descriptions and a summary of previous investigations for Sites 3, 4, 6, 30, 32, and 33.
- A summary of the field investigation methods used during the RI.
- A site-specific data quality assessment.

- The selection of Chemicals of Potential Concern (COPCs) for each site.
- An assessment of the extent, magnitude, and impact of contamination at the site.
- A qualitative and quantitative assessment of risks to human health and the environment.

The FS uses the results of the RI and the information presented in the GIR to identify Remedial Action Objectives (RAOs), Preliminary Remediation Goals (PRGs), Chemicals of Concern (COCs), and to develop, screen, and evaluate potential remedial alternatives. The FS has been prepared in accordance with the following regulations and guidance documents: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP): 40 *Code of Federal Regulations* (CFR), Part 300; and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (RI/FS Guidance) (USEPA, 1988).

1.1 THE CERCLA FS PROCESS

The development of remedial alternatives for CERCLA sites consists of developing PRGs, COCs, and areas and volumes of contamination and then identifying applicable technologies and developing those technologies into remedial alternatives to meet the PRGs.

The first step in the FS process is to develop RAOs specifying the contaminants, media of interest, and exposure pathways which leads to development of the PRGs and COCs. The PRGs are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs), when available, site-specific risk-based factors, or other available information. COCs are identified as those chemicals with average concentrations exceeding the PRGs and background. Once the PRGs and COCs have been determined, the areas and volumes of contamination requiring remedial action are determined.

Once RAOs/PRGs are identified, general response actions (GRAs) for each medium of interest are developed. GRAs typically fall into the following categories: No Action, containment, excavation, extraction, treatment, disposal, or other actions, singular or in combination, taken to satisfy the RAOs for the site.

The next step in the FS process is to identify and screen alternatives. This step considers applicable technologies for each GRA. This step eliminates technologies not technically feasible. Those technologies passing the screening phase are then assembled into remedial alternatives. The NCP requires a range of alternatives be presented in the FS to the maximum practicable extent. Remedial

alternatives are then described and analyzed in detail using the CERCLA evaluation criteria (Table 1-1) described in the NCP, including:

Threshold Criteria

- Overall protection of human health and the environment.
- Compliance with ARARs.

Balancing Criteria

- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of contaminants through treatment.
- Short-term effectiveness.
- Implementability.
- Cost.

Alternatives are evaluated against two additional factors (Modifying Criteria) after state participation and the public comment period for the FS:

Modifying Criteria

- State acceptance.
- Community acceptance.

The results of the detailed analyses are summarized and compared in a comparative analysis. The alternatives are compared against each other using the CERCLA evaluation criteria.

These criteria are used because SARA requires them to be considered during remedy selection. Modifying criteria, including 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 which is included in the Record of Decision (ROD).

Upon completion of the FS Report, the Proposed Plan will be developed. The Proposed Plan will identify the preferred remedial alternative for Sites 3, 4, 6, 30, 32, and 33. 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

Table 1-1
CRITERIA FOR DETAILED ANALYSIS OF ALTERNATIVES
NAS WHITING FIELD, MILTON, FLORIDA

THRESHOLD CRITERIA

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

- How Alternative Provides Health and Environmental

COMPLIANCE WITH ARARs

- Compliance with Chemical-Specific
- Compliance with Action-Specific
- Compliance with Location-Specific
- Compliance with Other Criteria, Advisories, and

BALANCING CRITERIA

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude Residual Risk
- Adequacy Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

- Treatment Process Used Materials
- Amount of Materials Destroyed Treated
- Degree to Reductions in Toxicity, Mobility, and
- Degree to Treatment is Irreversible
- Type and Quantity Residuals Remaining Treatment

SHORT-TERM EFFECTIVENESS

- Protection of During Remedial
- Protection of During Remedial
- Environmental
- Time Until Remedial Action Objectives Achieve

IMPLEMENTABILITY

- Ability to Construct Operate the
- Reliability of the Technology
- Ease of Additional Actions, If Necessary
- Ability to Monitor ness of Remedy
- Ability to Approvals From Agencies
- Coordination With Agencies
- Availability of Treatment, Storage, Disposal Services and Capacit
- Availability of Equipment, and Specialists
- Availability of Technologies

COST

- Capital Costs
- Operating Maintenance
- Present Worth Costs

MODIFYING CRITERIA

STATE ACCEPTANCE [1]

COMMUNITY ACCEPTANCE [1]

[1] These criteria are assessed following regulatory and public comment on the RI/FS report and the

Source: Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA,

responsiveness summary as an appendix. Once the ROD is signed, the chosen remedial alternative will be implemented.

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

1.2 PURPOSE

The purpose of the FS report for Sites 3, 4, 6, 30, 32, and 33 at NAS Whiting Field is to develop remedial alternatives to address threats to human health and the environment resulting from contaminated soil. RAOs are used to develop, screen, and evaluate potential remedial alternatives to meet the objectives.

The FS report was developed in accordance with the NCP which provides guidance for identifying applicable remedial action technologies. The FS report does not present all the possible variations and combinations of remedial actions possible, but presents distinctly different alternatives representing a range of opportunities for meeting the RAOs. It is expected these different alternatives can be adjusted during the proposed plan and decision process, and to a lesser extent during detailed design, to accomplish the RAOs in a manner similar to the initially proposed alternative. Also, the FS report does not present information on alternatives failing to meet the RAOs, except for a No Action alternative, which provides a baseline for comparison of all alternatives.

The following criteria are considered in identifying appropriate remedial action for Sites 3, 4, 6, 30, 32, and 33.

- RAOs. RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals.
- Applicable Technologies. Technologies applicable for addressing contaminated media are identified and screened. Technologies that cannot be implemented are eliminated.
- Remedial Alternatives. Technologies passing 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 are compared against each other using threshold and primary balancing criteria.

1.3 ENVIRONMENTAL CONDITIONS

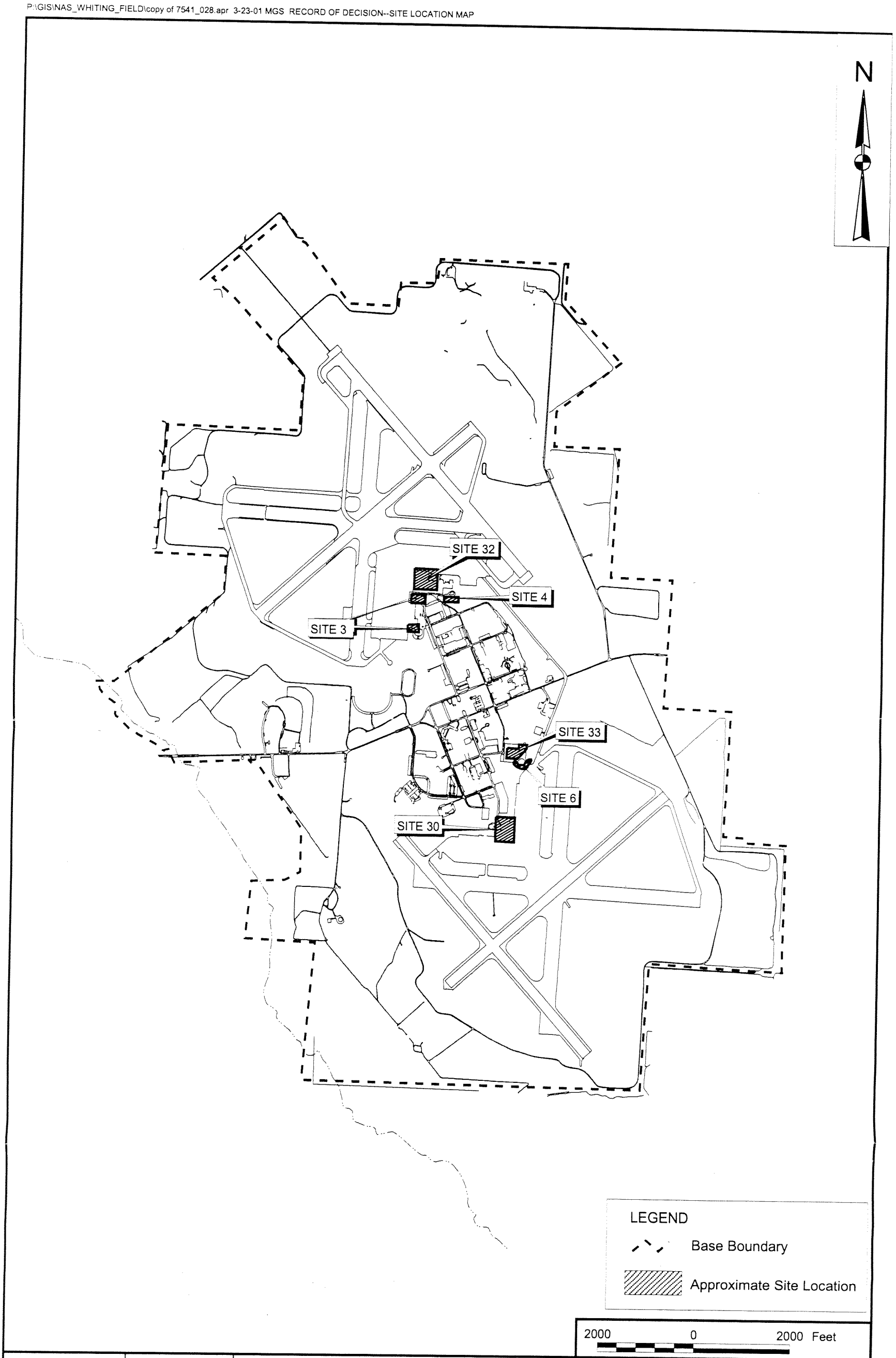
NAS Whiting Field is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola. Mobile, Alabama, is approximately 70 miles west of the air station, and Tallahassee, the capital of Florida, is 174 miles to the east. The installation was constructed in the early 1940s and since then has served as a naval aviation training facility. NAS Whiting Field presently consists of two airfields (North and South Fields) separated by an industrial area. The installation is approximately 3,842 acres in size. NAS Whiting Field provides the support facilities for flight and academic training. Figure 1-1 presents the installation layout and locations of RI/FS sites at NAS Whiting Field. Figure 1-2 shows the location of soil borings installed during the investigation of Sites 3, 4, and 32. Figure 1-3 shows the location of soil borings for Sites 6 and 33, and Figure 1-4 shows the location of soil borings for Site 30.

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested area to the south and southwest, and forests along the remaining boundaries. Located on an upland area, elevations at Whiting Field range from 50 to 190 feet above sea level. The facility is bounded by low-lying receiving water: Clear Creek to the west and south and Big Coldwater Creek to the east. These two streams are tributaries of the Blackwater River which discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system. Both Clear Creek and Big Coldwater Creek are classified by the Florida Department of Environmental Protection (FDEP) as Class II Waters Recreation-Propagation and Management of Fish and Wildlife. Blackwater River is classified as an Outstanding Florida Water. Outstanding Waters are considered to be of exceptional recreational and ecological significance.

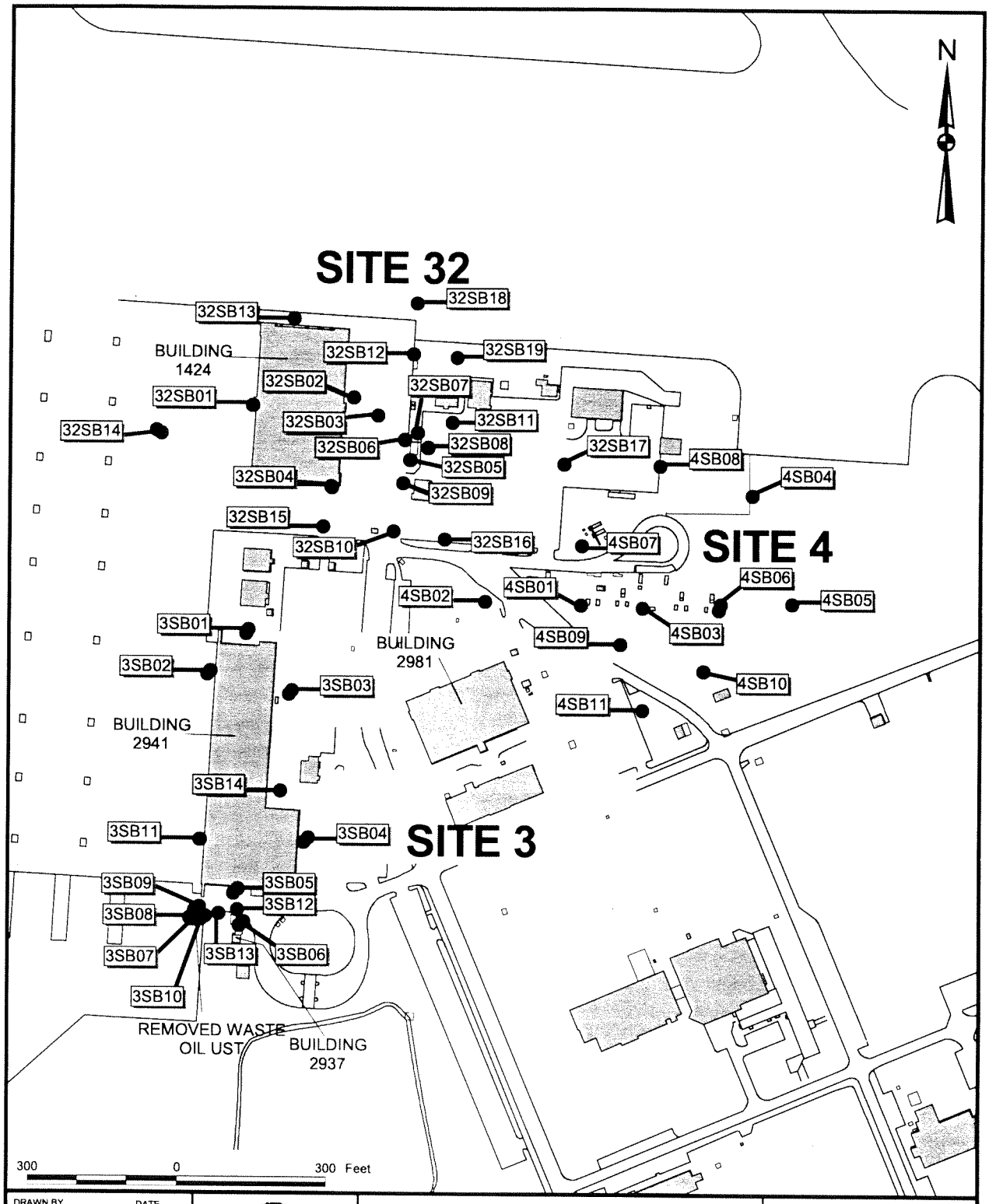
1.4 REGULATORY SETTING

The Navy Installation Restoration (IR) program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations, with the goal of expediting and improving environmental response actions while protecting human health and the environment. The IR program is conducted in accordance with Section 120 of CERCLA as amended by SARA and Executive Order 12580. CERCLA requires federal facilities to comply with the act, both procedurally and substantively. SOUTHNAVFACENGCOM is the agency responsible for the Navy IR program in the southeastern United States; therefore, SOUTHNAVFACENGCOM has the responsibility of processing NAS Whiting Field through the Preliminary Assessment, Site Inspection, RI/FS, and remedial response selection in compliance with the guidelines of NCP (40 CFR 300).

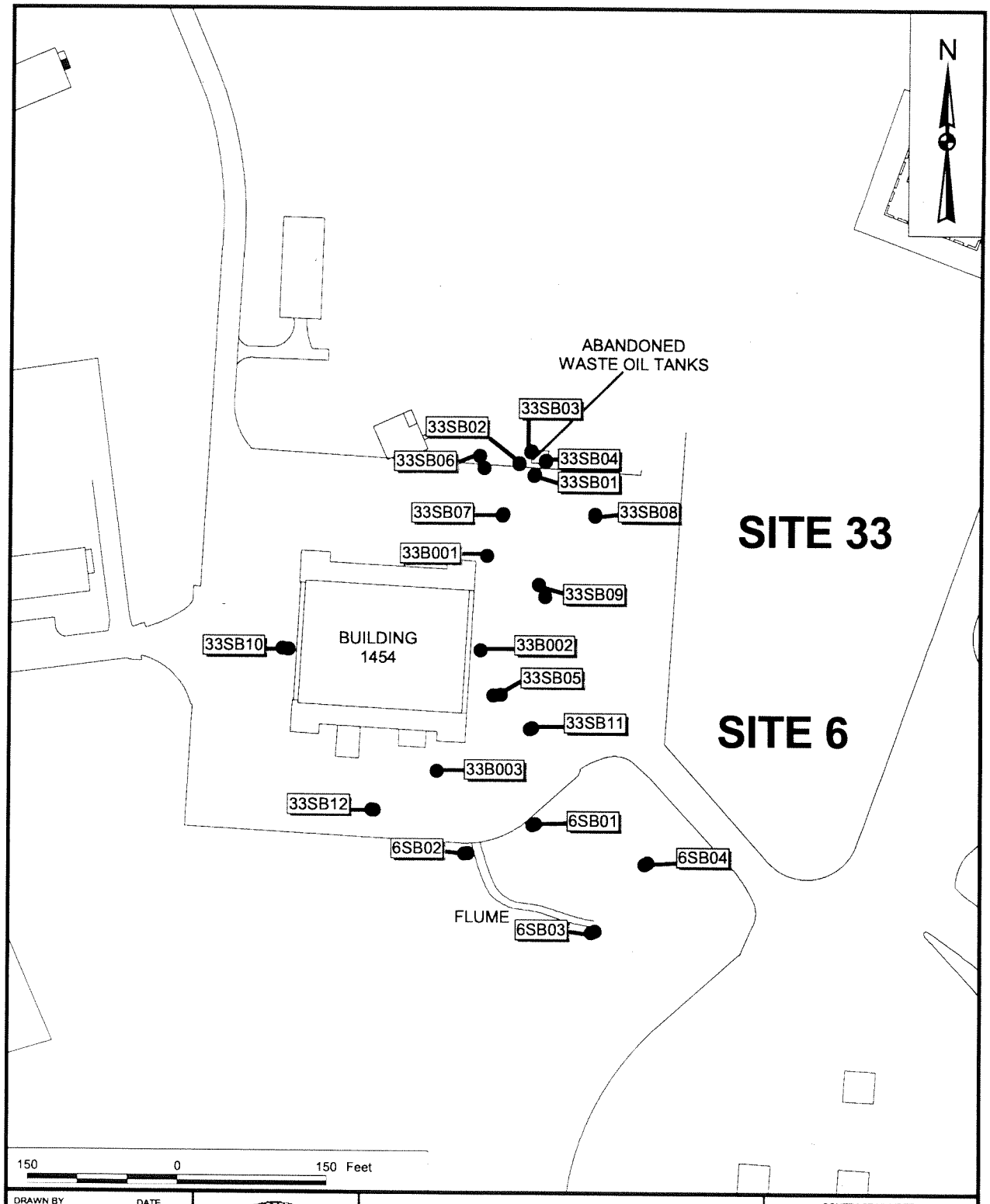
P:\GIS\NAS_WHITING_FIELD\copy of 7541_028.apr 3-23-01 MGS RECORD OF DECISION--SITE LOCATION MAP



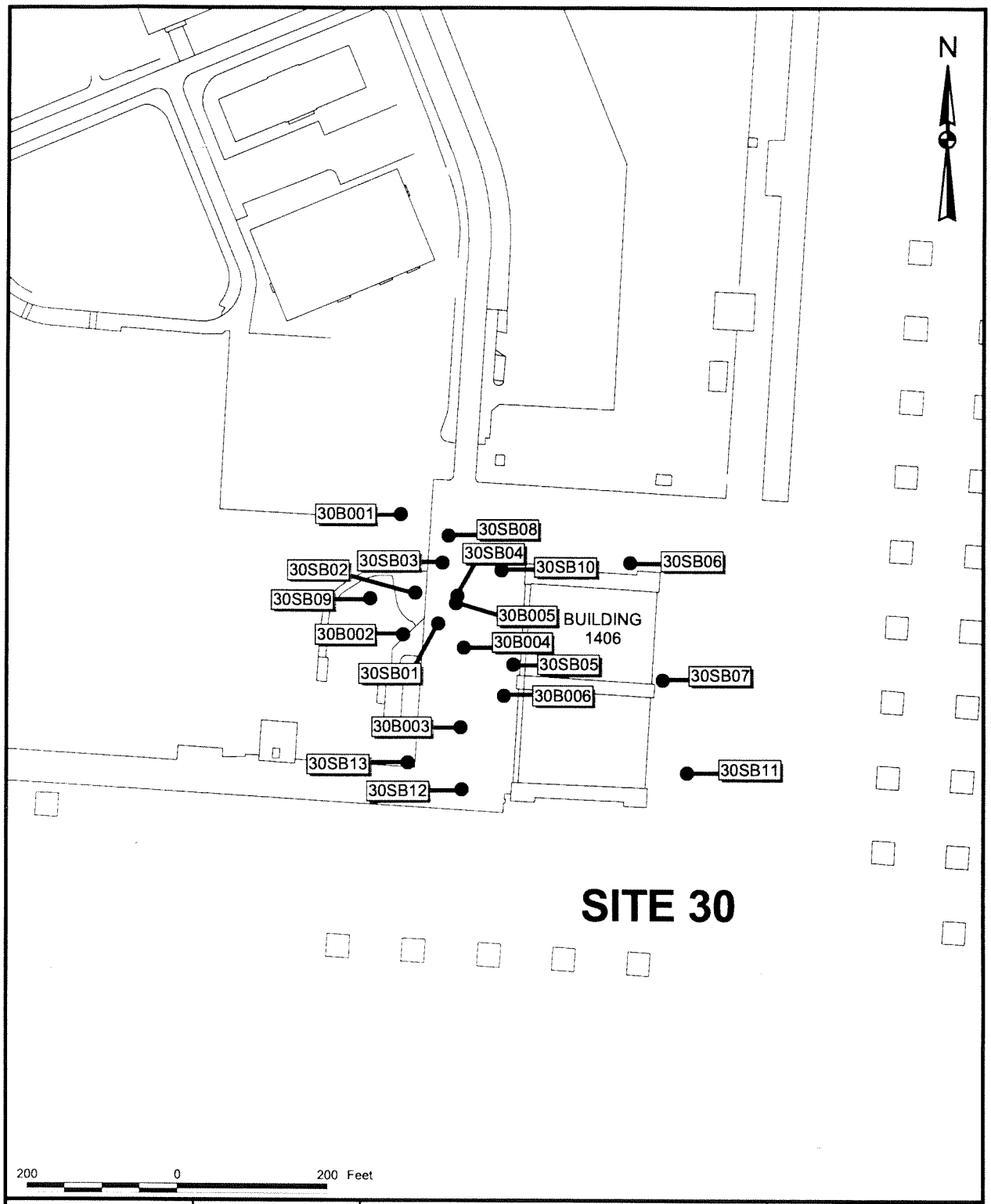
DRAWN BY J. BELLONE	DATE 8/2/00	SITE LOCATION MAP NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER 0052
CHECKED BY	DATE		APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 / REV 0



DRAWN BY J. BELLONE — DATE 10/20/99			CONTRACT NUMBER —
CHECKED BY — DATE		SITES 3, 4, AND 32 SOIL BORING LOCATION MAP NAS WHITING FIELD, MILTON, FLORIDA	APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 — REV 0



DRAWN BY J BELLONE	DATE 10/20/98	SITES 6 AND 33 SOIL BORING LOCATION MAP NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER —
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1-3 REV 0



DRAWN BY J BELLONE	DATE 10/20/99	SITE 30 SOIL BORING LOCATION MAP NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER —
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1-4 / REV 0

Section 105(a)(8)(A) of SARA required the U. S. Environmental Protection Agency (USEPA) to develop criteria to set priorities for remedial action based on relative risk to human and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 [55 *Federal Register* (FR) No. 241:51532-51667], to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk.

The HRS score for NAS Whiting Field was generated in 1993. The score was sufficient to place NAS Whiting Field on the National Priorities List (NPL); therefore, in January 1994, USEPA placed NAS Whiting Field on a list of sites proposed for inclusion on the NPL (40 CFR 300; FR 18 January 1994), and on May 31, 1994, NAS Whiting Field was placed on the NPL effective June 30, 1994 (40 CFR 300; FR 31 May 1994). Consequently, the RI/FS for NAS Whiting Field must follow the requirements of the NCP, as amended by SARA, and guidance for conducting an RI/FS under CERCLA (USEPA, 1988).

Per CERCLA Section 121(d), the Navy will follow ARARs of the State of Florida for all IR program activities at NAS Whiting Field.

1.5 REPORT ORGANIZATION

The FS report is organized into seven chapters. Chapter 1.0 presents the purpose, site description, and regulatory setting for the FS at NAS Whiting Field. Chapters 2.0 through 7.0 present the development of the RAOs, PRGs, COCs, and areas and volumes of contamination; identify and screen the alternatives; present the detailed analysis of the alternatives; and present the comparative analysis for each site. Each site is addressed individually in a separate chapter for ease of review.

The FS report also includes six Appendices (A-F). Appendix A provides a copy of Florida Soil Cleanup Target Levels (SCTLs) for soils (Chapter 62-777, F.A.C.), and Appendix B provides a copy of the USEPA Region III Soil Screening Levels. GRAs are described in Appendix C, and CERCLA evaluation criteria are discussed in Appendix D. Appendix E contains a cost estimate for the alternatives evaluated at each site, and Appendix F provides responses to USEPA and FDEP comments on the draft FS.

2.0 SITE 3 - UNDERGROUND WASTE SOLVENT STORAGE AREA

Site 3 includes the area surrounding Building 2941 and extends south to the Paint Locker, Building 2987 (see Figure 1-1). The site includes an area where two 500-gallon underground metal tanks were used from 1980 to April of 1984 for the storage of waste solvents and residue generated from paint-stripping operations conducted at Building 2941. Wastes from the tanks were periodically removed for off-base disposal. In April of 1984, use of the underground tanks was discontinued and the two tanks were removed from the site. During excavation operations, one of the tanks was punctured by a backhoe, resulting in the spillage of approximately 120 gallons of waste solvents onto the ground. Cleanup operations conducted resulted in the recovery of approximately 50 gallons of the waste solvent and the removal of approximately 6 yd^3 of contaminated soil. This material was sent off base for disposal. Examination of the tanks revealed holes up to 0.5 inch in diameter apparently caused by the waste solvents corroding through the metal tanks. The extent of leakage from the tanks before their removal is not known.

Site 3 also includes the area where an underground waste oil tank was located near the southwestern corner of Building 2941. This tank was used for storage of airframe, power plant, and ground support equipment liquid waste from 1968, and possibly earlier, until 1986. This tank was reportedly removed prior to the expansion of the hardstand in 1987.

Sanitary and storm lines located adjacent to or exiting Building 2941 to the north, west, and east of the building were also investigated as part of Site 3.

The remedial investigation for Site 3 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

2.1 ENVIRONMENTAL CONDITIONS

2.1.1 Nature and Extent of Contamination

Chemicals detected in the surface and subsurface soils at Site 3 include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), pesticides/polychlorinated biphenyls (PCBs), and inorganics. Most of the positive detections were confined to the surface soils. Surface soil results appear to show different patterns of SVOCs and pesticides. SVOCs appear to be limited to the surface soil in the area around the former underground storage tanks (USTs) near the southern end of Building 2941, except for bis(2-ethylhexyl)phthalate detected in 3SB02 (see Figure 1-2 for location of soil borings). The possible source of the release of SVOCs to the surface soil is surface spills from wastes being discharged to the waste oil and waste solvent USTs. Only one SVOC (diethyl phthalate) was detected in the subsurface soil at the former USTs.

Pesticide compounds in surface soil were detected almost exclusively in samples collected from the northern end of Building 2941 (3SB1, 3SB2, and 3SB3). Only one surface soil sample in the vicinity of the USTs (3SB013) contained pesticide compounds. Pesticide compounds were detected in three subsurface soil samples to depths of 25-27 feet below ground surface (bgs). 4,4'-DDD was detected in two soil borings (3SB06 and 3SB07) located in the vicinity of the abandoned USTs. 4,4'-DDT was also detected at 10 to 12 feet bgs in 32SB07. Dieldrin was detected in boring 3SB01 located on the northern end of Building 2941 at depths of 5 to 7 feet and 25 to 27 feet bgs. The occurrence of pesticides in the surface soils is most likely from pest control efforts.

The remaining chemicals (VOCs, TPH, and inorganics) were detected at a substantially lower frequency in the surface and subsurface soil than SVOCs and pesticides/PCBs. VOC constituents were concentrated along the east side of Building 2941. Acetone was detected more often in the subsurface soil than in the surface soil. Acetone is also a common laboratory-derived contaminant; however, relatively high acetone detections (16 to 100 J μg/kg) in the surface and subsurface soils along the east side of Building 2941 indicate they are valid soil concentrations. PCE was detected in the surface soil and subsurface soil at 3SB05 to a depth of 5-7 feet bgs. Infrequent detections of TPH appear to be centered around the abandoned USTs, with the exception of a detection in 3SB01.

Arsenic and cyanide appear to follow the same pattern as the pesticides in the surface and subsurface soil at Site 3. These constituents are common ingredients in commercial pesticides.

2.1.2 Risk Assessment Results

Surface Soil

The concentrations of six analytes (aluminum, arsenic, chromium, dieldrin, iron, and vanadium) exceeded site-specific background concentrations and either USEPA Region III Risk-Based Concentrations (RBCs) or Florida SCTLs for direct soil exposure (residential). These analytes were selected as COPCs and were used to evaluate the human health risks associated with the surface soil at Site 3 (Table 2-1).

Table 2-1
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Arsenic	✓	✓
Chromium	✓	
Iron	✓	
Vanadium	✓	
Dieldrin	✓	

The cancer risks associated with reasonable maximum exposure (RME) to surface soil are 1.5×10^{-6} for an older child trespasser, 2.4×10^{-6} for an adult trespasser, 6.9×10^{-6} for the occupational worker, 1.0×10^{-6} for the site maintenance worker, 1.4×10^{-7} for the construction worker, and 3.9×10^{-5} for the child/adult resident. The cancer risks for all receptors are less than or within the USEPA acceptable cancer risk range of 1×10^{-4} to 1×10^{-6}. The risk values for the construction worker and site maintenance worker are less than or equal to the FDEP target risk of 1×10^{-6}. However, the cancer risks associated with exposure to surface soils for the trespasser (older child and adult), the occupational worker, and the child/adult resident exceed the FDEP target risk of 1×10^{-6}. The primary risk driver is arsenic for all receptors. Dieldrin was also a risk driver for the child and adult resident.

The noncancer risks associated with surface soil ingestion and dermal contact for the older child and adult trespasser, occupational worker, site maintenance worker, construction worker, and the adult resident are below USEPA's and FDEP's target Hazard Index (HI) of 1. The noncarcinogenic risk (RME) for the child resident is 1.01. This noncarcinogenic risk slightly exceeds unity (1.0). *However, the noncarcinogenic risk for individual target organs does not exceed 1.0.*

Subsurface Soil

The concentrations of only one analyte (arsenic) exceeded site-specific background concentrations and either USEPA Region III RBCs or FDEP's SCTLs for direct soil exposure (industrial/commercial). Arsenic was selected as a COPC and was used to evaluate the human health risk associated with the subsurface soil at Site 3.

The cancer risk (RME) associated with exposure to subsurface soil (ingestion and dermal contact) for the construction worker is 1.5×10^{-7} which is below the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} and below the FDEP target level of 1×10^{-6}.

The noncarcinogenic risk (RME) for the construction worker for exposure to subsurface soils is below the USEPA and FDEP target HI of 1.0.

Ecological

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 3 is limited in quantity and quality since the site is characterized by concrete, asphalt, buildings, mowed turfgrass, and heavy human activity. Also due to the small size of this site, it comprises only a small portion of the home ranges of most terrestrial wildlife species found on the base. Although some types of wildlife can become accustomed to heavy human

activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival, and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

2.2 REMEDIAL ACTION OBJECTIVES

The objectives and goals for remedial actions at Site 3 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information presented in this section is used to identify and evaluate appropriate remedial technologies for Site 3 (Section 2.3).

2.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs.

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 siting laws specifically addressing a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. Applicable state standards are only those (1) identified by the state in a timely manner, (2) consistently enforced, and (3) 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 siting 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 their use is well suited to the particular

site. Only those state standards identified (1) in a timely manner and (2) 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 or be waived from the ARAR, 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) guidance criteria" are Federal and state nonpromulgated advisories or guidance not legally binding and not having 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).
- 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 sections and presented in Table 2-2.

2.2.1.1 Chemical-Specific ARARs

Chemical-specific requirements are standards limiting the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual

Table 2-2
SYNOPSIS OF FEDERAL AND STATE ARARs AND GUIDANCE FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
FEDERAL			
USEPA Region III Risk-Based Concentration Table	Provides risk-based concentrations for screening of soil.	Relevant and Appropriate. These guidelines aid in the screening of chemicals in soil and have been requested by the USEPA to be used at NAS Whiting Field as an ARAR.	Chemical-specific
CERCLA and the NCP Regulations (40 CFR, Section 300.430)	Discusses the types of LUCs to be established at CERCLA sites.	Applicable. These regulations may be used as guidance in establishing appropriate LUCs at Site 3.	Action-specific
Occupational Safety and Health Act (29 CFR Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	Applicable. These requirements apply to response activities conducted in accordance with the NCP. During the implementation of any remedial alternative for Site 3, these regulations must be followed.	Action-specific
Hazardous Materials Transportation Act Regulations (49 CFR 171-179)	Provides requirements for packaging, labeling, manifesting, and transporting hazardous materials.	Applicable: If soil is excavated and transported and is found to be hazardous, the soil would need to be handled, manifested, and transported as a hazardous waste.	Action-specific
National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)	Standards promulgated under the Clean Air Act for significant sources of hazardous air pollutants.	Relevant and Appropriate: Remedial Action (e.g., soil excavation) may result in release of hazardous air pollutants.	Action-specific
Resource Conservation and Recovery Act (RCRA) Treatment, Storage, and Disposal of Hazardous Waste (40 CFR 262-266)	Regulates the treatment, storage, and disposal of hazardous waste	Relevant and Appropriate: Hazardous waste generated by site remediation activities must meet RCRA generator and treatment, storage, or disposal requirements.	Action-specific
Land Disposal Restrictions (40 CFR 268)	Restricts certain listed or characteristic hazardous waste from placement or disposal on land without treatment.	Excavated soils or treatment residuals (such as spent activated carbon) may require disposal in a land fill.	Action-specific
STATE			
Florida SCTLs (Chapter 62-777, F.A.C.)	Default SCTLs. Human health risk-based cleanup goals for soil.	Applicable. These regulations apply to all remedial actions in the State of Florida.	Chemical-specific
Florida SCTLs (Chapter 62-785, F.A.C.)	Default SCTLs. Human health risk-based cleanup goals for Brownfield soils.	TBC: These regulations apply to all Brownfield remedial actions in the State of Florida.	Guidance
Florida Hazardous Waste Rules (Chapter 62-730, F.A.C.)	Adopts by reference, specific sections of the Federal hazardous waste regulations.	Relevant and Appropriate. These regulations are not applicable to Site 3 because they apply the handling of hazardous waste. These regulations may apply if material is removed from a site.	Action-specific

cleanup levels or the basis for calculating such levels. The State of Florida has developed chemical-specific, risk-based SCTLs for soil in Florida (FDEP, 1999). A listing of the SCTL values (Chapter 62-777, F.A.C.) is provided in Appendix A. The USEPA Region III has developed Soil Screening Levels (SSLs) which have been requested by the USEPA to be used at NAS Whiting Field as a "Relevant and Appropriate" ARAR. A listing of the USEPA Region III SSLs is provided in Appendix B.

2.2.1.2 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.

Observations made during the ecological assessment for Site 3 indicate no state or Federally listed rare, threatened, or endangered species of concern are known to exist on this site (Tetra Tech NUS, 1999). Site 3 does not contain wetland areas, and no part of the site is located within a 100-year floodplain.

2.2.1.3 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.

2.2.1.4 To Be Considered Criteria

As previously stated, TBCs are Federal and state nonpromulgated advisories or guidance 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.

2.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and the receptors present at the site. RAOs are identified in this section for surface and subsurface soil and will consider the results of the RI discussed in Section 2.1, particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida SCTL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of chemicals by rainwater from soils will be evaluated as part of Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, two RAOs have been developed for Site 3. They are as follows.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

2.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. As part of the CERCLA process, PRGs are periodically revised because of new guidance requirements and promulgated or updated ARARs. Final Remediation Goals are not formally set until the approval of the ROD and are often refined during the FS process.

Specifically PRGs are used to determine COCs, to estimate areas and volumes of impacted media, and to set performance standards for potential remedial alternatives. The steps leading to the development of the PRGs include the development of RAOs and the identification of the ARARs.

PRGs are determined based on ARARs, chemicals and media of interest, and exposure pathways. Two ARARs will be used for PRG development: the State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs (see Table 2-2). The FS evaluation for groundwater beneath these sites and the leaching of chemicals from soil to groundwater will be performed in the FS for Site 40, Basewide Groundwater. The current and future use of these sites is for industrial purposes; therefore, the exposure pathways are to occupational and construction workers.

Cleanup of inorganic chemicals below their established background concentrations will not be performed; therefore, background concentrations will be used as the lower limit for PRGs. The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.

2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 2-3 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 3.

2.2.4 Chemicals of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 2-4 shows the COC selections for Site 3.

2.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

Table 2-3
DETERMINATION OF PRGs AT SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Chromium	mg/kg	420	610	420	N	11	420	22.8	420
Iron	mg/kg	480,000	61,000	61,000	N	8,832	61,000	18,110	61,000
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
Dieldrin	mg/kg	0.3	0.36	0.3	C	NA	0.3	NA	0.3

[1]Combined list of all COPCs for Site 3.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, General Information Report (GIR), Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

* Chemical is not a health concern for the commercial/industrial exposure scenario.
mg/kg – milligrams per kilogram
NA – Not Applicable

Table 2-4
CHEMICAL OF CONCERN EVALUATION FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Surface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	21,500	--	21,500	Maximum	n<10	200,000	No
Arsenic	mg/kg	5.5	--	5.5	Maximum	n<10	3.7	**Yes**
Chromium	mg/kg	42.7	--	42.7	Maximum	n<10	420	No
Iron	mg/kg	12,900	--	12,900	Maximum	n<10	61,000	No
Vanadium	mg/kg	34	--	34	Maximum	n<10	1,400	No
Dieldrin	mg/kg	0.044	--	0.044	Maximum	n<10	0.3	No

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Arsenic	mg/kg	16	--	6.6	95% UCL-T	UCL<Max	6.2	**Yes**

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

[2]Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).

mg/kg = milligrams per kilogram

UCL = upper confidence limit

UCL-T = UCL of log-transformed data

The only COC at Site 3 is arsenic in the surface and subsurface soil (Figure 2-1). Three of the thirteen sample locations have at least one detection of arsenic above the PRG. Two samples are located near the northern end of Building 2941 (3SB01 and 3SB02), and the third sample (3SB06) is located directly south of the building.

Sample 3SB01 had an arsenic concentration of 5.5 mg/kg (PRG = 3.7 mg/kg) in the surface soil (0-2 feet bgs) and an arsenic concentration of 7.7 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 5-7 feet bgs. Arsenic was not detected in 3SB01 in samples collected at 15-17 feet bgs, 25-27 feet bgs, or the duplicate sample at 25-27 feet bgs. Sample 3SB02 had an arsenic concentration of 6.8 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 5-7 feet bgs. Arsenic was detected in the sample collected at 0-2 feet bgs below the PRG of 3.7 mg/kg. Arsenic was not detected in the sample or the duplicate collected at 10-12 feet bgs.

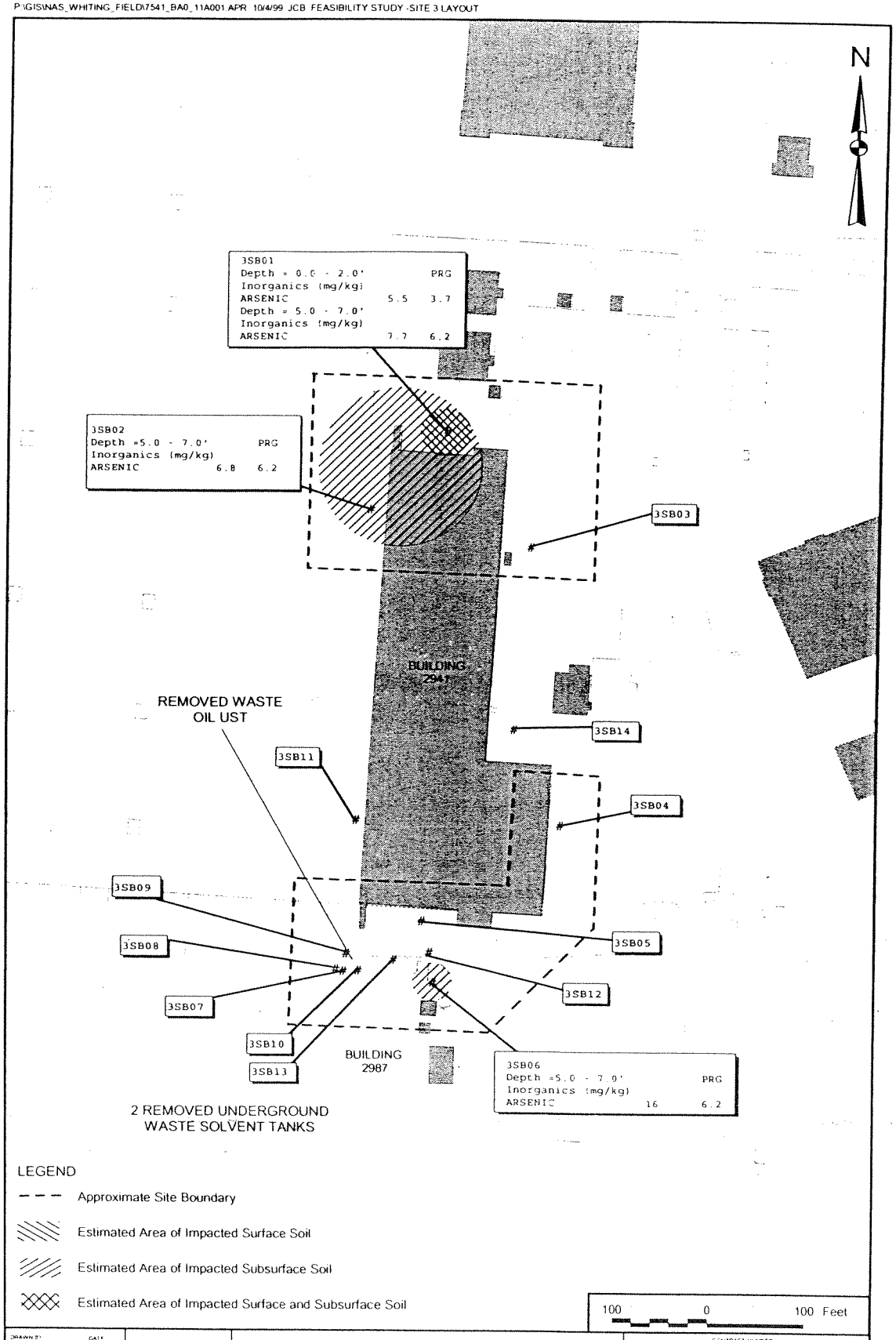
Sample 3SB06 had an arsenic concentration of 16 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 5-7 feet bgs. No arsenic was detected in samples collected at 0-2 feet bgs, 10-12 feet bgs, 15-17 feet bgs, 25-27 feet bgs, 70-72 feet bgs, 100-102 feet bgs, or the duplicate samples at 70-72 feet bgs and 100-102 feet bgs. In addition, arsenic was only detected in one of the remaining seven sample locations south of Building 2941, in location 3SB07 below the PRG of 6.2 mg/kg at a depth of 10-12 feet bgs. No arsenic was detected in the two sample locations between 3SB06 and 3SB07, including the sample from 3SB10 at 10-12 feet bgs.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 2-5.

Arsenic was detected in sample 3SB01 at 0-2 feet bgs and 5-7 feet bgs. Surface soil impact (0-2 feet bgs) was estimated to extend out from sample 3SB01 in a radius of 25 feet (1,964 ft^2), for an estimated soil volume of 145 yd^3. Because sample locations 3SB01 and 3SB02 have arsenic impact in the 5-7 feet bgs range and there are no data for soil between them, those locations were combined as one area of impact. The samples are located approximately 110 feet apart. Based on the absence of arsenic in the deeper samples at those two locations, impact is estimated to begin at 2 feet bgs and extend to a depth of 9 feet bgs. In addition, impact is assumed to extend 25 feet beyond each sample location, for a total distance of 160 feet. Assuming a circular area with a radius of 80 feet (20,106 ft^2), the estimated volume of soil impacted with arsenic is 5,213 yd^3. Approximately 35% of this area (or 182 yd^3) is covered with asphalt or concrete pavement and 40% (or 2,085 yd^3) is covered by Building 2941.

P:\GIS\NAS_WHITING_FIELD\7541_BA0_11A001.APR 10/4/99 JCB FEASIBILITY STUDY -SITE 3 LAYOUT



LEGEND

- Approximate Site Boundary
- Estimated Area of Impacted Surface Soil
- Estimated Area of Impacted Subsurface Soil
- Estimated Area of Impacted Surface and Subsurface Soil

100 0 100 Feet

DRAWN BY J. BELLONE DATE 10/4/99	AREAS IMPACTED BY CHEMICALS OF CONCERN IN SURFACE AND SUBSURFACE SOIL SITE 3 NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER
CHECKED BY DATE		APPROVED BY DATE
DISTINGUISHED AREA		APPROVED BY DATE
SCALE AS NOTED		DRAWING NO. FIGURE 2-1 REV 0

Table 2-5
VOLUME OF SOIL EXCEEDING PRGs AT SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	vol (yd^3)	radius[f] (ft)	area (ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
3SB01	As – 5.5 @0-2	25	1,964	145	80	20,106	5,213	1,344	7,037	1,824	8,042	2,085
	As – 7.7 @5-7											
3SB02	As – 6.8 @5-7											
3SB06	As – 16 @5-7				20	1,257	279	140	942	209	0	0
Total Site 3			1,964	145		21,363	5,492	1,484	7,979	2,033	8,042	2,085

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius.

Sample 3SB06 had arsenic impact only in the 5-7 feet bgs range. None was detected in the surface soil or in any sample below 10 feet. Because arsenic was not detected above PRGs in the surrounding sample locations, the area of impact was assumed to be localized with a 20-foot radius (1,257 ft^2). The impact is estimated to begin at a depth of 3 feet and extend to a depth of 9 feet. The estimated volume of arsenic-impacted soil at 3SB06 is 279 yd^3. Approximately 75 percent of this area (209 yd^3) is covered by a concrete slab.

Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil exceeding PRGs.

2.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 2.2.

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

2.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The COC at Site 3 consists of the inorganic arsenic. Soil contamination extends from the surface to a depth of approximately 9 feet bgs. The total estimated volume of contaminated soil is 5,637 yd^3 including 2,033 yd^3 covered by concrete/asphalt pavement and 2,085 yd^3 covered by Building 2941.

The following GRAs were considered for the contaminated soils at Site 3.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

The remaining sections of this chapter identify the types of technologies, evaluate and select representative technologies for each technology type, and develop remedial alternatives using the selected technologies. A detailed evaluation of remedial alternatives is presented in Section 2.4.

2.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing the RAOs identified for Site 3. Each technology is then screened based on site- and waste-limiting characteristics.

Site-limiting characteristics considered during this process include the following:

- Site geology, hydrogeology, and terrain.
- Availability of space and resources necessary to implement the technology.
- Presence of special site features (e.g., wetlands, floodplains, or endangered species).

The following waste-limiting characteristics were also considered:

- Contaminated media.
- Types and concentrations of waste constituents.
- Physical and chemical properties of the waste (e.g., volatility, solubility, and mobility).

Table 2-6 presents the remedial technologies/process options applicable for addressing the RAOs for Site 3. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 2-7 summarizes the technologies/process options passing the screening criteria. Table 2-7 also shows the Representative Process Option (RPO) selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 2.3.4.

2.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated.

Table 2-6
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 3 NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No Action	No Action	None	No remedial actions taken. Five-year review would be required.	Retained[1]
Limited action	Land Use Controls	Land Use Controls	LUCs for property in the area of soil contamination would include restrictions on excavation/construction or future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), and institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic degradation	In situ degradation of organics using microorganisms in an oxygen-enriched environment. Would be used in combination with bioventing/soil venting.	Eliminated[2]
		Anaerobic degradation	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[3]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[4]
		Vapor extraction/bioventing/ Soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Eliminated[5]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[6]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[7]
	Thermal	Vitrification	Immobilization of inorganic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[8]

Table 2-6
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 3 NAS WHITING FIELD, MILTON, FLORIDA PAGE 2 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[9]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[9]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[9]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for all sites; however, it will be retained as a baseline consideration.

[2]Aerobic biodegradation is not suitable for treating arsenic.

[3]Anaerobic biodegradation is not suitable for treating arsenic.

[4]Soil flushing may make arsenic more mobile.

[5]Vapor extraction is not suitable for arsenic.

[6]Steam stripping is not effective on arsenic.

[7]Solidification is effective at decreasing the mobility of arsenic but would not reduce the risks in surface soil.

[8]Underground utilities would interfere with vitrification, and the use of vitrification would severely limit potential futures uses.

[9]On-site landfills are not a viable option at Site 3 due to the groundwater beneath the site.

Table 2-7
SOIL TECHNOLOGIES AND PROCESS OPTIONS PASSING PRELIMINARY SCREENING FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Limited action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology.

For soil actions, alternatives address PRGs and/or exposure pathways and the time frame in which the alternative will achieve them. Alternatives are developed by combining different RPOs to address the problems at a site. A range of alternatives is developed encompassing all probable actions from a baseline No Action alternative to a maximum practical response. The range of alternatives is not necessarily ordered by increasing protection of human health and the environment. The alternatives are then compared to the nine CERCLA evaluation criteria. The range of alternatives developed for soils remediation is presented in Table 2-8.

Table 2-8
RANGE OF ALTERNATIVES FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment – Minimizes Long-Term Management

The first alternative type is No Action. The No Action alternative is used as the lowest level of remedial action and to provide a baseline for comparing alternatives. Under the No Action alternative, there will not be any costs except for 5-year review costs.

The second alternative type is containment/limited action. The containment/limited action alternative usually provides source containment, which restricts the exposure pathways to receptors. This alternative type provides little or no treatment but protects human health and the environment by preventing potential exposure to and/or reducing the mobility of constituents. For organic constituents, natural attenuation processes degrade the constituents over time. Inorganic constituents may be demobilized by adsorption and concentrations reduced through natural attenuation processes.

The third alternative type is treatment addressing the principal threats to human health and the environment (USEPA, 1988). Usually several different alternatives may be developed falling into this category of remedial action. For soil remedial responses, the time frame for the third alternative type is usually short to moderate. Response actions are usually provided at the source areas to treat constituents.

The fourth alternative type is treatment minimizing long-term management. This alternative type represents the upper bound of the alternative range and relies on an aggressive treatment approach. Harmful constituents may be treated in situ to irreversible and less harmful forms or removed from the site. For soil remedial responses, the time frame for the fourth alternative type is usually short relative to those for other alternative types. Often a combination of various aggressive treatment systems is employed to reduce any harmful constituents in a timely manner.

2.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized below.

- Engineering controls such as in situ barriers could be used for waste posing a relatively low long-term threat and for sites at which treatment is impracticable.
- Principal threats (i.e., highly mobile or highly toxic waste) will be treated, if practicable.
- A combination of engineering controls and treatment will be used, as appropriate, to achieve protection of human health and the environment. An example would include treatment of "hot spots" in combination with a cap.
- LUCs, such as access restrictions and other LUCs, will be used to supplement engineering controls, as appropriate, to prevent exposure to hazardous wastes.
- Innovative technologies will be considered when such technologies offer the potential for superior treatment performance or to lower costs for performance similar to the demonstrated technologies.

In developing soil alternatives, the range of options accounts for various site conditions. Soil alternatives are developed on a sitewide basis because of the type of constituent, constituent characteristics and concentrations, and depth and volume of impacted soil. A combination of RPOs is used to address not only cleanup levels but also the time frame within which the remedial objectives will be achieved.

Alternatives are developed achieving ARARs and/or other protective health-based levels using different methodologies. Excavation of soils is considered to provide removal of near surface soil as well as bulk removal for permanent means of removing impacted soils, thereby minimizing worker exposure risks. Separate alternatives are developed to reflect the option of either near surface soil removal or bulk excavation. Soils needing to be disposed in either case will be taken to an off-site permitted landfill.

Arsenic is the only COC for direct contact of surface and subsurface soil at Site 3. Three remedial alternatives (shown in Table 2-9) have been assembled into the appropriate alternative types for the soil at this site. The first alternative, No Action, is carried forward because CERCLA, SARA, and National Environmental Policy Act (NEPA) Regulations [40 CFR 1501.2(c)] require consideration of this alternative. The No Action alternative, S3-1, is also used as a basis for comparison with other alternatives.

Table 2-9
SITE 3 SOIL REMEDIAL ALTERNATIVES
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S3-1	No Action	None	• Five-year Reviews.
Alternative S3-2 Surface Soil (exceeding PRGs) Removal and LUCs	Containment/Limited Action No or Minimal Treatment	LUCs, Excavation, Disposal, Soil Cover	• LUCs including LUC Assurance Plan (LUCAP) and LUC Implementation Plan (LUCIP). • Delineation/confirmatory sampling of surface soil adjacent to 3SB01. • Excavation/disposal of surface soil (0-2 feet bgs) exceeding PRGs at 3SB01. • Backfill excavation with clean fill. • Establish vegetative cover. • Posting of warning signs. • Five-year site reviews.
Alternative S3-3 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 3SB01, 3SB02, and 3SB06. • Demolition and removal/disposal of asphalt and concrete pavement and uncontaminated surface soil. • Excavation/disposal of surface and subsurface soil exceeding PRGs at 3SB01, 3SB02, and 3SB06. (Contaminated soil will not be removed from beneath buildings.) • Backfill excavation with clean fill. • Replacement of asphalt or concrete pavement. • Establish vegetative cover in non-paved areas. • Posting of warning signs. • Five-year site reviews.

Alternative S3-2 is a containment/limited action alternative addressing the principal threat of direct contact with surface soil. This alternative removes near surface soils by excavation and/or provides a soil cover over the surface soil contaminated above PRGs, thus preventing any potential direct exposure. Land use controls (LUCs) will be implemented to ensure access to the site is restricted during cleanup and to ensure appropriate future land use once the remediation is complete. LUCs are described in Appendix C.

Alternative S3-3 minimizes long-term management through bulk excavation of all soils exceeding PRGs (except under buildings) and disposal at an off-site Treatment, Storage, and Disposal Facility (TSDF) or landfill. The excavated soil will be characterized as hazardous or nonhazardous before shipment to the appropriate TSDF. LUCs will be implemented to ensure appropriate future land use.

2.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

2.4.1 <u>Site 3 Alternatives</u>

The three alternatives for Site 3 represent a range of actions including no action, containment/limited action addressing principal threats, and aggressive actions minimizing the need for long-term management. The three alternatives providing a range of treatment options for Site 3 are listed below.

Alternative S3-1: No Action

Alternative S3-2: Surface Soil (Exceeding PRGs) Removal and LUCs

Alternative S3-3: Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs

2.4.1.1 Alternative S3-1: No Action

2.4.1.1.1 Description

In an FS the No Action alternative is typically considered to serve as a baseline consideration or to address sites not requiring any active remediation. The No Action alternative assumes no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions would remain or be implemented under the No Action alternative. Natural attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, would be expected to occur over long periods of time but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

2.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S3-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S3-1, would provide no long-term effectiveness or permanence for Site 3. Arsenic present in Site 3 would pose a continuing risk to human health and the environment. The magnitude of and potential for residual risk within Site 3 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S3-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 3 would not change significantly and the risk posed to human health and the environment would be expected to continue because Alternative S3-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it would not be expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituents for natural attenuation are usually organics but can also be effective on inorganics. The processes of natural attenuation and natural biodegradation can provide irreversible treatment. Natural attenuation is estimated to have a limited effect on the reduction of inorganic concentrations contained within Site 3 soil.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There is no need to coordinate with other agencies or acquire permits. Services or materials are not required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost associated with the No Action alternative is the cost for 5-year reviews since no remedial action will occur. The estimated present worth total project cost is $18,008 including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

2.4.1.2 Alternative S3-2: Surface Soil (Exceeding PRGs) Removal and LUCs

2.4.1.2.1 Description

Alternative S3-2 addresses the principal threats through the implementation of LUCs, surface soil excavation, and off-base disposal. LUCs are described in Appendix C.

Impacted surface soil (up to 2 feet bgs) exceeding PRGs in the area surrounding sample location 3SB01, would be excavated and disposed of offsite. Because impacted soil exists below the depth of the proposed excavation, the excavated area would be backfilled with clean, native backfill material, compacted, and revegetation to create a soil cover for this area. Site inspections and maintenance would be required. All areas currently covered with concrete or asphalt would not require excavation because the existing material serves as a barrier to prevent humans from contacting the soil exceeding PRGs. Disposal in an off-base TSDF and/or landfill would be used for the approximately 145 yd^3 of soil excavated from Site 3. Some pretreatment of the excavated soil may be necessary to meet land disposal restrictions (LDRs) and would be provided by the TSDF, if required.

2.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S3-2 would provide protection to human health and the environment by minimizing all exposure pathways through the removal of impacted surface soils that may pose a risk through restricting access to remaining impacted soil by LUCs, soil cover, or concrete/asphalt barriers. Immediate risk from

potential exposure during maintenance activities would be reduced by the removal of impacted surface soil and its subsequent off-base disposal. LUCs would be effective in the protection of human health. Soil, concrete, or asphalt barriers would protect humans and the environment by containment. There would be no significant risks to human health or the environment during implementation of Alternative S3-2 if normal dust-control procedures are conducted and direct worker contact with impacted materials is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S3-2 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S3-2 if confirmational sampling and analyses determine source areas greater than 2 feet bgs are stable and relatively stationary. Over time Alternative S3-2 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, any excavated soil may require pretreatment to meet LDRs which would be provided by the TSDF, if required. Although containment (e.g., soil cover, concrete, asphalt) is not an active remedial process, exposure to the constituents would be prevented. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S3-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S3-2 is low since contaminants are not treated. However, excavation, disposal, and containment provide long-term effectiveness and permanence in minimizing exposure pathways, assuming the barrier material (compacted, clean native soil) is maintained at a depth greater than 2 feet above source areas. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and containment barriers remain in place. The magnitude of constituent concentrations would be reduced as a result of excavation, off-base disposal, and natural attenuation. A 5-year review would be required to assess the effectiveness of excavation of surface soils, containment of remaining inorganic constituents, and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs would be sufficient to restrict access to impacted soils. The life expectancy for the Site 3 soil cover would be 20 to 30 years; however, the service life of the soil cover is

greatly affected by weather and the level of maintenance performed. Long-term reliability would be maintained because natural surface flow patterns would be returned to near original conditions and erosion would be minimized. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of impacted surface soils would reduce mobility of constituents by physically moving the constituents from the site to a secure landfill. Containment would also reduce the mobility of inorganic constituents that may pose a risk through fugitive dust. Excavation and disposal of surface soil and containment of subsurface soil utilizing a soil cover would minimize exposure pathways, but reduction of the concentrations of the remaining constituents would rely on natural attenuation. Toxicity of excavated soils may be reduced through treatment in an off-base TSDF before land disposal. This alternative would provide a low degree of irreversible treatment through natural attenuation processes, but would significantly reduce the mobility of the constituents by the excavation of impacted surface soils, off-base disposal, and the introduction of a soil cover as a horizontal barrier. Minor inorganic constituent residuals would remain above action levels after the implementation of Alternative S3-2. The implementation and operation of Alternative S3-2 would produce no treatment residuals.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S3-2 would be controllable and would result from the excavation, transportation, off-base disposal, construction of a soil cover, and operations and maintenance (O&M) of the remedial alternative. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S3-2 would be approximately 90 days. A more detailed evaluation during design may identify (1) other components required for soil cover material, (2) concurrent constructibility of components, and (3) individual source area excavation and soil cover construction details. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S3-2 would be effective in minimizing all exposure pathways. The estimated time to achieve the RAOs is less than 1 year.

Implementability

The RPOs associated with Alternative S3-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and location of the soil cover. Excavation and installation

of the soil cover at Site 3 would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. Monitoring of the integrity of the soil cover would also be required. By excavating the impacted surface soil and backfilling with clean soil, the ground surface grade would be returned to near original grade. The long-term integrity of the vegetated cover would be increased because surface flow patterns would be returned to near normal conditions, which would reduce the erosion of the capping material. O&M activities would be of low intensity and may involve regrading, compaction, revegetation, erosion control, and monitoring. All components of Alternative S3-2 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S3-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S3-2; however, modification of LUCs and removal/replacement of soil cover may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost for Alternative S3-2 is $153,183 including a capital cost of $92,611, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

2.4.1.3 Alternative S3-3: Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs

2.4.1.3.1 Description

Alternative S3-3 minimizes the need for long-term management because all surface and subsurface soil containing COCs exceeding PRGs would be removed. Monitoring would consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted surface and subsurface soil exceeding PRGs not covered by Building 2941 (5,637 yd^3 – 2,085 yd^3 = 3,552 yd^3). The excavation would consist of removing the soil from the two impacted areas from the surface down to approximately 9 feet bgs. After all impacted soil within the excavation area exceeding PRGs is removed, the excavated areas would be backfilled with clean, native material, compacted, and revegetated with no long-term monitoring or maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil from Site 3. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

2.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S3-3 would provide protection of human health and the environment by removal and off-base disposal of all soil exceeding PRGs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial land use exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk is permanently removed from the site. There would be no significant risks to human health and the environment during implementation of Alternative S3-3 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized. Therefore, Alternative S3-3 would provide a high level of protection for human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health and the environment would be satisfied by Alternative S3-3. Alternative S3-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S3-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S3-3 is low since contaminants are not treated. However, excavation and off-base disposal provide long-term effectiveness and permanence by minimizing exposure pathways, assuming all impacted soil exceeding PRGs is identified, excavated, and disposed.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would only consist of LUC monitoring and 5-year reviews.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically moving them from the site to a secure landfill. The toxicity of the excavated constituents may

be reduced through treatment in an off-base TSDF before landfill disposal. Minor inorganic constituent residuals would remain below action levels after the implementation of Alternative S3-3. No treatment residuals would be produced by the implementation of Alternative S3-3.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S3-3 would be controllable and would result from the excavation, transportation, and off-base disposal of impacted soil. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S3-3 would be approximately 90 days. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S3-3 would be immediately effective in minimizing all exposure pathways. The estimated time to achieve the RAOs is less than 1 year.

Implementability

The RPOs associated with Alternative S3-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. Excavation and disposal of Site 3 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S3-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S3-3 in minimizing the source areas. Future remedial actions would not be hindered by the implementation of Alternative S3-3; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost for Alternative S3-3 is $821,118 including a capital cost of $764,028, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

2.4.2 Summary Of Site 3 Soil

As part of the detailed analyses of alternatives for Site 3, one alternative involving no action, one alternative involving containment/limited action, and one alternative minimizing long-term management have been evaluated. Alternative S3-1 is the only alternative that does not satisfy the threshold criteria to

the full extent but is retained for comparison purposes. Alternatives S3-2 and S3-3 provide varying degrees of protection and treatment and will be viable for the selection as a preferred alternative. The relative merits of all Site 3 alternatives are evaluated in Section 2.5.

2.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 2.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1).

The main objectives for the preferred remedial action are to be protective of human health and the environment and to comply with ARARs. Protection of human health and the environment and compliance with ARARs are considered threshold criteria. For an alternative to be considered as final, these two threshold criteria must be met. No Action alternatives are removed from further analysis because they do not meet the two threshold criteria; however, they are included in the summary tables for comparison. The following five criteria are referred to as the balancing criteria: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The balancing criteria require the most discussion in this section because the key differences between alternatives frequently relate to one or more of these five criteria. The modifying criteria include (1) state acceptance and (2) community acceptance. These criteria will be addressed after regulatory review of the FS report has been completed in the form of response summary to the Proposed Plan and ROD.

A summary of the comparative analyses and costs for the Site 3 alternatives is presented in Table 2-10. This comparison between alternatives is based on the CERCLA evaluation criteria.

Table 2-10
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 4

Criteria	Alternative S3-1 No Action	Alternative S3-2 Surface Soil (Exceeding PRGs) Removal and LUCs	Alternative S3-3 Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs
THRESHOLD CRITERIA			
Overall Protection of Human Health and the Environment			
Human Health Protection	No reduction in risk.	Provides a high level of protection. LUCs reduce risk from residuals. Excavation, disposal, and containment barrier reduce risk of potential exposure.	Provides highest level of protection. LUCs reduce risk from residuals. Excavation and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Excavation and soil cover stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Excavation and disposal will reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)			
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs in greater than 30 years.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs if proper PPE used during excavation, disposal, and construction of soil cover.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA			
Long-Term Effectiveness and Permanence			
Reduction in Residual Risk	Natural attenuation may decrease risk; however, risk is significant for >30 years.	Risk reduced by excavation and disposal of surface-impacted soil. Natural attenuation may decrease remaining risk; however, risk due to subsurface-impacted soil is significant for an estimated 30 years.	Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by excavation and off-site disposal.

Table 2-10
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 2 OF 4

Criteria	Alternative S3-1 No Action	Alternative S3-2 Surface Soil (Exceeding PRGs) Removal and LUCs	Alternative S3-3 Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability.	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Dermal contact and incidental ingestion not controlled.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and soil cover.	Exposure to residuals is eliminated or reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	Soil cover may require replacement or repair.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Minimum management required for estimated 30 years.
Reduction of Mobility, Toxicity, or Volume through Treatment			
Amount Destroyed or Treated	None	Excavated surface soil is disposed of off site. Remaining soil has no direct treatment. Soil cover is for containment only.	All impacted soil containing COC exceeding PRGs is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by excavation and containment. Toxicity of excavated soils may be reduced in an off-site TSDF. Toxicity of remaining soils may be reduced through natural attenuation.	Mobility reduced by excavation and disposal in landfill. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Off-site TSDF treatment and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of inorganics left from natural attenuation.	Inorganic residuals remain above industrial action levels in subsurface soil.	No inorganic residuals remain above industrial action levels.

Table 2-10
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA
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Criteria	Alternative S3-1 No Action	Alternative S3-2 Surface Soil (Exceeding PRGs) Removal and LUCs	Alternative S3-3 Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs
Short-Term Effectiveness			
Community Protection During Implementation	Not applicable	Temporary increases in dust emissions through excavation of surface soils and soil cover installation; controlled by proper construction techniques.	Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	Continued impact from existing conditions.	Excavation of surface soils and soil cover installation can generate impacted soil, runoff, and fugitive dust.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time[a]	Not applicable	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Not applicable	Estimated at 1 year.	Estimated at 1 year.
Implementability			
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to provide excavation and soil cover installation. Fewer contractors accept impacted soil for disposal.	Many contractors available to provide excavation. Fewer contractors accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation. Soil cover reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable

Table 2-10
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 3
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 4 OF 4

Criteria	Alternative S3-1 No Action	Alternative S3-2 Surface Soil (Exceeding PRGs) Removal and LUCs	Alternative S3-3 Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring indicates excavation effectiveness and removal of contaminated areas.
Permitting Requirements	Not applicable	Transportation and Disposal Permit will be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Readily available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Readily available
Cost[b]			
Capital Costs	$0	$92,611	$764,028
Short-Term O&M	$0	$0	$0
Long-Term O&M			
5-Year Review	$7,375	$7,375	$7,375
Land-Use Controls	$0	$3,092	$2,839
Total Project Present Worth Cost	$18,008	$153,183	$821,118

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

2.5.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

The existing exposure pathways to humans for Site 3 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological receptors in the environment. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the Site 40, Basewide Groundwater RI/FS. For an alternative to be protective of human health and the environment, it must protect humans from all potential exposure pathways.

Alternative S3-3 would provide the highest levels of overall protection through LUCs and physical removal of the COCs exceeding PRGs in surface and subsurface soil within Site 3, reducing the risks associated with all potential exposure pathways in the shortest period of time.

Alternative S3-2 would provide protection of human health and the environment through LUCs, physical removal of the impacted surface soil containing COCs exceeding PRGs and containment (by covering with soil cover) of the remaining impacted soil. Containment ensures reduced risk from all potential pathways but does not provide active remediation. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs.

Table 2-10 presents a summary for the overall protectiveness of human health and the environment for all Site 3 alternatives.

2.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S3-2 and S3-3 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. PRGs are numerical values representing chemical-specific ARARs. Over time, both alternatives would meet PRGs within Site 3. Table 2-10 presents a summary of ARARs compliance for each alternative.

2.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

Magnitude of Residual Risks

Alternative S3-3 would provide a higher level of long-term effectiveness and permanence than Alternative S3-2 by providing active removal of all impacted soil within Site 3 exceeding inorganic PRGs, thereby reducing residual risk from impacted soil left at the site. Alternative S3-3 is expected to significantly reduce all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of impacted soil. Alternative S3-2 would include removal of the surface-impacted soil and provide containment for any remaining constituents. No alternative, except No Action, for Site 3 would produce or leave residuals requiring treatment and/or disposal posing any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur. Alternative S3-2 would minimize risks to the receptors from direct exposure to contaminants at the surface, but, because it is only a containment alternative, the effectiveness for residual risk reduction and remediation of impacted soil at depth exceeding PRGs would be moderate. Alternative S3-2 would require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternative S3-3 would permanently remove the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternative S3-3 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal and off-base disposal of all or a portion of the impacted soil. Alternative S3-2 would involve containment barriers, which does not actively remediate constituents but would be adequate and reliable in controlling exposure to any remaining constituents. Because Alternative S3-2 would reduce the risks through the installation of containment barriers, future maintenance and monitoring of the containment barrier would be required.

Table 2-10 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 3 alternative.

2.5.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternative S3-3 would permanently and significantly reduce mobility of chemical constituents to the highest level of the alternatives evaluated for Site 3. Alternative S3-3 is considered a permanent remedy and is designed to provide the greatest reduction of risk through removal and off-base disposal. No COCs at concentrations greater than PRGs would remain at the site under Alternative S3-3. Alternative S3-2 would reduce the mobility of impacted soil through containment but would not provide active treatment of remaining soils to reduce toxicity and volume. Alternative S3-2 would remove the COCs present in surface soils at concentrations greater than PRGs. All the alternatives would rely on some degree of natural attenuation to aid in the remediation of the residuals remaining in the soil; however, the types and concentrations of constituent residuals are assumed to be below action levels. The concentrations of toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 2-10 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 3 alternative.

2.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives, such as Alternatives S3-2 and S3-3, would take progressively longer to protect human health because of the time needed for treatment and to excavate and/or construct capping. Alternatives S3-2 and S3-3 have an estimated remedial time to reach objectives of less than 1 year. Alternatives S3-2 and S3-3 would create short-term risks of worker exposure and the potential of fugitive dust during excavation, transportation, and/or soil cover construction. These risks appear manageable using appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust and runoff) are expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 2-10 provides a summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 3 alternative.

2.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternatives S3-2 and S3-3 may require Federal, state, or local permits because they include excavation, transportation, and off-base disposal of impacted soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternatives S3-2 and S3-3 would require coordination with other agencies for deed recordation and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S3-3 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternative S3-2.

Alternative S3-2 would require monitoring of the soil cover for erosion and potential exposure. Alternative S3-3 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate personal protective equipment (PPE). Exposure from dermal contact and ingestion of soil is difficult to monitor.

Alternatives S3-2 and S3-3 would require the use of a TSDF or landfill for excavated, impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 2-10 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of services and capacities; and availability of equipment, specialists, and materials, for each Site 3 alternative.

2.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. Alternative S3-3 has the highest cost, followed by Alternative S3-2. Table 2-10 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 3 alternative. Detailed cost estimates are provided in Appendix E.

2.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments, and Navy responses to the comments, are provided in Appendix F.

2.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS Report and the Proposed Plan for Site 3.

3.0 SITE 4 - NORTH AVGAS TANK SLUDGE DISPOSAL AREA

Site 4 is a former UST facility located northeast of Building 2981 at North Field (see Figure 1-1). The former tank farm, within the fenced North Field restricted area, covers approximately 2.5 acres and is currently covered with grass.

Site 4 contained eight 23,700-gallon steel tanks, one 15,000-gallon steel tank, and one 750-gallon tank, dating back to 1943 when NAS Whiting Field first began operations. Nine USTs at this site were used for aviation gasoline (AVGAS) storage, and one UST was used for storage of contaminated jet fuel. All USTs and associated piping were removed in the mid-1990s. There are no records of spills or leaks at Site 4, but petroleum contamination was observed when the USTs were removed.

From 1943 to 1968, the nine AVGAS tanks were cleaned out approximately every 4 years. The tank bottom sludge probably containing tetraethyl lead was buried at shallow depths in the area immediately adjacent to the surrounding tanks. Navy personnel estimated 1,000 to 2,000 gallons of sludge were disposed of in this manner (Geraghty & Miller, 1986).

The remedial investigation for Site 4 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

3.1 ENVIRONMENTAL CONDITIONS

3.1.1 Nature and Extent of Contamination

Chemicals detected in surface and subsurface soil samples at Site 4 include VOCs, SVOCs, and inorganics. Pesticide compounds were detected only in surface soil samples at Site 4. With the exception of the pesticide compounds, these chemicals are most frequently detected and usually at their highest concentrations in soil samples collected from soil borings 4SB01, 4SB03, and 4SB06 located at the former USTs (see Figure 1-2 for location of soil borings).

No VOCs exceeded regulatory criteria in either surface or subsurface soil samples at Site 4. Benzo(a)pyrene was the only SVOC exceeding USEPA Region III RBCs or FDEP cleanup goals for residential and industrial soil at Site 4. Dieldrin, aluminum, arsenic, and vanadium exceeded the USEPA Region III RBCs for residential soil. Arsenic and vanadium also exceeded the FDEP cleanup goals for residential soil. Arsenic was the only chemical other than benzo(a)pyrene to exceed the USEPA Region III RBCs and FDEP cleanup goals for industrial soil.

3.1.2 Risk Assessment Results

Surface Soil

The concentrations of five analytes (aluminum, arsenic, dieldrin, iron, and vanadium) exceeded site-specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (residential). These analytes were selected as COPCs and were used to evaluate the human health risks associated with the surface soil at Site 4 (Table 3-1).

Table 3-1
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Arsenic	✓	✓
Iron	✓	
Vanadium	✓	
Benzo(a)pyrene		✓
Benzo(a)anthracene		✓
Benzo(b)fluoranthene		✓
Benzo(k)fluoranthene		✓
Chrysene		✓
Dibenzo(a,h)anthracene		✓
Indeno(1,2,3-cd)pyrene		✓
Dieldrin	✓	

The cancer risks (RME) associated with exposure to surface soil (ingestion and dermal contact) are 1.1×10^{-6} for an older child trespasser, 1.7×10^{-6} for an adult trespasser, 5.0×10^{-6} for the occupational worker, 7.6×10^{-7} for the site maintenance worker, 1.0×10^{-7} for the construction worker, and 2.9×10^{-5} for the child/adult resident. The cancer risks for all receptors are less than or within the USEPA acceptable cancer risk range of 1×10^{-4} to 1×10^{-6}. The risk values for the construction worker and site maintenance worker are less than the FDEP target risk of 1×10^{-6}. However, the cancer risks associated with exposure to surface soils for the older child trespasser, the adult trespasser, the occupational worker, and the child/adult resident exceed the FDEP target risk of 1×10^{-6}. The primary risk driver is arsenic for all receptors. Dieldrin, in addition to arsenic, was a risk driver for the child and adult resident.

The noncancer risks associated with surface soil ingestion and dermal contact for the older child and adult trespasser, the occupational worker, the site maintenance worker, the construction worker, the adult resident, and the child resident are below the USEPA and FDEP target HI of 1.0.

Subsurface Soil

The concentrations of eight analytes [arsenic, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] exceeded site-specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (industrial/commercial). If one carcinogenic polyaromatic hydrocarbon (PAH) was selected as a COPC [e.g., benzo(a)pyrene], all carcinogenic PAHs were retained as COPCs. These analytes were selected as COPCs and were used to evaluate the human health risk associated with the subsurface soil at Site 4.

The cancer risk (RME) associated with construction worker exposure (ingestion and dermal contact) to subsurface soil 2 to 22 feet deep is 2.5×10^{-7}. This risk is below the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} and below the FDEP target level of 1×10^{-6}. The noncarcinogenic risk (RME) for the construction worker for exposure to subsurface soils at Site 4 is below the USEPA and FDEP target HI of 1.0.

The concentrations of only one analyte (arsenic) exceeded site-specific background concentrations and either EPA RBCs or Florida SCTLs for direct soil exposure (industrial/commercial). Arsenic was selected as a COPC and was used to evaluate the human health risk associated with the subsurface soil at Site 4.

Ecological

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 4 is limited and of poor quality since the site is characterized by mowed turfgrass with no trees and heavy human activity. As a result of the heavy human activity and vehicle and aircraft noise, terrestrial wildlife is deterred from using the site. Although some types of wildlife can become accustomed to heavy human activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival, and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

3.2 REMEDIAL ACTION OBJECTIVES

The objectives and goals for remedial actions at Site 4 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information presented in this section is used to identify and evaluate appropriate remedial technologies for Site 4 (Section 3.3).

3.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs. A complete discussion of ARARs is provided in Section 2.2.1.

3.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and the receptors present at the site. RAOs are identified for surface and subsurface soil and consider the results of the RI (discussed in Section 3.1), particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida SCTL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of chemicals by rainwater from soils will be evaluated as part of Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, two RAOs have been developed for Site 4.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

3.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Section 2.2.3 provides the basis for selection of PRGs.

The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.
2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 3-2 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 4.

3.2.4 Chemicals of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 3-3 shows the COC selections for Site 4.

3.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

Table 3-2
DETERMINATION OF PRGs AT SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Iron	mg/kg	480,000	61,000	61,000	N	8,832	61,000	18,110	61,000
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
Benzo(a)anthracene	mg/kg	5	7.8	5	C	NA	5	NA	5
Benzo(a)pyrene	mg/kg	0.5	0.78	0.5	C	NA	0.5	NA	0.5
Benzo(b)fluoranthene	mg/kg	4.8	7.8	4.8	C	NA	4.8	NA	4.8
Benzo(k)fluoranthene	mg/kg	52	78	52	C	NA	52	NA	52
Chrysene	mg/kg	450	780	450	C	NA	450	NA	450
Dibenzo(a,h)anthracene	mg/kg	0.5	0.78	0.5	C	NA	0.5	NA	0.5
Indeno(1,2,3-cd)pyrene	mg/kg	5.3	7.8	5.3	C	NA	5.3	NA	5.3
Dieldrin	mg/kg	0.3	0.36	0.3	C	NA	0.3	NA	0.3

[1]Combined list of all COPCs for Site 4.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, FAC.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, General Information Report (GIR), Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

*Chemical is not a health concern for the commercial/industrial exposure scenario.

mg/kg – milligrams per kilogram
NA – Not Applicable

Table 3-3
CHEMICAL OF CONCERN EVALUATION FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

Surface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	27,800	--	18,920	95%UCL-T	UCL < Max	200,000	No
Arsenic	mg/kg	5.5	--	3.8	95%UCL-T	UCL < Max	3.7	**Yes**
Iron	mg/kg	14,800	--	9,671	95%UCL-T	UCL < Max	61,000	No
Vanadium	mg/kg	41.4	--	26.9	95%UCL-T	UCL < Max	1,400	No
Dieldrin	mg/kg	0.085	--	0.085	Maximum	UCL > Max	0.3	No

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Arsenic	mg/kg	6.4	--	6.4	Maximum	n<10	6.2	**Yes**
Benzo(a)anthracene	mg/kg	1.9	--	1.9	Maximum	n<10	5	No
Benzo(a)pyrene	mg/kg	1.1	--	1.1	Maximum	n<10	0.5	**Yes**
Benzo(b)fluoranthene	mg/kg	1.2	--	1.2	Maximum	n<10	4.8	No
Benzo(k)fluoranthene	mg/kg	0.59	--	0.59	Maximum	n<10	52	No
Chrysene	mg/kg	0.94	--	0.94	Maximum	n<10	450	No
Dibenzo(a,h)anthracene	mg/kg	0.23	--	0.23	Maximum	n<10	0.5	No
Indeno(1,2,3-cd)pyrene	mg/kg	0.12	--	0.12	Maximum	n<10	5.3	No

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

[2]Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).

mg/kg = milligrams per kilogram

UCL = upper confidence limit

UCL-T = UCL of log-transformed data

COCs at Site 4 include arsenic in the surface soil and arsenic and benzo(a)pyrene in the subsurface soil (Figure 3-1). Four of the eleven sample locations have at least one COC. Three are located just south of the ten removed AVGAS USTs, and the fourth is located slightly north of the former USTs.

Sample 4SB03 had a benzo(a)pyrene concentration of 1.1 J mg/kg (PRG = 0.5 mg/kg) in the duplicate sample taken at 20-22 feet bgs, where the J qualifier signifies an estimated concentration. The original sample for 20-22 feet bgs had a benzo(a)pyrene detection below the PRG. Benzo(a)pyrene was also detected in the surface soil sample (0-2 feet bgs) and in the deeper samples (50-52 feet bgs and 85-87 feet bgs) at concentrations 0.026 J mg/kg, well below the PRG.

Sample 4SB06 had an arsenic concentration of 5.5 mg/kg (PRG = 3.7 mg/kg) in the surface soil. No arsenic was detected in 4SB06 in any of the deeper samples, which start at 18 feet bgs. Sample 4SB07 had an arsenic concentration of 6.4 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 12-14 feet bgs. No arsenic was detected in the surface soil at that location. Samples deeper than 14 feet bgs were not collected. Sample 4SB09 had an arsenic concentration of 5 mg/kg in the surface soil and 6.4 mg/kg in the sample collected at 16-18 feet bgs. Arsenic was detected in the duplicate sample at 16-18 feet bgs below the PRG. No arsenic was detected in 4SB09 in the deeper samples, which start at 35 feet bgs.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 3-4.

Sample 4SB03 had benzo(a)pyrene impact above its PRG in the 20-22 feet bgs range. Because of the limited data within the area of the tanks, the impacted area was assumed to cover the tank pit area (110 ft x 160 ft or 17,671 ft^2). The surface soil sample and the samples below 50 feet did not have benzo(a)pyrene concentrations above the PRG, so the impact was assumed to begin approximately 10 feet bgs and extend to 35 feet bgs. The estimated volume of soil impacted with benzo(a)pyrene is 16,362 yd^3. For excavation purposes, the soil from 0-10 feet bgs would also have to be removed, and therefore, the estimated volume of soil would be 6,545 yd^3.

Sample 4SB03 lies approximately in the center of a triangle formed by arsenic-impacted sample locations 4SB06, 4SB07, and 4SB09, but sample 4SB03 did not have any arsenic detections. Neither sample locations 4SB01 (located between samples 4SB07 and 4SB09) and 4SB10 (located between samples 4SB06 and 4SB09) had any arsenic concentrations above the PRG. Therefore, samples 4SB06, 4SB07, and 4SB09 cannot be considered as one impacted area and are considered as three localized areas (20-foot radius or 1,257 ft^2) of impacted soil.

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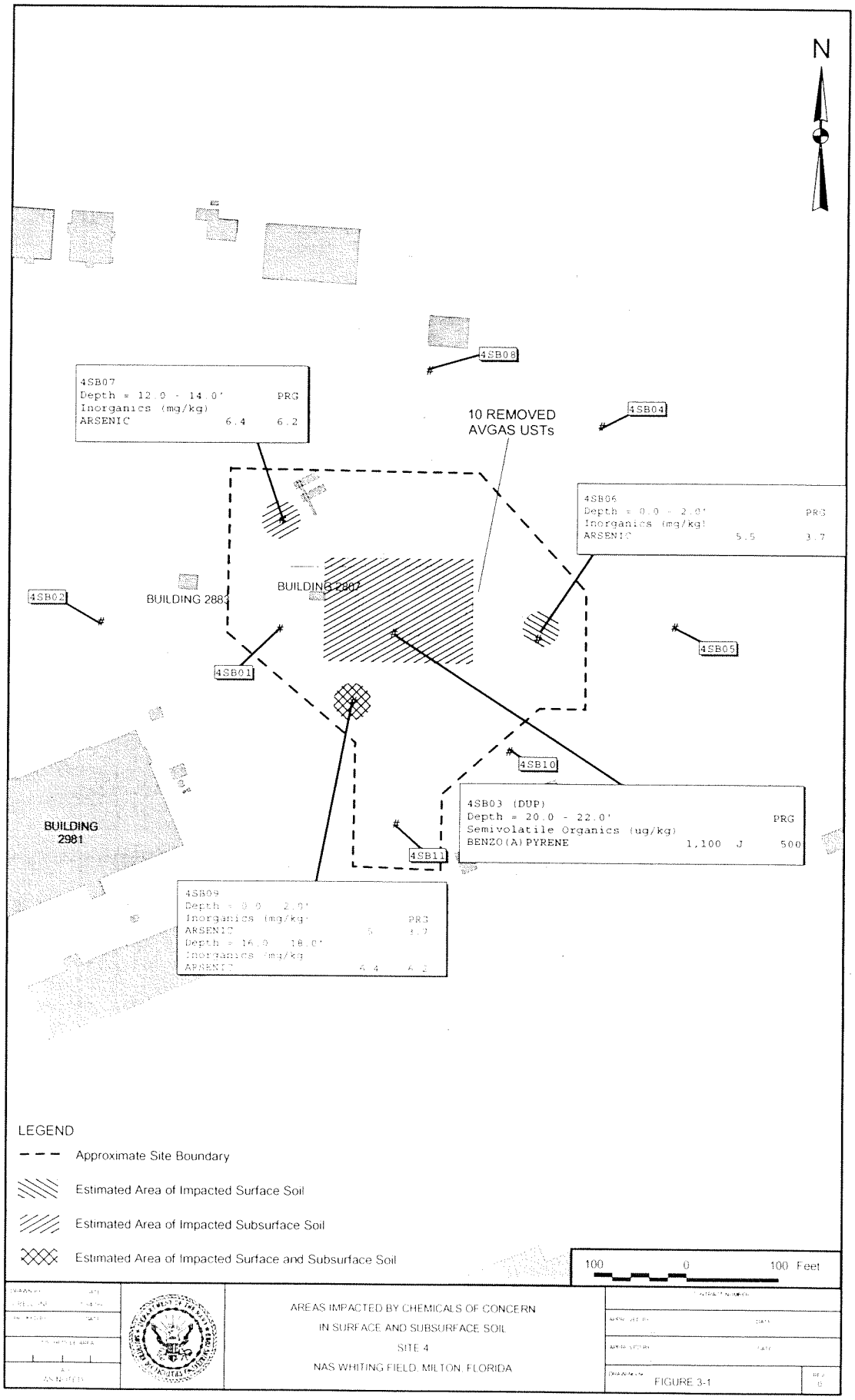


Table 3-4
VOLUME OF SOIL EXCEEDING PRGs AT SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered Soil[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	vol (yd^3)	radius[f] (ft)	area (ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
4SB03	B(a)P – 1.1 J @20-22	0	0	0	75	17,671	16,362	6,545	0	0	0	0
4SB06	As – 5.5 @0-2	20	1,257	93	20	1,257	372	0	0	0	0	0
4SB07	As – 6.4 @12-14	0	0	0	20	1,257	559	326	0	0	0	0
4SB09	As – 5 @0-2	20	1,256	93	20	1256	1,117	0	0	0	0	0
Total Site 4			2,513	186		21,441	18,410	6,871	0	0	0	0

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius

Sample 4SB06 had arsenic above the PRG in the surface soil only. The sample collected at 18-20 feet bgs had no detectable arsenic; therefore, the impact is assumed to extend approximately 10 feet bgs. The estimated volume of soil impacted with arsenic at 4SB06 is 465 yd^3.

Sample 4SB07 had arsenic above the PRG in the 12-14 feet bgs sample. The surface soil sample did not have arsenic concentration above the PRG, so the impact was assumed to begin approximately 7 feet bgs. No samples were collected below 12-14 feet, so the depth of impact was estimated at an additional 5 feet bgs. The estimated volume of soil impacted with arsenic at 4SB07 is 559 yd^3. For excavation purposes, the soil from 0-7 feet bgs would also have to be removed; therefore, the estimated volume of soil would be 326 yd^3.

Sample 4SB09 had an arsenic concentration above PRG in both the surface soil sample and the sample collected at 16-18 feet bgs. No arsenic was detected in the deeper samples starting at 35 feet bgs, so the impact was assumed to extend to 26 feet bgs. The estimated volume of soil impacted with arsenic at 4SB09 is 1,210 yd^3.

Summary

The Site 4 total estimated volume of contaminated surface soil is 186 yd^3 and of subsurface soil is 18,410 yd^3 for a combined total of 18,596 yd^3. An additional 6,871 yd^3 of soil would have to be removed to get to the contaminated subsurface soil. Also, no areas of contamination are presently covered by concrete/asphalt or by a building. Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil exceeding PRGs.

3.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 3.2.

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

3.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The COCs at Site 4 consists of arsenic and benzo(a)pyrene. Soil contamination extends from the surface to a depth of approximately 35 feet bgs. The total estimated volume of contaminated soil is 18,596 yd^3.

The following GRAs apply to contaminated soils at Site 4.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

3.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing the RAOs identified for Site 4. Each technology is then screened based on site- and waste-limiting characteristics. See Section 2.3.2 for additional information.

Table 3-5 presents the remedial technologies/process options applicable for addressing the RAOs for Site 4. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 3-6 summarizes the technologies/process options passing the screening criteria. Table 3-6 also shows the RPO selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 3.3.4.

3.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated. The range of alternatives developed for soils remediation is presented in Table 3-7, and Section 2.3.3 provides a discussion of the range of alternatives.

Table 3-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 4 NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No action	No action	None	No remedial actions taken. Five year review would be required.	Retained[1]
Limited action	LUCs	LUCs	LUCs for property in the area of soil contamination would include restrictions on excavation/construction and future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic degradation	In situ degradation of organics using microorganisms in an oxygen-enriched environment. Would be used in combination with bioventing/soil venting.	Retained
		Anaerobic degradation	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[2]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[3]
		Vapor extraction/bioventing/ soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Retained[4]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[5]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[6]
	Thermal	Vitrification	Immobilization of inorganic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[7]

Table 3-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 4 NAS WHITING FIELD, MILTON, FLORIDA PAGE 2 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[8]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[8]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[8]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for all sites; however, it will be retained as a baseline consideration.

[2]Anaerobic biodegradation is not suitable for treating arsenic or benzo(a)pyrene.

[3]Soil flushing may make arsenic more mobile.

[4]Vapor extraction is not suitable for nonvolatile organics such as benzo(a)pyrene. Bioventing/soil venting would be suitable.

[5]Steam stripping has limited effectiveness on benzo(a)pyrene.

[6]Solidification is effective at decreasing the mobility of arsenic and some organics but would not reduce the risks in surface soil.

[7]Underground utilities would interfere with vitrification and, the use of vitrification would severely limit potential futures uses.

[8]On-site landfills are not a viable option at Site 4 due to the groundwater beneath the site.

Table 3-6
SOIL TECHNOLOGIES AND PROCESS OPTIONS PASSING PRELIMINARY SCREENING FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Limited action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Treatment	Physical/chemical	Bioventing/Soil Venting	Bioventing/Soil Venting
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology

Table 3-7
RANGE OF ALTERNATIVES FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment –Minimizes Long-Term Management

3.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized in Section 2.3.4.

The COCs for Site 4 are inorganics (arsenic) from the surface down to approximately 14 feet and organics [benzo(a)pyrene] at 20 to 22 feet bgs. Four soil alternatives are assembled into the appropriate alternative types for this site, which are listed in Table 3-8.

Site 4 alternatives S4-1, S4-2, and S4-4 contain the same RPOs as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Refer to the discussion in Section 2.3.4 for a brief description of these alternatives.

Table 3-8
SITE 4 SOIL REMEDIAL ALTERNATIVES
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S4-1 No Action	No Action	None	• Five-year Reviews.
Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs	Containment/Limited Action – No or Minimal Treatment	LUCs, Excavation, Disposal, Soil Cover	• LUCs including LUC Assurance Plan (LUCAP) and LUC Implementation Plan (LUCIP). • Delineation/confirmatory sampling of surface soil adjacent to 4SB06 and 4SB09. • Excavation/disposal of surface soil (0-2 feet bgs) containing arsenic exceeding PRGs at 4SB06 and 4SB09. • Backfill excavation with clean fill. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.
Alternative S4-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Containment/Limited/Treatment Action – Minimal Treatment	LUCs, Excavation, Disposal, Soil Cover, In Situ Soil Venting	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 4SB06 and 4SB09. • Excavation/disposal of surface soil (0-2 feet bgs) containing arsenic exceeding PRGs at 4SB06 and 4SB09. • Backfill excavation with clean fill. • Establish vegetative cover. • Install and operate an in situ soil venting system at location 4SB03. • Posting of warning signs. • Five-Year site reviews.
Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 4SB03, 4SB06, 4SB07, and 4SB09. • Excavation/disposal of surface and subsurface soil containing arsenic and benzo(a)pyrene exceeding PRGs at 4SB03, 4SB06, 4SB07, and 4SB09. • Backfill excavation with clean fill. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.

Alternative S4-3 is assembled to address the principal threat of direct contact with the subsurface soil. LUCs are used in the alternative to reduce any residual risk, to assess the degree of remediation, and to ensure appropriate future land use. This alternative may be a long-term approach to meet remedial objectives in a noninvasive manner. Alternative S4-3 involves in situ soil venting/bioventing as the method for the permanent treatment of SVOCs. This in situ treatment process promotes in situ volatilization and biodegradation of constituents by providing an oxygen supply to indigenous microorganisms and by sustaining aerobic conditions.

3.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

3.4.1 Site 4 Alternatives

The four alternatives for Site 4 represent a range of actions including no action, containment/limited action addressing principal threats, and aggressive actions minimizing the need for long-term management. The four alternatives providing a range of treatment options for Site 4 are listed below.

- Alternative S4-1: No Action
- Alternative S4-2: Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S4-3: Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs
- Alternative S4-4: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

3.4.1.1 Alternative S4-1: No Action

3.4.1.1.1 Description

In an FS the No Action alternative serves as a baseline or to addresses sites that do not require any active remediation. The No Action alternative assumes that no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions would remain or be implemented under the No Action alternative. Natural

attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, will be expected to occur over long periods of time but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

3.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S4-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S4-1 would provide no long-term effectiveness or permanence for Site 4. Arsenic and benzo(a)pyrene present in Site 4 would pose a continuing risk to human health and the environment. The magnitude of and potential for residual risk within Site 4 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S4-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 4 would not change significantly, and the risk posed to human health and the environment would be expected to continue because Alternative S4-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it would not be expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituents for natural attenuation are PAHs as well as inorganics. The processes of natural attenuation and natural biodegradation can provide irreversible treatment. Natural attenuation is estimated to have a limited effect on the reduction of inorganic concentrations contained within Site 4 soil.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during the implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There is no need to coordinate with other agencies or acquire permits. Services or materials are not required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost for the No Action alternative is the cost for the 5-year reviews because no remedial action will occur. The estimated present worth total project cost is $18,008 including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

3.4.1.2 Alternative S4-2: Surface Soil (exceeding PRGs) Removal and LUCs

3.4.1.2.1 Description

Alternative S4-2 addresses the principal threats through the implementation of LUCs, surface soil excavation, and off-base disposal. LUCs are described in Appendix C.

Impacted surface soil (up to 2 feet bgs) exceeding PRGs in the areas surrounding sample locations 4SB06 and 4SB09 would be excavated to remove approximately 186 yd^3. Because impacted soil exists below the depth of the excavation, the excavated area would be backfilled with clean, native backfill material, compacted, and revegetated to create a soil cover. For these areas long-term monitoring and maintenance would be required. Disposal in an off-base TSDF and/or landfill would be used for the soil excavated from Site 4. Some pretreatment of the excavated soil may be necessary to meet LDRs and would be provided by the TSDF, if required.

3.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S4-2 provides protection to human health and the environment by minimizing all exposure pathways through the removal of impacted surface soils that may pose a risk through restricting access to remaining impacted soil by LUCs and the soil cover. Immediate risk from potential exposure during maintenance activities would be reduced by the removal of impacted surface soil and its subsequent off-base disposal. LUCs are partially effective in the protection of human health. The soil cover would protect humans and the environment by containment. There would be no significant risks to human health or the environment during implementation of Alternative S4-2 if normal dust-control procedures are conducted and direct worker contact with impacted materials is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S4-2 would provide a high level of protection.

Compliance with ARARs

All action-specific ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S4-2 if confirmational sampling and analyses determine any source areas greater than 2 feet bgs are stable and relatively stationary. Over time Alternative S4-2 would satisfy chemical- and

action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, any excavated soil may require pretreatment to meet LDRs which would be provided by the TSDF, if required. Although containment (e.g., soil cover) is not an active remedial process, exposure to the constituents would be prevented. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S4-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S4-2 is low since contaminants are not treated. However, excavation, disposal, and containment provide long-term effectiveness and permanence in minimizing exposure pathways, assuming the barrier material (compacted, clean native soil) is maintained at a depth greater than 2 feet above source areas. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and the soil cover remain in place. The magnitude of constituent concentrations would be reduced as a result of excavation, off-base disposal, and natural attenuation. A 5-year review would be required to assess the effectiveness of excavation of surface soils, the effectiveness of the soil cover to contain remaining inorganic and organic constituents, and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs are sufficient to restrict access to impacted soils. The life expectancy for the Site 4 soil cover would be 20 to 30 years; however, the service life of the soil cover is greatly affected by weather and the level of maintenance performed. Long-term reliability would be maintained because natural surface flow patterns would be returned to near original conditions and erosion would be minimized. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of impacted surface soils would reduce mobility of constituents by physically moving the constituents from the site to a secure landfill. The soil cover would also reduce the mobility of inorganic constituents that may pose a risk through fugitive dust. Excavation and disposal of surface soil and the containment of subsurface soil utilizing a soil cover would minimize exposure pathways, but reduction of the concentrations of the remaining constituents would rely on natural attenuation. Toxicity of excavated soils may be reduced through treatment in an off-base TSDF before

land disposal. This alternative would provide a low degree of irreversible treatment through natural attenuation processes, but would significantly reduce the mobility of the constituents by the excavation of impacted surface soils, off-base disposal, and the introduction of a soil cover as a horizontal barrier. Minor inorganic constituent residuals would remain above action levels after the implementation of Alternative S4-2. The implementation and operation of Alternative S4-2 would produce no treatment residuals.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S4-2 would be controllable and would result from the excavation, transportation, off-base disposal, construction of a soil cover, and O&M of the remedial alternative. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S4-2 would be approximately 90 days. A more detailed evaluation during design may identify (1) other components required for the soil cover material, (2) concurrent constructibility of components, and (3) individual source area excavation and cover construction details. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S4-2 would be effective in minimizing all exposure pathways. The time required to achieve remedial response objectives by minimizing all exposure pathways is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S4-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and location of the soil cover. Excavation and installation of the soil cover for Site 4 would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. Monitoring of the integrity of the soil cover would also be required. By excavating the impacted surface soil and backfilling with clean native soil, the ground surface grade would be returned to near original grade. The long-term integrity of the vegetated soil cover would be increased because surface flow patterns would be returned to near normal conditions, which would reduce the erosion of the soil cover material. O&M activities would be of low intensity and may involve regrading, compaction, revegetation, erosion control, and monitoring. All components of Alternative S4-2 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S4-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S4-2; however, modification of LUCs and removal/replacement of the soil cover may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $160,582 including a capital cost of $100,009, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for long-term monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

3.4.1.3 Alternative S4-3: Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs

3.4.1.3.1 Description

This alternative addresses the principal threats through the implementation of LUCs, surface soil excavation, in situ soil venting of subsurface soil, and off-base disposal. LUCs are described in Appendix C. Excavation and disposal are described in Section 3.4.1.2.1. Surface soil surrounding sample locations 4SB06 and 4SB09 would be excavated and the excavated soil disposed of off site (as described in Section 3.4.1.2.1).

This alternative would also address principal threats through in situ soil venting of the area around sample location 4SB03 to promote volatilization and biodegradation of organic constituents and to reduce remedial time. In situ soil venting is a demonstrated technology for the removal of organic compounds from the unsaturated or vadose zone. A vacuum is applied to the soil column to volatilize and transport organic constituents to a collection system. The organic constituents in the soil are removed by the airstream and, upon withdrawal, are treated using a technique, such as thermal oxidation or carbon adsorption, appropriate for the specific compounds. The recovery rate increases as the vapor pressure of a compound increases. Soil venting technology can potentially treat soil beneath structures, along utility pipelines, and to soil depths beyond the practical limits of excavation. The oxygen provided by in situ soil venting also stimulates existing biological growth. The indigenous microbes can multiply in the presence of oxygen, digest the constituents, and accelerate the remediation process.

The in situ soil venting system would treat a surface area of approximately 17,671 ft^2 to a depth of approximately 35 feet bgs. The conceptual design would consist of 12 wells installed to a depth of 35 feet bgs with a vapor recovery system and gas phase carbon off-gas treatment. The system would operate for approximately 3 years.

3.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S4-3 would provide protection of human health and the environment by minimizing all exposure pathways through the removal and off-base disposal of all impacted surface soil containing COCs exceeding PRGs at Site 4 as well as in situ treatment of subsurface soil surrounding sample location 4SB03 using soil venting. Immediate and future risk from exposure would be reduced by the removal and off-base disposal of all impacted surface soil exceeding PRGs. The reliability of excavation, off-base disposal, and soil venting is high in the protection of human health and the environment because the source of risk is permanently removed from the site and/or irreversibly treated in place. There would be no significant risks to human health and the environment during implementation of Alternative S4-3 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S4-3 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing the risk to human health and would be satisfied by Alternative S4-3. Over time Alternative S4-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives on base including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S4-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence of Alternative S4-3 through in situ soil venting would be high assuming soil venting is successful in treating organic constituents near sample location 4SB03. Excavation, off-base disposal, and containment provides long-term effectiveness and permanence in minimizing exposure pathways, assuming all impacted surface soil near sample locations 4SB06 and 4SB09 is identified, excavated, and disposed of off-base, and the soil cover material (compacted, clean native soil) is maintained at a 2 feet or greater depth. Soil venting would enhance in situ biodegradation and provide long-term effectiveness once excavations are backfilled and venting has begun as well as when the soil venting system's operation has ceased. A 5-year review would be required to assess the effectiveness of excavation, off-base disposal, containment for arsenic, and the effectiveness of soil venting in removing organic constituents from the soil.

The adequacy and reliability of LUCs would be sufficient to restrict access to remaining impacted soils. Constituent concentrations and residual risks would decrease with the operation of the soil venting system and would continue to decrease after system operation has ceased because of the promotion of in situ biodegradation. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal in a secure landfill of impacted surface soil containing COCs exceeding PRGs within Site 4 would reduce the mobility of constituents. The toxicity and volume of excavated constituents would be reduced through treatment at the TSDF, if required, before landfilling. Containment would reduce the mobility of arsenic that may pose a risk through fugative dust. Soil venting would also reduce the toxicity and volume of organic constituents through volatilization, biodegradation, and the removal of the constituents from the vadose zone under a vacuum. Any carbon adsorption units used for soil venting offgas capture would require treatment to reduce the volume and ensure proper disposal of the adsorbed organic constituents. Minor organic constituent residuals below action levels would remain after implementation and operation of Alternative S4-3; however, these residuals would naturally degrade over time through the promotion of in situ biodegradation provided by in situ soil venting.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from construction of Alternative S4-3 would be controllable and would result from the excavation, transportation, soil staging, off-base disposal, containment, and in situ soil venting. Health and safety issues include dust control, runoff control, emissions control, and proper decontamination procedures. Construction time to implement Alternative S4-3 would be approximately 1 year. A more detailed evaluation during design may identify individual source area construction/excavation details. Minimal risk to the community would be expected from excavation of impacted soil, off-base disposal, and in situ soil venting system operation during Alternative S4-3 implementation. Alternative S4-3 would be effective in minimizing exposure pathways and reducing constituent concentrations having the potential to impact groundwater through leaching. The time required to achieve remedial response objectives is estimated to be less than 3 years.

Implementability

The RPOs associated with Alternative S4-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and the location of the soil cover. Excavation and off-

base disposal of Site 4 surface soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation would be required around utilities. In situ soil venting would require drilling, trenching, and treatment area construction. O&M activities associated with Alternative S4-3 would be of low intensity, involving periodic sampling and analysis of excavated soils, soil venting system O&M, offgas adsorption material handling and/or treatment, monitoring, and fence maintenance. All components of Alternative S4-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S4-3 in minimizing exposure pathways and reducing constituent concentrations. Future remedial actions would not be hindered by the implementation of Alternative S4-3; however, modifications of LUCs, fencing removal/replacement, and/or the addition or closure of soil venting systems may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $382,190 including a capital cost of $213,683, $40,379 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for long-term monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

3.4.1.4 Alternative S4-4: Surface and Subsurface Soil (Exceeding PRGs) Removal and LUCs

3.4.1.4.1 Description

Alternative S4-4 minimizes the need for long-term management because all surface and subsurface soil containing COCs exceeding PRGs would be removed. LUCs are described in Appendix C. Monitoring would consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted surface and subsurface soil exceeding PRGs. The excavation would consist of removing soil from the surface down to approximately 35 feet bgs. The estimated excavation would be approximately 25,467 yd^3 of which approximately 18,596 yd^3 would be contaminated. After all impacted soil within the excavation areas containing COCs exceeding PRGs is removed, the excavated area would be backfilled with clean, native material, compacted, and revegetated with no long-term monitoring or maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil from Site 4. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

3.4.1.4.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S4-4 would provide protection of human health and the environment by removal and off-base disposal of all soil containing COCs exceeding PRGs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial landuse exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk is permanently removed from the site. There would be no significant risks to human health and the environment during implementation of Alternative S4-4 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized. Therefore, Alternative S4-4 would provide a high level of protection of human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health and the environment would be satisfied by Alternative S4-4. Alternative S4-4 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S4-4.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S4-4 is low since contaminants are not treated. However, excavation and off-base disposal provide long-term effectiveness and permanence by minimizing exposure pathways, assuming all impacted soil exceeding PRGs is identified, excavated, and disposed.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would only consists of LUCs and 5-year reviews.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically moving them from the site to a secure landfill. The toxicity of the excavated constituents may be reduced through treatment in an off-base TSDF before landfill disposal. Minor inorganic constituent residuals would remain below action levels after the implementation of Alternative S4-4. No treatment residuals would be produced by the implementation of Alternative S4-4.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S4-4 would be controllable and would result from the excavation, transportation, and off-base disposal of impacted soil. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S4-4 would be approximately 90 days. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S4-4 would be immediately effective in minimizing all exposure pathways. The time required until remedial response objectives are achieved is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S4-4 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. Excavation and disposal of Site 4 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S4-4 would be reliable in the protection of human health and the environment. The need for future remedial actions will depend on the effectiveness of Alternative S4-4 in the source areas. Future remedial actions would not be hindered by the implementation of Alternative S4-4; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $3,234,423 including a capital cost of $3,177,333, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for long-term monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

3.4.2 Summary Of Site 4 Soil

As part of the detailed analyses of alternatives for Site 4, one alternative involving no action, one alternative involving containment/limited action, one alternative with minimal treatment, and one alternative eliminating or minimizing long-term management have been evaluated. Alternative S4-1 is the only alternative that does not satisfy the threshold criteria to the full extent but is retained for comparison purposes. Alternatives S4-2 through S4-4 provide varying degrees of protection and treatment and would be viable for the selection as a preferred alternative. The relative merits of all Site 4 alternatives are evaluated in Section 3.5.

3.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 3.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1). Additional discussion of the comparative analysis is provided in Section 2.5.

A summary of the comparative analyses and costs for the Site 4 alternatives is presented in Table 3-9. This comparison between alternatives is based on the CERCLA evaluation criteria.

3.5.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

The existing exposure pathways to humans for Site 4 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological receptors. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the

Table 3-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 4

Criteria	Alternative S4-1 No Action	Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S4-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No reduction in risk.	Provide a high level of protection. LUCs reduce risk from residuals. Excavation, disposal, and the soil cover reduce risk of potential exposure.	Provides a high level of protection. LUCs and treatment reduce risk from residuals. Excavation, disposal, and the soil cover reduce risk of potential exposure.	Provides highest level of protection. LUCs reduce risk from residuals. Excavation and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Excavation and the soil cover stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Natural attenuation and soil venting reduces constituent concentrations of impacted soils over time.	Excavation and disposal will eliminate or reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs in greater than 30 year.	Meets ARARs for organics in 3 years and inorganics in greater than 30 years.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs if proper PPE used during construction of the soil cover.	Meets ARARs if proper PPE used during excavation, disposal, and construction of in situ venting system and cover.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	Natural attenuation may decrease risk; however, risk is significant for >30 years.	Risk reduced by excavation and disposal of surface-impacted soil. Natural attenuation may decrease remaining risk; however, risk due to subsurface-impacted soil is significant for an estimated 30 years.	Provides medium level of long-term residual risk reduction. Risk reduced by Soil Venting of the impacted soil. Any residual concentrations will be reduced over time through natural attenuation; however, risk due to subsurface-impacted soil is significant for an estimated 30 years.	Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by excavation and off-site disposal. Any residual concentrations may be reduced over time through natural attenuation.

Table 3-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 2 OF 4

Criteria	Alternative S4-1 No Action	Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S4-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability if cover is maintained.	Provides a high level of reliability because of proven technology, and if the cover is maintained	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Direct Contact and Incidental Ingestion are not controlled.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and the soil cover.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and the soil cover.	Exposure to residuals is eliminated or reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	The soil cover may require replacement or repair.	The soil cover may require replacement or repair.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Management required for estimated 30 years.	Minimum management required for estimated 30 year.
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	None	Excavated surface soil is disposed of off site. Remaining contaminants may naturally attenuate over time. The soil cover is for containment only.	Organic compound removal is about 90%. Inorganic compounds may naturally attenuate over time. The soil cover is for containment only.	All impacted soil exceeding Remediation Goals is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by excavation and the soil cover. Toxicity of excavated soils may be reduced in an off-site Treatment, Storage, and Disposal Facility (TSDF). Toxicity of remaining soils may be reduced through natural attenuation.	Mobility reduced by excavation and the soil cover. Toxicity is reduced by treatment and natural attenuation.	Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Off-site TSDF treatment and natural attenuation are irreversible processes.	Off-site TSDF treatment, Soil Venting and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of inorganics left from natural attenuation.	Minor inorganic and organic residuals remain above industrial action levels in subsurface soil.	Inorganics left from Soil Venting and natural attenuation remain above industrial action levels.	No organic or inorganic residuals remain above industrial action levels.

Table 3-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 3 OF 4

Criteria	Alternative S4-1 No Action	Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S4-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	Not applicable	Temporary increase in dust emissions through excavation of surface soils and the soil cover installation can be controlled by proper construction techniques.	Temporary increase in dust emissions during installation of Soil Venting system, excavation of soils and the soil cover can be controlled by proper construction techniques.	Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	Continued impact from existing conditions.	Excavation of surface soils and the soil cover installation can generate impacted soil, runoff, and fugitive dust.	Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time[a]	Not applicable	Less than 1 year	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Estimated at 30 years.	Estimated at 1 year.	Estimated at 2 year.	Estimated at 1 year.
Implementability				
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to provide excavation and the soil cover. Fewer contractors accept impacted soil for disposal.	Many contractors available to construct and operate Soil Venting system and excavation and the soil cover. Fewer contractors accept impacted soil for disposal.	Many contractors available to provide excavation. Fewer contractors accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation. The soil cover reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Soil Venting is a reliable technology for treating organic contaminants. The soil cover reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable	Implementable

Table 3-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 4
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 4 OF 4

Criteria	Alternative S4-1 No Action	Alternative S4-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S4-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative S4-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring gives notice of treatment efficiency and progress of remediation.	Monitoring indicates excavation effectiveness and removal of contaminated areas.
Permitting Requirements	Not applicable	Transportation and Disposal Permit will be required.	Transportation and Disposal Permit will be required. Permit for air emissions may be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Available	Readily Available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Available	Readily Available
Cost[b]				
Capital Costs	$0	$100,009	$213,683	$3,177,333
Short-Term O&M	$0	$0	$40,379	$0
Long-Term O&M				
5-Year Review	$7,375	$7,375	$7,375	$7,375
Land-Use Controls	$0	$3,092	$3,092	$2,839
Total Project Present Worth Cost	$18,008	$160,582	$382,190	$3,234,423

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

Alternatives S4-3 and S4-2 would provide protection of human health and the environment through institutional controls, physical removal of the impacted surface soil that exceeds PRGs, and containment (by the soil cover) of the remaining impacted soil. The soil cover would ensure reduced risk from all potential pathways but would not provide active remediation. Alternative S4-3 would also protect human health and the environment to some extent through in situ soil venting. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs.

Table 3-9 presents a summary for the overall protectiveness of human health and the environment for all Site 4 alternatives.

3.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S4-2 through S4-4 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. PRGs are numerical values representing chemical-specific ARARs. Over time, both alternatives would meet PRGs within Site 4. Table 3-9 presents a summary of ARARs compliance for each alternative.

3.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

Magnitude of Residual Risks

Alternative S4-4 would provide a higher level of long-term effectiveness and permanence than Alternatives S4-2 and S4-3 by providing active removal of impacted soil within Site 4 exceeding inorganic PRGs, thereby reducing residual risk from all impacted soil left at the site. Alternative S4-4 would significantly reduce all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of impacted soil. Alternative S4-3 would provide a higher level of long-term effectiveness and permanence than Alternative S4-2 due to the in situ treatment of the benzo(a)pyrene. Alternatives S4-2 and S4-3 would include removal of the surface-impacted soil and provide containment for any remaining constituents. No alternative, except No Action, for Site 4 would produce or leave residuals requiring treatment and/or disposal that would pose any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur. Alternative S4-2 would minimize risks to the receptors

from direct exposure to contaminants at depth, but, because it is only a containment alternative, the effectiveness for residual risk reduction and remediation of impacted soil at the surface exceeding PRGs would be moderate. Alternatives S4-2 and S4-3 would leave some contaminants untreated; thus, the effectiveness for residual risk reduction would be low. Evaluation, modeling, and sampling would be required to determine residual risk reduction by Alternatives S4-2 and S4-3. Alternatives S4-2 and S4-3 would require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives, except No Action, would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternative S4-4 would permanently remove the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternative S4-4 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal and off-base disposal of all or a portion of the impacted soil. Alternatives S4-2 and S4-3 would involve the use of a soil cover, which does not actively remediate constituents but would be adequate and reliable in controlling exposure to any remaining constituents. Because Alternatives S4-2 and S4-3 would reduce the risks through the installation of the soil cover, future maintenance and monitoring of the cover would be required. Alternative S4-3 would rely on enhanced biodegradation of contaminants and would not require any controls once the treatment is complete.

Table 3-9 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 4 alternative.

3.5.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternative S4-4 would permanently and significantly reduce mobility of chemical constituents to the highest level of the alternatives evaluated for Site 4. Alternative S4-4 is considered a permanent remedy and is designed to provide the greatest reduction of risk through removal and off-base disposal. No COCs at concentrations greater than PRGs would remain at the site under Alternative S4-4. Alternatives S4-2 and S4-3 would reduce the mobility of impacted soil through containment but would not provide active treatment of remaining soils to reduce toxicity and volume. Alternatives S4-2 and S4-3 would remove the COCs present in surface soils at concentrations greater than PRGs. Alternative S4-3 would decrease toxicity through treatment of the organics. All the alternatives would rely on some degree of natural attenuation to aid in the remediation of the residuals remaining in the soil; however, the types and

concentrations of constituent residuals would be assumed to be below action levels. The concentrations of toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 3-9 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 4 alternative.

3.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives, such as Alternatives S4-2 through S4-4, would take progressively longer to protect human health because of the time needed for treatment and to excavate and/or construct the soil cover. Alternatives S4-2 and S4-4 have an estimated remedial time to reach objectives of less than 1 year; Alternative S4-3 would be less than 3 years. Alternatives S4-2 through S4-4 would create short-term risks of worker exposure and the potential of fugitive dust during excavation, transportation, and/or soil cover construction. These risks appear manageable using appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust, and runoff) are expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 3-9 provides a summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 4 alternative.

3.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternatives S4-2 through S4-4 may require Federal, state, or local permits because they include excavation, transportation, and off-base disposal of impacted soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternatives S4-2 through S4-4 would require coordination with other agencies for deed recordation and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S4-4 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternatives S4-2 and S4-3.

Alternatives S4-2 and S4-3 would require monitoring of the soil cover for erosion and potential exposure. Alternative S4-4 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate PPE. Exposure from dermal contact and ingestion of soil during construction would be minimized by use of appropriate PPE.

Alternatives S4-2 through S4-4 would require the use of a TSDF or landfill for excavated, impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 3-9 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of services and capacities; and availability of equipment, specialists, and materials, for each Site 4 alternative.

3.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. The costs for all Site 4 alternatives are within 50% difference of each other. Alternative S4-4 has the highest cost, followed by Alternatives S4-3 and S4-2, respectively. Table 3-9 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 4 alternative. Detailed cost estimates are provided in Appendix E.

3.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments, and Navy responses to the comments, are provided in Appendix F.

3.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS Report and the Proposed Plan for Site 4.

4.0 SITE 6 - SOUTH TRANSFORMER OIL DISPOSAL AREA

Site 6 is located southeast of the Midfield Maintenance Hangar, Building 1454 (see Figure 1-1). At Site 6, from the 1940s until 1964, transformers were reportedly drained into the grassed "0-2" ditch located east of Building 1454. It is likely the dielectric fluid from the transformers contained PCBs. Runoff from the grassed ditch drains in a northeasterly direction eventually into Big Coldwater Creek, located approximately 2.3 miles east of the disposal site (Geraghty & Miller, 1984).

The remedial investigation for Site 6 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

4.1 ENVIRONMENTAL CONDITIONS

4.1.1 Nature and Extent of Contamination

The source of chemicals in the surface and subsurface soils at Site 6 can be attributed to the release of transformer oil into a drainage ditch located south of Building 1454. However, SVOCs and PCBs were infrequently detected in the surface and subsurface soils. Other chemicals detected in the surface and subsurface soils include VOCs, TPH, and inorganics. Exceedances of regulatory criteria were limited to surface soils only.

All SVOCs detected in the surface and subsurface soils at Site 6, except BEHP, were identified in soils collected from 6SB03. This boring is located at the discharge of the flume into which transformer oil may have been released. The highest concentrations of SVOCs were detected in the surface soils. The number of SVOCs and concentrations decreased with depth until no compounds were detected in a sample collected from 15-17 feet bgs. Pesticide/PCB compounds were detected in the surface soil at 6SB04 only and one subsurface soil sample at 6SB01 (5-7 feet bgs). The Aroclor-1260 detection in the surface soil at 6SB04 was the only PCB compound detected at the site and is likely the result of the discharge of transformer oil to the flume.

Elevated organic concentrations are most prevalent in the shallow soil in the area adjacent to the Midfield Hangar apron. Runoff from the apron is directed to this area; therefore, the source for the above average organic concentrations may be from hangar activities as well as the discharge of transformer oil to the ditch.

4.1.2 Risk Assessment Results

Surface Soil

The concentrations of 14 analytes [aluminum, Aroclor-1260, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chromium, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, iron, TPH, and vanadium] exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (residential). When one carcinogenic PAH was selected as a COPC [i.e. benzo(a)pyrene], all carcinogenic PAHs were retained as COPCs. These analytes were selected as COPCs and were used to evaluate the human health risks associated with the surface soil at Site 6 (Table 4-1).

Table 4-1
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Arsenic	✓	
Chromium	✓	
Iron	✓	
Vanadium	✓	
Benzo(a)anthracene	✓	
Benzo(a)pyrene	✓	
Benzo(b)fluoranthene	✓	
Benzo(k)fluoranthene	✓	
Chrysene	✓	
Dibenzo(a,h)anthracene	✓	
Indeno(1,2,3-cd)pyrene	✓	
Aroclor-1260	✓	
TPH	✓	

The cancer risks (RME) associated with exposure to surface soil (ingestion and dermal contact) are 1.8 x 10^{-6} for an older child trespasser, 2.5 x 10^{-6} for an adult trespasser, 7.9 x 10^{-6} for the occupational worker, 8.8 x 10^{-7} for the site maintenance worker, 2.5 x 10^{-7} for the construction worker, and 5.7 x 10^{-5} for the child/adult resident. All RME cancer risk values are within or below the USEPA acceptable cancer risk range of 1 x 10^{-4} to 1 x 10^{-6} for all receptors. The risk values for the construction worker and the site maintenance worker are less than the FDEP target risk of 1 x 10^{-6}. However, the cancer risks associated with exposure to surface soils for the adult trespasser, older child trespasser, occupational worker, and child/adult resident exceed the FDEP level of concern of 1 x 10^{-6}. The primary risk drivers are arsenic and benzo(a)pyrene for all receptors.

The noncancer RME risks associated with surface soil ingestion and dermal contact for the adult and older child trespasser, occupational worker, site maintenance worker, construction worker, and the adult resident are below the USEPA and FDEP target HI of 1.0. The noncarcinogenic risk for the child resident is 1.06, which slightly exceeds unity (1.0). *However, the noncarcinogenic risk does not exceed 1.0 for individual target organs*.

Subsurface Soil

No chemicals were detected in subsurface soil exceeding site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (industrial/commercial). A human health risk assessment was not performed for the subsurface soil at Site 6 since no chemicals were selected as COPCs

Ecological

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 6 is limited and of poor quality since the site is characterized by mowed turfgrass, heavy human activity, and high vehicle/aircraft traffic. As a result of the heavy human activity and vehicle and aircraft noise, terrestrial wildlife is deterred from using the site. Although some types of wildlife can become accustomed to heavy human activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival, and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

4.2 REMEDIAL ACTION OBJECTIVES

The objectives and goals for remedial actions at Site 6 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information presented in this section is used to identify and evaluate appropriate remedial technologies for Site 6 (Section 4.3).

4.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs. A complete discussion of ARARs is provided in Section 2.2.1.

4.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and the receptors present at the site. RAOs are identified for surface and subsurface soil and consider the results of the RI (discussed in Section 4.1), particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida STCL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of the chemicals by rainwater from soils will be evaluated as part of Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, two RAOs have been developed for Site 6.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

4.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Section 2.2.3 provides the basis for selection of PRGs.

The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.
2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 4-2 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 6.

4.2.4 Chemicals of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 4-3 shows the COC selections for Site 6.

4.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

COCs at Site 6 include arsenic, benzo(a)pyrene and TPH in the surface soil (Figure 4-1). There were no detections of any chemicals above their PRGs in the subsurface soil. Three of the four chemical detections exceeding the PRGs were found in 6SB03, located at the southeast end of the flume. The other sample location with a detection of a COC is located approximately 90 feet northeast of 6SB03. The two western sample locations did not have any chemicals exceeding the PRGs.

Sample 6SB03 also had benzo(a)pyrene concentrations of 1.6 mg/kg and 1.9 mg/kg (PRG = 0.5 mg/kg) in the sample and duplicate sample, respectively, collected in the surface soil.

Table 4-2
DETERMINATION OF PRGs AT SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Chromium	mg/kg	420	610	420	N	11	420	22.8	420
Iron	mg/kg	480,000	61,000	61,000	N	8,832	61,000	18,110	61,000
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
Benzo(a)anthracene	mg/kg	5	7.8	5	C	NA	5	NA	5
Benzo(a)pyrene	mg/kg	0.5	0.78	0.5	C	NA	0.5	NA	0.5
Benzo(b)fluoranthene	mg/kg	4.8	7.8	4.8	C	NA	4.8	NA	4.8
Benzo(k)fluoranthene	mg/kg	52	78	52	C	NA	52	NA	52
Chrysene	mg/kg	450	780	450	C	NA	450	NA	450
Dibenzo(a,h)anthracene	mg/kg	0.5	0.78	0.5	C	NA	0.5	NA	0.5
Indeno(1,2,3-cd)pyrene	mg/kg	5.3	7.8	5.3	C	NA	5.3	NA	5.3
Aroclor-1260	mg/kg	2.1	2.9	2.1	C	NA	2.1	NA	2.1
TPH	mg/kg	2,500		2,500	NA	NA	2,500	NA	2500

[1]Combined list of all COPCs for Site 6.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, GIR, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

*Chemical is not a health concern for the commercial/industrial exposure scenario.

mg/kg – milligrams per kilogram
NA – Not Applicable

Table 4-3
CHEMICAL OF CONCERN EVALUATION FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

Surface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	29,100	--	29,100	Maximum	n<10	200,000	No
Arsenic	mg/kg	3.5	--	3.5	Maximum	n<10	3.7	No
Chromium	mg/kg	65	J	65	Maximum	n<10	420	No
Iron	mg/kg	14,800	--	14,800	Maximum	n<10	61,000	No
Vanadium	mg/kg	42.2	--	42.2	Maximum	n<10	1,400	No
Benzo(a)anthracene	mg/kg	1.9	--	1.9	Maximum	n<10	5	No
Benzo(a)pyrene	mg/kg	1.9	--	1.9	Maximum	n<10	0.5	**Yes**
Benzo(b)fluoranthene	mg/kg	2.1	--	2.1	Maximum	n<10	4.8	No
Benzo(k)fluoranthene	mg/kg	1.7	--	1.7	Maximum	n<10	52	No
Chrysene	mg/kg	2.1	--	2.1	Maximum	n<10	450	No
Dibenzo(a,h)anthracene	mg/kg	0.2	J	0.2	Maximum	n<10	0.5	No
Indeno(1,2,3-cd)pyrene	mg/kg	1.6	--	1.6	Maximum	n<10	5.3	No
Aroclor-1260	mg/kg	0.6	J	0.6	Maximum	n<10	2.1	No
TPH	mg/kg	3,580	--	3,580	Maximum	n<10	2,500	**Yes**

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
None	mg/kg	--	--	--	--	--	--	--

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.

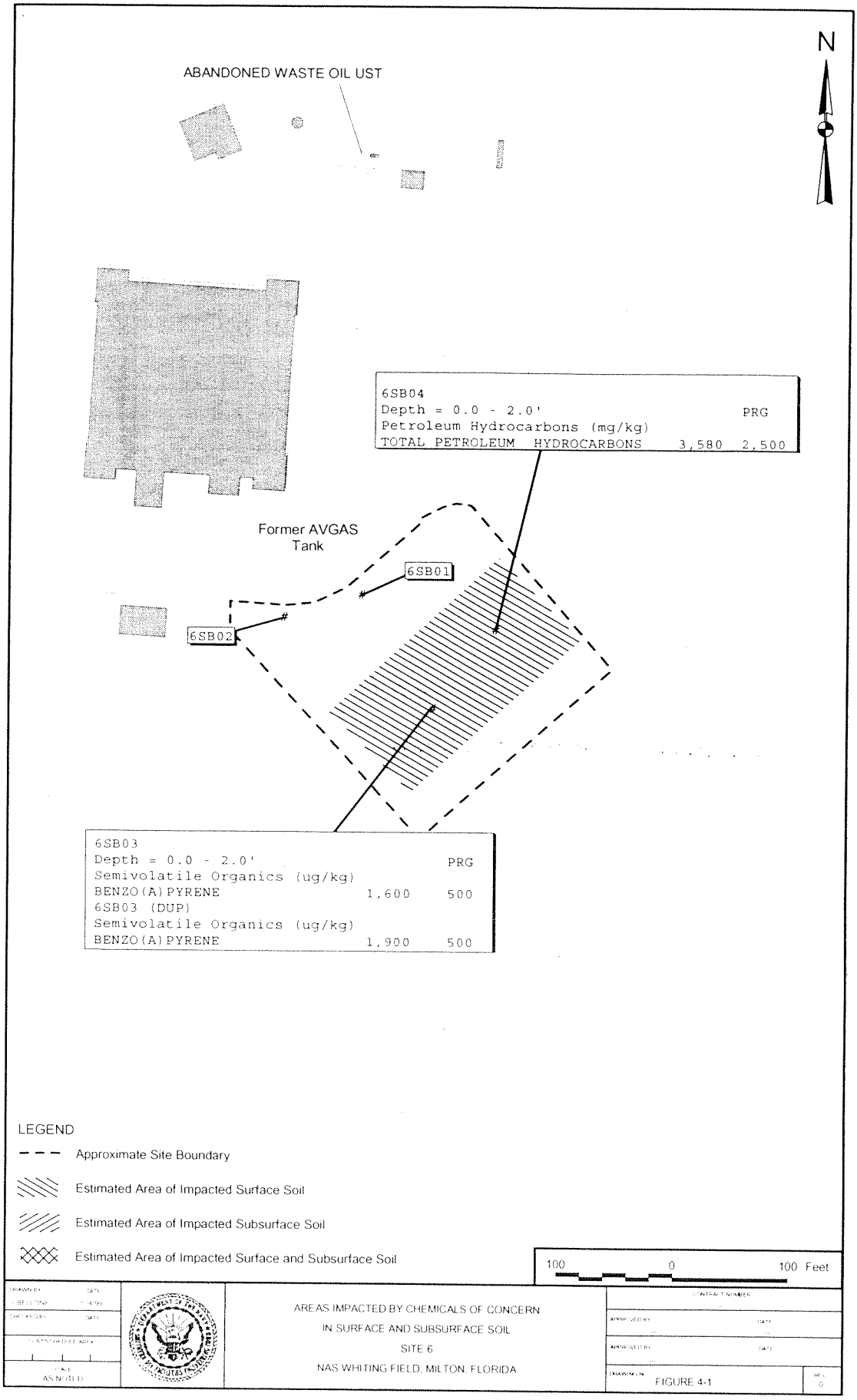
[2]Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).

mg/kg = milligrams per kilogram

UCL = upper confidence limit

UCL-T = UCL of log-transformed data

P:\GIS\NAS WHITING FIELD\7541.BA0.11A001 10/4/99 JCB FEASIBILITY STUDY SITE 6 LAYOUT



Benzo(a)pyrene was detected in the 5-7 feet bgs sample below the PRG and was not detected in any deeper sample, starting at 10 feet bgs.

Sample 6SB04 had a TPH concentration of 3,580 mg/kg (PRG = 2,500 mg/kg) in the surface soil. TPH was detected in the deeper samples collected at 5-7 feet bgs, 10-12 feet bgs, and 20-22 feet bgs at concentrations <24.1 mg/kg, well below the PRG.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 4-4.

Samples 6SB03 and 6SB04 do not share any COCs but are of a similar chemical group and the other two sample locations are not impacted above PRGs. Samples 6SB03 and 6SB04 will be considered as one impacted area [100 feet by 200 feet (20,100 ft^2)] areas of impacted soil.

Sample 6SB03 had benzo(a)pyrene impact above the PRGs in the surface soil. Benzo(a)pyrene was not detected above PRGs in the deeper samples, which start at 5 feet bgs; therefore, the impact is assumed to extend to 4 feet bgs. Sample 6SB04 had TPH impact above the PRG in the surface soil. TPH was not detected at 6SB04 in any deeper sample, which start at 5 feet bgs; therefore, the impact is assumed to extend to 4 feet bgs. The estimated volume of soil impacted at 6SB03 and 6SB04 is 2,963 yd^3.

Summary

The Site 6 total estimated volume of contaminated surface soil is 1,482 yd^3 and of subsurface soil is 1,482 yd^3 for a combined total of 2,963 yd^3. Also, there are no areas of contamination presently covered by concrete/asphalt or by a building. Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil exceeding PRGs.

4.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 4.2.

Table 4-4
VOLUME OF SOIL EXCEEDING PRGs AT SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered Soil[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	vol (yd^3)	Radius[f] (ft)	area ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
6SB03	B(a)P – 1.6 @0-2	80	20,100	1,482	80	20,100	1,482	0	0	0	0	0
	B(a)P – 1.9 @0-2D											
6SB04	TPH – 3,580 @0-2											
Total Site 6			20,100	1,482		20,100	1,482	0	0	0	0	0

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

4.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The COCs at Site 6 consists of benzo(a)pyrene and TPH. Soil contamination extends from the surface to a depth of approximately 4 feet bgs. The total estimated volume of contaminated soil is 2,963 yd^3.

The following GRAs apply to contaminated soils at Site 6.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

4.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing the RAOs identified for Site 6. Each technology is then screened based on site- and waste-limiting characteristics. See Section 2.3.2 for additional information.

Table 4-5 presents the remedial technologies/process options applicable for addressing the RAOs for Site 6. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 4-6 summarizes the technologies/process options passing the screening criteria. Table 4-6 also shows the RPO selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 4.3.4.

Table 4-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 6 NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No action	No action	None	No remedial actions taken. Five-year reviews would be required.	Retained[1]
Limited action	LUCs	LUCs	LUCs for property in the area of soil contamination would include restrictions on excavation/construction and future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic degradation	In situ degradation of organics using microorganisms in an oxygen-enriched environment. Would be used in combination with bioventing/soil venting	Retained
		Anaerobic degradation	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[2]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[3]
		Vapor extraction/bioventing/soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Retained[4]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[5]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[6]
	Thermal	Vitrification	Immobilization of inorganic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[7]

Table 4-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 6 NAS WHITING FIELD, MILTON, FLORIDA PAGE 2 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[8]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[8]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[8]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for this site; however, it will be retained as a baseline consideration.

[2]Anaerobic biodegradation is not suitable for treating benzo(a)pyrene.

[3]Soil flushing may make inorganics more mobile.

[4]Vapor extraction is not suitable for nonvolatile organics such as benzo(a)pyrene and TPH. Bioventing/soil venting would be used.

[5]Steam stripping has limited effectiveness on the organic COCs.

[6]Solidification is not effective at decreasing the mobility of organics.

[7]The use of vitrification would severely limit potential futures uses.

[8]On-site landfills are not a viable option at Site 6 due to the groundwater beneath the site.

Table 4-6
SOIL TECHNOLOGIES AND PROCESS OPTIONS THAT PASSED PRELIMINARY SCREENING FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Limited action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Treatment	Physical/chemical	Bioventing/Soil Venting	Bioventing/Soil Venting
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology

4.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated. The range of alternatives developed for soil remediation is presented in Table 4-7, and Section 2.3.3 provides a discussion of the range of alternatives.

Table 4-7
RANGE OF ALTERNATIVES FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment – Minimizes Long-Term Management

4.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized in Section 2.3.4.

The COCs for Site 6 are organics [benzo(a)pyrene and TPH] from the surface down to 4 feet bgs. Four soil alternatives are assembled into the appropriate alternative types for this site, which are listed in Table 4-8.

Table 4-8
SITE 6 SOIL REMEDIAL ALTERNATIVES
NAS WHITING FIELD, MILTON, FLORIDA

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S6-1 No Action	No Action	None	• Five-year Reviews.
Alternative S6-2 Surface Soil (exceeding PRGs) Removal and LUCs	Containment/Limited Action – No or Minimal Treatment	LUCs, Excavation, Disposal, Soil Cover	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 6SB03 and 6SB04. • Excavation/disposal of surface soil (0-2 feet bgs) exceeding PRGs at 6SB03 and 6SB04. • Backfill excavation with clean fill. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.
Alternative S6-3 Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Containment/Limited/Treatment Action – Minimal Treatment	LUCs, In Situ Soil Venting	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 6SB03 and 6SB04. • Install and operate an in situ soil venting system at locations 6SB03 and 6SB04. • Posting of warning signs. • Five-Year site reviews.
Alternative S6-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 6SB03 and 6SB04. • Excavation/disposal of surface and subsurface soil exceeding PRGs at 6SB03 and 6SB04. • Backfill excavation with clean fill. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.

Site 6 alternatives S6-1, S6-2, and S6-4 contain the same RPOs as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Alternative S6-3 contains the same RPOs as for Site 4 alternative S4-3. Refer to the discussion in Sections 2.3.4 and 3.3.4 for a brief description of these alternatives.

4.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*

(USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

4.4.1 Site 6 Alternatives

The four alternatives for Site 6 represent a range of actions including no action, containment/limited action addressing principal threats, and aggressive actions minimizing the need for long-term management. The four alternatives providing a range of treatment options for Site 6 are listed below.

- Alternative S6-1: No Action
- Alternative S6-2: Surface Soil (exceeding PRGs) Removal and LUCs
- Alternative S6-3: Soil Venting and LUCs
- Alternative S6-4: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

4.4.1.1 Alternative S6-1: No Action

4.4.1.1.1 Description

In an FS the No Action alternative serves as a baseline consideration or to address sites that do not require any active remediation. The No Action alternative assumes that no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions will remain or be implemented under the No Action alternative. Natural attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, would be expected to occur over long periods of time but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

4.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S6-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S6-1 would provide no long-term effectiveness or permanence for Site 6. Organic COCs present in Site 6 would pose a continuing risk to human health. The magnitude of and potential for residual risk within Site 6 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S6-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 6 would not change significantly, and the risk posed to human health would be expected to continue because Alternative S6-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it would not be expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituents for natural attenuation are TPH and PAHs. The process is expected to be less effective in meeting remedial objectives and may be applicable to only some of the compounds within these chemical groups. The processes of natural attenuation and natural biodegradation can provide irreversible treatment.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during the implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There is no need to coordinate with other agencies or acquire permits. Services or materials are not required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost for the No Action alternative is the cost for the 5-year reviews because no remedial action will occur. The estimated present worth total project cost is $18,008 including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

4.4.1.2 Alternative S6-2: Surface Soil (exceeding PRGs) Removal and LUCs

4.4.1.2.1 Description

Alternative S6-2 addresses the principal threats through the implementation of LUCs, surface soil excavation, a soil cover, and off-base disposal. LUCs are described in Appendix C.

Impacted surface soil (up to 2 feet bgs) exceeding PRGs in the areas surrounding sample locations 6SB03 and 6SB04 would be excavated to remove approximately 1482 yd^3. Because impacted soil exists below the depth of the excavation, the excavated area would be backfilled with clean, native backfill material, compacted, and revegetated to create a soil cover. For these areas long-term monitoring and maintenance would be required. Disposal in an off-base TSDF and/or landfill would be used for the soil

excavated from Site 6. Some pretreatment of the excavated soil may be necessary to meet LDRs and would be provided by the TSDF, if required.

4.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S6-2 would provide protection to human health and the environment by minimizing all exposure pathways through the removal of impacted surface soils that may pose a risk through restricting access to remaining impacted soil by LUCs and the soil cover. Immediate risk from potential exposure during maintenance activities would be reduced by the removal of impacted surface soil and its subsequent off-base disposal. LUCs are partially effective in the protection of human health. The soil cover would protect humans by containment. There would be no significant risks to human health or the environment during implementation of Alternative S6-2 if normal dust-control procedures are conducted and direct worker contact with impacted materials is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S6-2 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S6-2 if confirmational sampling and analyses determine source areas greater than 2 feet bgs are stable and relatively stationary. Over time Alternative S6-2 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however any excavated soil may require pretreatment to meet LDRs which would be provided by the TSDF, if required. Although containment (e.g., soil cover) is not an active remedial process, exposure to the constituents would be prevented. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S6-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S6-2 is low since contaminants are not treated. However, excavation, disposal, and containment provide long-term effectiveness and permanence in minimizing exposure pathways, assuming the barrier material

(compacted, clean native soil) is maintained at a depth greater than 2 feet above source areas. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and the soil cover remain in place. The magnitude of constituent concentrations would be reduced as a result of excavation, off-base disposal, and natural attenuation. A 5-year review would be required to assess the effectiveness of excavation of surface soils, the effectiveness of the soil cover to contain remaining organic constituents, and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs are sufficient to restrict access to impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. The life expectancy for the Site 6 soil cover would be 20 to 30 years; however, the service life of the soil cover is greatly affected by weather and the level of maintenance performed. Long-term reliability would be maintained because natural surface flow patterns would be returned to near original conditions and erosion would be minimized. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of impacted surface soils would reduce mobility of constituents by physically moving the constituents from the site to a secure landfill. The soil cover would also reduce the mobility of organic constituents that may pose a risk through fugitive dust. Excavation and disposal of surface soil and containment of subsurface soil utilizing a soil cover would minimize exposure pathways, but reduction of the concentrations of the remaining constituents would rely on natural attenuation. Toxicity of excavated soils may be reduced through treatment in an off-base TSDF before land disposal. This alternative could provide a low degree of irreversible treatment through natural attenuation processes, but would significantly reduces the mobility of the constituents by the excavation of impacted surface soils, off-base disposal, and the introduction of a soil cover as a horizontal barrier. Minor organic constituent residuals would remain above action levels after the implementation of Alternative S6-2. The implementation and operation of Alternative S6-2 would produce no treatment residuals.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S6-2 would be controllable and would result from the excavation, transportation, off-base disposal, construction of a soil cover, and O&M of the remedial alternative. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S6-2 is approximately 90 days. A more detailed evaluation during design may identify (1) other components required for the soil cover material, (2) concurrent constructibility of components, and (3) individual source

area excavation and the soil cover construction details. Minimal risk to the community would expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S6-2 would be effective in minimizing all exposure pathways. The time required to achieve remedial response objectives by minimizing all exposure pathways is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S6-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and location of the soil cover. Excavation and the installation of the soil cover for Site 6 would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. Monitoring of the integrity of the soil cover would also be required. By excavating the impacted surface soil and backfilling with native soil (the soil cover), the ground surface grade would be returned to near original grade. The long-term integrity of the vegetated soil cover would be increased because surface flow patterns would be returned to near normal conditions, which would reduce the erosion of the soil cover material. O&M activities would be of low intensity and may involve regrading, compaction, revegetation, erosion control, and monitoring. All components of Alternative S6-2 would be reliable in the protection of human health and the environment. The need for future remedial actions depend on the effectiveness of Alternative S6-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S6-2; however, modification of LUCs and the soil cover removal/replacement may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $354,147 including a capital cost of $293,575, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

4.4.1.3 Alternative S6-3: In Situ Soil Venting and LUCs

4.4.1.3.1 Description

This alternative would minimize long-term management. LUCs are described in Appendix C. Soil surrounding sample locations 6SB03 and 6SB04 would be treated using in situ soil venting (as described in Section 3.4.1.3.1).

This alternative would address principal threats through in situ soil venting to promote volatilization and biodegradation of organic constituents and to reduce remedial time. A description of in situ soil venting is provided in Section 3.2.3.1.

The in situ soil venting system would treat a surface area of approximately 20,100 ft^2 to a depth of approximately 4 feet bgs. The conceptual design would consist of 12 wells installed to a depth of 10 feet bgs with a vapor recovery system and gas phase carbon treatment. The system would operate for approximately 3 years.

4.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S6-3 would provide protection of human health and the environment by minimizing all COCs through in situ treatment of soil surrounding sample locations 6SB03 and 6SB04 using soil venting. Immediate and future risk from exposure would be reduced by in situ treatment of all impacted soil exceeding PRGs. The reliability of soil venting would be high in the protection of human health and the environment because the source of risk would be irreversibly treated in place. There would be no significant risks to human health and the environment during implementation of Alternative S6-3 if normal dust control and runoff control procedures are conducted and direct worker contact with impacted soils is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S6-3 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing the risk to human health would be satisfied by Alternative S6-3. Over time Alternative S6-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives on base including the State of Florida SCTLs. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S6-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence of Alternative S6-3 through in situ soil venting would be high assuming (1) all impacted soils near sample locations 6SB03 and 6SB04 are identified and (2) soil venting is successful in treating organic constituents. Soil venting would enhance in situ

biodegradation and provide long-term effectiveness once excavations are backfilled and venting has begun as well as when the soil venting system's operation has ceased. A 5-year review would be required to assess the effectiveness of soil venting in removing organic constituents from the soil.

The adequacy and reliability of LUCs would be sufficient to restrict access to impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. Constituent concentrations and residual risks would decrease with the operation of the soil venting system and would continue to decrease after system operation has ceased because of the promotion of in situ biodegradation. Long-term management would consist of LUCs and monitoring and is expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Soil venting would reduce the toxicity and volume of organic constituents through volatilization, biodegradation, and the removal of the constituents from the vadose zone under a vacuum. Any carbon adsorption units used for soil venting offgas capture would require treatment to reduce the volume and ensure proper disposal of the adsorbed organic constituents. Minor organic constituent residuals below action levels would remain after implementation and operation of Alternative S6-3; however, these residuals would naturally degrade over time through the promotion of in situ biodegradation provided by in situ soil venting.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from construction of Alternative S6-3 would be controllable and would result from the in situ soil venting. Health and safety issues include dust control, emissions control, and proper decontamination procedures. Construction time to implement Alternative S6-3 would be less than 1 year. A more detailed evaluation during design may identify individual source area construction/excavation details. Minimal risk to the community would be expected from in situ soil venting system operation during Alternative S6-3 implementation. The time required to achieve remedial response objectives is estimated to be less than 3 years.

Implementability

The RPOs associated with Alternative S6-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the soil venting treatment system. In situ soil venting would require drilling, trenching, and treatment area construction. O&M activities associated with Alternative S6-3 would be of low intensity, involving periodic sampling and analysis of soil venting system O&M, offgas adsorption

material handling and/or treatment, and monitoring. All components of Alternative S6-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S6-3 in minimizing exposure pathways and reducing constituent concentrations. Future remedial actions would not be hindered by the implementation of Alternative S6-3; however, modifications of LUCs and/or the addition or closure of soil venting systems may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $317,887 including a capital cost of $157,258, $38,735 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

4.4.1.4 Alternative S6-4: Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs

4.4.1.4.1 Description

Alternative S6-4 would minimize the need for long-term management because all surface and subsurface soil containing COCs exceeding PRGs would be removed. LUCs are described in Appendix C. Monitoring would consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted surface and subsurface soil exceeding PRGs. The excavation would consist of removing soil from the surface down to approximately 4 feet bgs. The estimated excavation would be approximately 2,979 yd^3 of which approximately 2,979 yd^3 would be contaminated. After all impacted soil within the excavation areas containing COCs exceeding PRGs is removed, the excavated area would be backfilled with clean, native material, compacted, and revegetated with no long-term maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil from Site 6. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

4.4.1.4.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S6-4 would provide protection of human health and the environment by removal and off-base disposal of soil containing COCs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial land use exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk is permanently removed from the site. There would be no significant risks to human health and the environment during implementation

of Alternative S6-4 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized. Therefore, Alternative S6-4 would provide a high level of protection of human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health would be satisfied by Alternative S6-4. Alternative S6-4 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which will be provided by the TSDF, if required. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S6-4.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S6-4 is low since contaminants are not treated. However, excavation and off-base disposal provide long-term effectiveness and permanence by minimizing exposure pathways, assuming all impacted soil exceeding PRGs is identified, excavated, and disposed.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would not be required because all contaminated soil would be removed.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically moving them from the site to a secure landfill. The toxicity of the excavated constituents may be reduced through treatment in an off-base TSDF before landfill disposal. Minor organic constituent residuals would remain below action levels after the implementation of Alternative S6-4. No treatment residuals would be produced by the implementation of Alternative S6-4.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S6-4 would be controllable and would result from the excavation, transportation, and off-base disposal of impacted soil. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S6-4 would be approximately 90 days. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S6-4 would be immediately effective in minimizing all exposure pathways. The time required until remedial response objectives are achieved is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S6-4 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. Excavation and disposal of Site 6 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S6-4 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S6-4 in minimizing the source areas. Future remedial actions would not be hindered by the implementation of Alternative S6-4; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $628,012 including a capital cost of $570,922, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

4.4.2 Summary of Site 6 Soil

As part of the detailed analyses of alternatives for Site 6, one alternative involving no action, one alternatives involving containment/limited action, and two alternatives minimizing long-term management have been evaluated. Alternative S6-1 is the only alternative that does not satisfy the threshold criteria to the full extent but is retained for comparison purposes. Alternatives S6-2 through S6-4 provide varying degrees of protection and treatment and would be viable for the selection as a preferred alternative. The relative merits of all Site 6 alternatives are evaluated in Section 4.5.

4.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 4.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1). Additional discussion of the comparative analysis is provided in Section 2.5.

A summary of the comparative analyses and costs for the Site 6 alternatives is presented in Table 4-9. This comparison between alternatives is based on the CERCLA evaluation criteria.

4.5.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

The existing exposure pathways to humans for Site 6 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological receptors. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the Site 40 FS. For an alternative to be protective of human health and the environment, therefore, it must protect humans from all potential exposure pathways.

Alternatives S6-4 and S6-3 would provide the highest levels of overall protection through LUCs and physical removal of the COCs exceeding PRGs in surface and subsurface soil within Site 6 reducing the risks associated with all potential exposure pathways in a short period of time.

Alternatives S6-2 would provide protection of human health and the environment through LUCs, physical removal of the impacted surface soil that exceeds PRGs and containment of the remaining impacted soil. Containment would ensure reduced risk from all potential pathways but does not provide active remediation. Alternative S6-3 also would protect human health to some extent through in situ soil venting. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs.

Table 4-9 presents a summary for the overall protectiveness of human health and the environment for all Site 6 alternatives.

Table 4-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 4

Criteria	Alternative S6-1 No Action	Alternative S6-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S6-3 Soil Venting and LUCs	Alternative S6-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No reduction in risk.	Provide a high level of protection. LUCs reduce risk from residuals. Excavation, disposal, and the soil cover reduce risk of potential exposure.	Provides a high level of protection. LUCs and treatment reduce risk from residuals.	Provides highest level of protection. LUCs reduce risk from residuals. Excavation and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Excavation and the soil cover stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Natural attenuation and soil venting reduces constituent concentrations of impacted soils over time.	Excavation and disposal will eliminate or reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs in greater than 30 year.	Meets ARARs in 3 years.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs if proper PPE used during excavation, disposal, and construction of the soil cover.	Meets ARARs if proper PPE used during construction of in situ venting system.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	Natural attenuation may decrease risk; however, risk is significant for >30 years.	Risk reduced by excavation and disposal of surface-impacted soil. Natural attenuation may decrease remaining risk; however, risk due to subsurface impacted soil is significant for an estimated 30 years.	Provides medium level of long-term residual risk reduction. Risk reduced by Soil Venting of the impacted soil. Any residual concentrations will be reduced over time through natural attenuation	Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by excavation and off-site disposal.

Table 4-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA
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Criteria	Alternative S6-1 No Action	Alternative S6-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S6-3 Soil Venting and LUCs	Alternative S6-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability if the soil cover is maintained.	Provides a high level of reliability because of proven technology	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Direct Contact and Incidental Ingestion are not controlled.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and the soil cover.	Exposure risk reduced by LUCs and soil venting.	Exposure to residuals is eliminated or reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	The soil cover may require replacement or repair.	No technical components required.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Management required for estimated 10 years.	Minimal management required for estimated 30 year.
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	None	Excavated surface soil is disposed of off site. Remaining soil contaminants may naturally attenuate over time. The soil cover is for containment only.	Organic compound removal is about 90%.	All impacted soil exceeding Remediation Goals is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by excavation and the soil cover. Toxicity of excavated soils may be reduced in an off-site Treatment, Storage, and Disposal Facility (TSDF). Toxicity of remaining soils may be reduced through natural attenuation.	Toxicity is reduced by treatment and natural attenuation.	Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Off-site TSDF treatment and natural attenuation are irreversible processes.	Soil Venting and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of organics left from natural attenuation.	Minor organic residuals remain above industrial action levels.	No organic residuals remain above industrial action levels.	No organic residuals remain above industrial action levels.

Table 4-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 3 OF 4

Criteria	Alternative S6-1 No Action	Alternative S6-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S6-3 Soil Venting and LUCs	Alternative S6-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	Not applicable	Temporary increase in dust emissions through excavation of surface soils and the soil cover installation can be controlled by proper construction techniques.	Temporary increase in dust emissions during installation of Soil Venting system can be controlled by proper construction techniques.	Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	Continued impact from existing conditions.	Excavation of surface soils and the soil cover installation can generate impacted soil, runoff, and fugitive dust.	Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time [a]	Not applicable	Less than 1 year	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Estimated at 30 years.	Estimated at 1 year.	Estimated at 3 year.	Estimated at 1 year.
Implementability				
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to provide excavation and the soil cover. Fewer contractors accept impacted soil for disposal.	Many contractors available to construct and operate Soil Venting system.	Many contractors available to provide excavation. Fewer contractors accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation. The soil cover is reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Soil Venting is a reliable technology for treating organic contaminants.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable	Implementable

Table 4-9
SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 6
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 4 OF 4

Criteria	Alternative S6-1 No Action	Alternative S6-2 Surface Soil (exceeding PRGs) Removal and LUCs	Alternative S6-3 Soil Venting and LUCs	Alternative S6-4 Surface and Subsurface Soil (exceeding PRGs) Removal and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring gives notice of treatment efficiency and progress of remediation.	Monitoring indicates excavation effectiveness and removal contaminated areas.
Permitting Requirements	Not applicable	Transportation and Disposal Permit will be required.	Transportation and Disposal Permit will be required. Permit for air emissions may be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Available	Readily Available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Available	Readily Available
Cost[a]				
Capital Cost	$0	$293,575	$157,258	$570,922
Short-Term O&M	$0	$0	$38,735	$0
Long-Term O&M				
5-Year Review	$7,375	$7,375	$7,375	$7,375
Land-Use Controls	$0	$3,092	$3,092	$2,839
Total Project Cost (Present Worth)[b]	$18,008	$354,147	$317,887	$628,012

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

4.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S6-2 through S6-4 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. PRGs are numerical values representing chemical-specific ARARs. Over time, both alternatives would meet PRGs within Site 6. Table 4-9 presents a summary of ARARs compliance for each alternative.

4.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

Magnitude of Residual Risks

Alternatives S6-4 and S6-3 would provide the highest level of long-term effectiveness and permanence than Alternative S6-2 by providing active removal of all COCs within Site 6 exceeding organic PRGs, thereby reducing residual risk from all impacted soil left at the site. Alternative S6-4 would be expected to significantly reduce all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of impacted soil. Alternative S6-3 would provide a high level of long-term effectiveness and permanence due to the in situ treatment of the benzo(a)pyrene and TPH. Alternative S6-2 would include removal of the surface-impacted soil and provide containment for any remaining constituents. No alternative, except No Action, for Site 6 would produce or leave residuals requiring treatment and/or disposal that may pose any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur. Alternative S6-2 would minimize risks to the receptors from direct exposure to contaminants at depth, but, because it is only a containment alternative, the effectiveness for residual risk reduction and remediation of impacted soil at the surface exceeding PRGs would be moderate. Alternative S6-2 would leave some contaminants untreated; thus, the effectiveness for residual risk reduction would be low. Evaluation, modeling, and sampling would be required to determine residual risk reduction by Alternative S6-2. Alternative S6-2 would require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternative S6-4 would permanently remove the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternative S6-4 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal and off-base disposal of all or a portion of the impacted soil. Alternative S6-3 would rely on enhanced biodegradation of contaminants and does not require any controls once the treatment is complete. Alternative S6-2 would involve the use of a soil cover, which does not actively remediate constituents but would be adequate and reliable in controlling exposure to any remaining constituents. Because Alternative S6-2 reduces the risks through containment, future maintenance and monitoring of the soil cover will be required.

Table 4-9 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 6 alternative.

4.5.4 Reduction of Mobility, Toxicity, or Volume through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternatives S6-4 and S6-3 would permanently and significantly reduce mobility of chemical constituents to the highest level of the alternatives evaluated for Site 6. Alternative S6-4 is considered a permanent remedy and is designed to provide the greatest reduction of risk through removal and off-base disposal. Alternative S6-3 would decrease toxicity through treatment of the COCs. No COCs at concentrations greater than PRGs would remain at the site under Alternatives S6-4 and S6-3. Alternative S6-2 would reduce the mobility of impacted soil through containment but would not provide active treatment of remaining soils to reduce toxicity and volume. Alternative S6-2 would remove the COCs present in surface soils at concentrations greater than PRGs. All the alternatives would rely on some degree of natural attenuation to aid in the remediation of the residuals remaining in the soil; however, the types and concentrations of constituent residuals are assumed to be below action levels. The concentrations of toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 4-9 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 6 alternative.

4.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives would take progressively longer to protect human health because of the time needed for treatment and to excavate and/or construct the soil cover. Alternatives S6-2 and S6-4 have an estimated remedial time to reach objectives of less than 1 year. Alternative S6-3 has an estimated remedial time to reach objects of approximately 3 years. Alternatives S6-2 and S6-4 would create short-term risks of worker exposure and the potential of fugitive dust during excavation, transportation, and the soil cover construction. These risks appear manageable using appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust, and runoff) are expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 4-9 provides a summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 6 alternative.

4.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternatives S6-2 and S6-4 may require Federal, state, or local permits because they include excavation, transportation, and off-base disposal of impacted soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternative S6-3 may require an air discharge permit. Alternatives S6-2 through S6-4 would require coordination with other agencies for LUCs and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S6-4 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternatives S6-2 and S6-3.

Alternative S6-2 would require monitoring of the soil cover for erosion and potential exposure. Alternative S6-4 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate PPE. Exposure from dermal contact and ingestion of soil is difficult to monitor.

Alternatives S6-2 and S6-4 would require the use of a TSDF and landfill or its services for excavated impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 4-9 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of services and capacities; and availability of equipment, specialists, and materials, for each Site 6 alternative.

4.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. The costs for all Site 6 alternatives are within 35% difference of each other. Alternative S6-4 has the highest cost, followed by Alternatives S6-3 and S6-2, respectively. Table 4-9 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 6 alternative. Detailed cost estimates are provided in Appendix E.

4.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments, and Navy responses to the comments, are provided in Appendix F.

4.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS Report and the Proposed Plan for Site 4.

5.0 SITE 30 - SOUTH FIELD MAINTENANCE HANGAR

Site 30 is located at the South Field Maintenance Hangar, Building 1406. The site includes Building 1406, the adjacent wash rack area, and the location of the abandoned waste oil tanks west of Building 1406.

The South Field Maintenance Hangar was constructed in the mid-1940s to support maintenance service to training aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning. Maintenance activities generated waste engine oil, cleaning solvents, and paint stripping wastes. Other wastes generated by the maintenance operations included mineral spirits, methyl ethyl ketone (MEK), hydraulic fluid, and all-purpose universal (APU) thinner. The waste oil from fixed-wing aircraft and helicopter maintenance was reportedly poured into the underground waste oil tanks located adjacent to the wash rack until the tanks were abandoned in the 1980s. The waste oil was removed from the tanks by a contractor for off-base disposal.

The remedial investigation for Site 30 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

5.1 ENVIRONMENTAL CONDITIONS

5.1.1 Nature and Extent of Contamination

The source of chemicals detected in the surface and subsurface soils at Site 30 can be attributed to aircraft maintenance activities at the South Field Hangar, the former waste oil tanks, and aircraft cleaning at the wash rack area located on the east side of the hangar. Chemicals detected in the surface and subsurface soils include VOCs, SVOCs, pesticide compounds, and inorganics.

5.1.2 Risk Assessment Results

Two separate risk evaluations were conducted for Site 30 during the RI (Tetra Tech NUS, 1999). The first risk evaluation considered the concrete pads remain in place and the second risk assessment considered the hypothetical removal of the concrete pads overlying the contaminated soil. It is unlikely that the concrete pads will be removed from Site 30, but if they were removed, it is likely clean fill would be used to replace the concrete. Risk assessment results from the RI (Tetra Tech NUS, 1999) are presented for surface soil and subsurface soil, assuming the concrete remains in place and for the hypothetical future conditions, assuming concrete is removed.

Surface Soil: Assuming Concrete Remains In Place

The concentrations of seven analytes (aluminum, arsenic, chromium, iron, manganese, vanadium, and TPH) exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (residential). These analytes were selected as COPCs and were used to evaluate the human health risk associated with the surface soil at Site 30, assuming the existing concrete pavement was removed (Table 5-1).

TABLE 5-1
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Arsenic	✓	✓
Chromium	✓	
Iron	✓	
Manganese	✓	
Vanadium	✓	
TPH	✓	✓

The RME cancer risk was 1.4×10^{-6} for the older child trespasser, 2.2×10^{-6} for the adult trespasser, 6.3×10^{-6} for the occupational worker, 9.6×10^{-7} for the maintenance worker, 1.2×10^{-7} for the construction worker, and 3.5×10^{-5} for the on-site resident (child/adult). The RME cancer risk for the maintenance worker and the construction worker were less than both the USEPA and FDEP target risks. The RME cancer risk for the older child trespasser, the adult trespasser, the occupational worker, and the on-site resident (child/adult) exceeded the FDEP target risk of 1×10^{-6}, but were within the USEPA acceptable range of 1×10^{-4} to 1×10^{-6}. Arsenic is the carcinogenic risk driver.

The RME noncancer risks were below the USEPA and FDEP target HI of 1.0 for all receptors except the on-site resident child. The noncarcinogenic risk for the on-site child was 1.42.

Subsurface Soil: Assuming Concrete Remains in Place

The concentrations of two analytes (arsenic and TPH) exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (industrial/commercial). These analytes were selected as COPCs and were used to evaluate the human health risk associated with the subsurface soil at Site 30.

The cancer risk (RME) associated with exposure to subsurface soil (ingestion and dermal contact) for the construction worker is 1.4×10^{-7} which is below the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} and below the FDEP target level of 1×10^{-6}.

The noncarcinogenic risk (RME) for the construction worker for exposure to subsurface soils is below the USEPA and FDEP target HI of 1.0.

Ecological: Assuming Concrete Remains in Place

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 30 is limited and of poor quality since the site is characterized by mowed turfgrass, heavy human activity, and high vehicle/aircraft traffic. As a result of the heavy human activity and vehicle and aircraft noise, terrestrial wildlife is deterred from using the site. Although some types of wildlife can become accustomed to heavy human activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival, and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

Hypothetical Future Conditions Assuming Concrete Removal at Site 30

Although it is unlikely the concrete will be removed from Site 30 in the future, exposure to soil beneath the concrete was evaluated as surface soil. The following conclusions were drawn based on this scenario.

- The COPCs in surface soil do not pose unacceptable carcinogenic risk to the evaluated receptors, according to the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6}.

- According to the FDEP acceptable risk of 1×10^{-6}, the COPCs in surface soil at Site 30 pose unacceptable RME carcinogenic risks to the older child trespasser, the adult trespasser, the occupational worker, and the on-site resident (adult/child). The Central Tendency Exposure (CTE) carcinogenic risk is acceptable for all Site 30 receptors except the on-site resident (adult/child). HIs (not including the contribution from TPH or iron) for Site 30 receptors were all less than 1.0 under the RME scenario, except for the on-site child resident. The on-site child resident HI was 1.42 for the RME case, but 0.24 for the CTE case. When the effect to target organs was evaluated for the on-site child resident, none of the target organs had an HI exceeding 1.0. Values given here do not include risks attributed to TPH or iron. TPH and iron are addressed separately due to a high level of uncertainty associated with TPH and iron risk characterization.

- TPH is a noncarcinogenic risk driver for the child resident at Site 30. The RME noncarcinogenic risk for the child receptor was 4.7 at Site 30; the CTE noncarcinogenic risk for this receptor was 1.6 at Site 30. For all other receptors at Site 30, the TPH HI did not exceed unity.

- Iron is a noncarcinogenic risk driver at Site 30 for the resident child receptor. The RME iron risk for the resident child receptor at Site 30 exceeded unity (1.9), but the CTE resident iron risk (0.37) did not exceed unity. For all other receptors, the iron HI did not exceed unity. Iron risks are highly uncertain due to the uncertainty associated with the iron reference dose.

- Arsenic is the carcinogenic risk driver for Site 30.

5.2 REMEDIAL ACTION OBJECTIVES

Remedial actions at Site 30 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information presented in this section is used to identify and evaluate appropriate remedial technologies for Site 30 (Section 5.3).

5.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs. A complete discussion of ARARs is provided in Section 2.2.1.

5.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and

the receptors present at the site. RAOs are identified for surface and subsurface soil and consider the results of the RI (discussed in Section 5.1), particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida STCL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of the chemicals by rainwater from soils will be evaluated as part of the FS for Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, three RAOs have been developed for Site 30.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

RAO 3: To remove potential contamination sources (USTs), reducing future risks to human health and the environment.

5.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Section 2.2.3 provides the basis for selection of PRGs.

The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.
2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 5-2 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 30.

5.2.4 Chemicals of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 5-3 shows the COC selections for Site 30.

5.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

COCs at Site 30 include arsenic and TPH in both the surface soil and TPH in subsurface soil (Figure 5-1). Six of the 18 sample locations have at least one chemical exceeding the PRG. Four sample locations are near and slightly south of the abandoned USTs. One other location with COCs is located south of the washrack area and the sixth and final location is just north of Building 1406.

Sample 30SB01 had a TPH concentration of 5,300 mg/kg (PRG = 2,500 mg/kg) in the sample collected at 10-12 feet bgs. TPH was detected in the samples collected at 30SB01 at 0-2 feet bgs, 5-7 feet bgs, and several samples deeper than 15 feet bgs, but none were above the PRG.

Sample 30SB02 had an arsenic concentration of 4 mg/kg (PRG = 3.7 mg/kg) in the surface soil. No arsenic was detected in any of the deeper samples at 30SB02, which start at 10 feet bgs. Sample 30SB02 had a TPH concentration of 9,610 mg/kg (PRG = 2,500 mg/kg), also in the surface soil. TPH was detected in the two deeper samples (10-12 feet bgs and 20-22 feet bgs) at concentrations below the PRG.

Sample 30SB03 had an arsenic concentration of 4.5 mg/kg (PRG = 3.7 mg/kg) in the surface soil. No arsenic was detected in the deeper sample at 30SB03, from 10-12 feet bgs. Sample 30SB03 had a TPH concentration of 2,660 mg/kg (PRG = 2,500 mg/kg), also in the surface soil. TPH was detected in the deeper sample (10-12 feet bgs) at a concentration below the PRG.

TABLE 5-2
DETERMINATION OF PRGS AT SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Chromium	mg/kg	420	613	420	N	11	420	22.8	420
Iron	mg/kg	480,000	61,000	61,000	N	8,832	61,000	18,110	61,000
Manganese	mg/kg	22,000	4,100	4,100	N	392	4,100	42.6	4,100
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
TPH	mg/kg	2,500		2,500	NA	NA	2,500	NA	2,500

[1]Combined list of all COPCs for Site 30.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, GIR, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

*Chemical is not a health concern for the commercial/industrial exposure scenario.

mg/kg – milligrams per kilogram
NA – Not Applicable

TABLE 5-3
CHEMICAL OF CONCERN EVALUATION FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Surface Soil

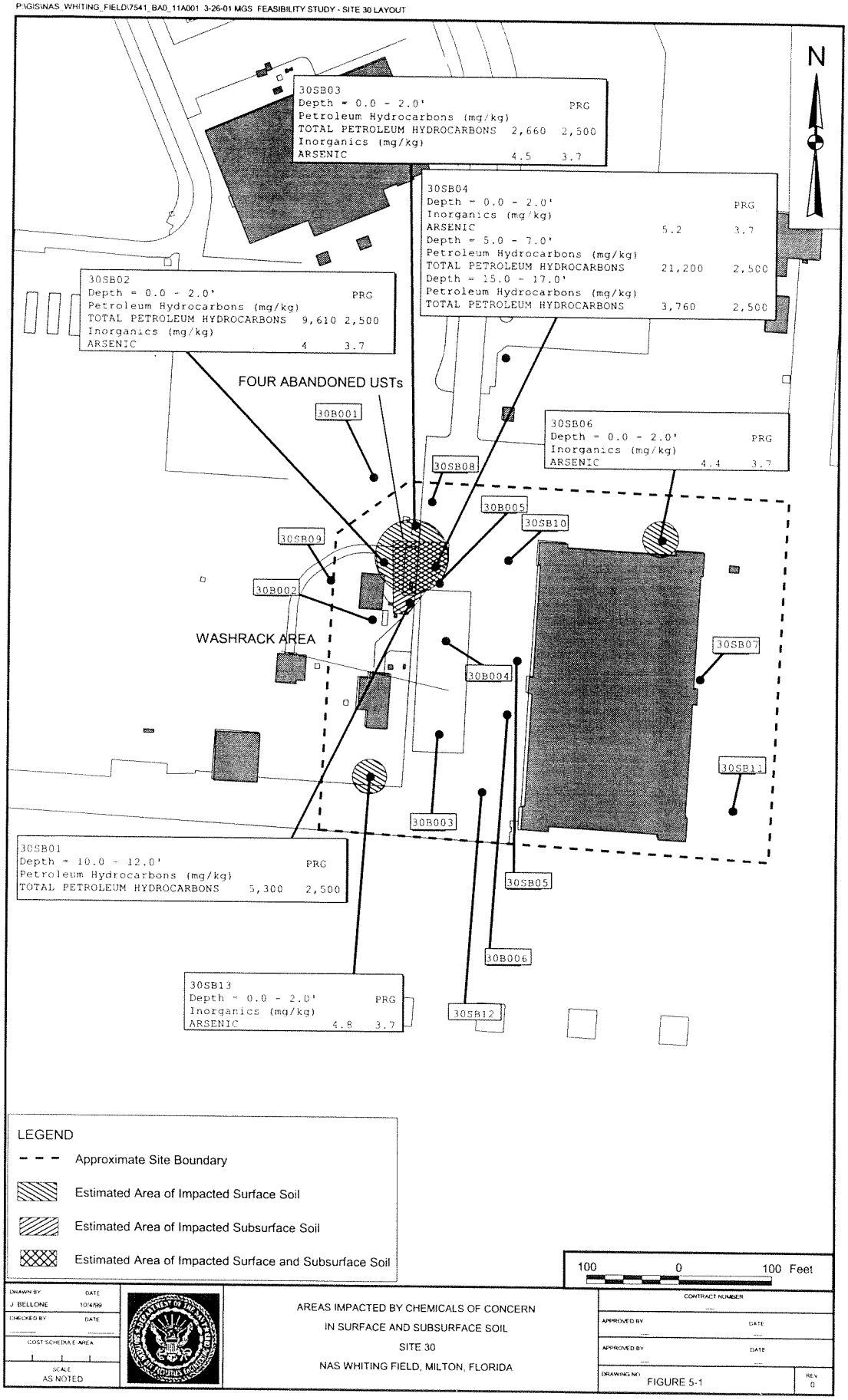
Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	41,600	--	41,600	Maximum	n<10	200,000	No
Arsenic	mg/kg	5.2	--	5.2	Maximum	n<10	3.7	**Yes**
Chromium	mg/kg	30.7	--	30.7	Maximum	n<10	420	No
Iron	mg/kg	24,100	--	24,100	Maximum	n<10	61,000	No
Manganese	mg/kg	898	--	898	Maximum	n<10	4,100	No
Vanadium	mg/kg	63.7	--	63.7	Maximum	n<10	1,400	No
TPH	mg/kg	9610	--	2,660	Maximum	n<10	2,500	**Yes**

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Arsenic	mg/kg	8.6	--	5.9	95%UCL-T	UCL<Max	6.2	No
TPH	mg/kg	21,200	--	21,200	Maximum	UCL>Max	2,500	**Yes**

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.
[2]Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).
mg/kg = milligrams per kilogram
UCL = upper confidence limit
UCL-T = UCL of log-transformed data

P:\GIS\NAS_WHITING_FIELD\7541_BA0_11A001 3-26-01 MGS FEASIBILITY STUDY - SITE 30 LAYOUT



DRAWN BY J. BELLONE DATE 10/4/99	AREAS IMPACTED BY CHEMICALS OF CONCERN IN SURFACE AND SUBSURFACE SOIL SITE 30 NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER
CHECKED BY DATE		APPROVED BY DATE
COST SCHEDULE AREA		APPROVED BY DATE
SCALE AS NOTED		DRAWING NO. FIGURE 5-1 REV 0

Sample 30SB04 had an arsenic concentration of 5.2 mg/kg (PRG = 3.7 mg/kg) in the surface soil. No arsenic was detected in any of the four deeper samples, which start at 5 feet bgs. Sample 30SB04 had a TPH concentration of 21,200 mg/kg (PRG = 2,500 mg/kg) in the sample collected at 5-7 feet bgs and 3,760 mg/kg in the sample collected at 15-17 feet bgs. TPH was detected in 30SB04 in the 10-12 feet bgs and 25-27 feet bgs samples at concentrations below the PRG.

Sample 30SB06 had an arsenic concentration of 4.4 mg/kg (PRG = 3.7 mg/kg) in the surface soil. Arsenic was detected at a concentration of 8.6 mg/kg in the sample collected at 10-12 feet bgs, but arsenic is not a COC in subsurface soil. No deeper samples were collected at this location.

Sample 30SB13 had an arsenic concentration of 4.8 mg/kg (PRG = 3.7 mg/kg) in the surface soil. No arsenic was detected in the next deeper sample collected at 10-12 feet bgs.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 5-4.

Samples 30SB01, 30SB02, 30SB03, and 30SB04 are clustered near the abandoned USTs and share the same COCs, arsenic and TPH (30SB01 has only TPH as a COC). They are considered as one impacted area. Samples 30SB02, 30SB03, and 30SB04 have surface soil (0-2 feet bgs) impact above PRGs. The area including those three sample locations is estimated to be 5,027 ft^2 (see Figure 5-1). The depth of impact was estimated to be 4 feet bgs. The estimated volume of surface soil impacted with arsenic and TPH is 372 yd^3.

Samples 30SB01, 30SB02, 30SB03, and 30SB04 have subsurface impact of TPH above PRGs and are considered as one area of impact. Sample 30SB01 had TPH above the PRG in the 10-12 feet bgs sample, and sample 30SB04 had TPH above the PRG is the 5-7 feet bgs sample and the 15-17 feet bgs sample. Both 30SB01 and 30SB04 surface soil samples did not have TPH above the PRG. The 25-27 feet bgs sample for 30SB04 did not have TPH above the PRG. Although the 15-17 feet bgs sample for 30SB01 did not have TPH impact above the PRG, the depth of impact for the combined area of impact was considered to be 20 feet bgs. The area is estimated to be 9,566 ft^2 (see Figure 5-1). The estimated

TABLE 5-4
VOLUME OF SOIL EXCEEDING PRGs AT SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered Soil[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	vol (yd^3)	radius[f] (ft)	area (ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
30SB01	TPH – 5,300 @10-12	40	5,027	372	55	9,566	2,592	67	4,647	1,472	0	0
30SB02	As – 4 @ 0-2											
	TPH – 9610 @ 0-2											
30SB03	As – 4.5 @ 0-2											
	TPH – 2,660 @ 0-2											
30SB04	As 5.2 @ 0-2											
	TPH – 21,200 @ 5-7											
	TPH – 3,760 @15-17											
30SB06	As – 4.4 @0-2 As – 8.6 @10-12	20	1,256	93	20	1,256	93	0	1,256	186	0	0
30SB13	As – 4.8 @0-2	20	1,257	93	20	1,257	186	0	189	14	0	0
Total Site 30			7,540	558		12,079	2,871	67	6,092	1,672	0	0

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius

volume of TPH-impacted subsurface soil for this impact area is 2,592 yd^3. Approximately 50% of this area (or 1,472 yd^3) is covered with concrete.

Sample 30SB06 had arsenic above the PRG in the surface soil. Arsenic was detected in the sample collected at 10-12 feet bgs, but arsenic is not a COC in subsurface soil. No other samples were collected at that location, so the depth of surface soil was estimated at an additional 2 feet bgs. The impacted soil is estimated to begin at the surface and extend to 14 feet bgs. The area of impact was assumed to be localized within a 20-foot radius or 1,256 ft^2. The estimated volume of soil impacted with arsenic at 30SB6 is 93 yd^3 of surface soil and 698 yd^3 of subsurface soil. Approximately 100 percent of this area (or 186 yd^3) is covered with concrete.

Sample detection 30SB13 is located south of the washrack area and has an arsenic detection above the PRG in the surface soil. No arsenic was detected in the 10-12 feet bgs sample of 30SB13; therefore, this location was considered a localized area (20-feet radius or 1,256 ft^2) of impact.

Sample 30SB13 had arsenic above the PRG in the surface soil. No arsenic was detected in deeper sample at 10-12 feet bgs and is estimated to extend to 6 feet bgs. The estimated volume of soil impacted with arsenic at 30SB13 is 93 yd^3 of surface soil and 186 yd^3 of subsurface soil with approximately 14 yd^3 of this area covered in concrete.

Summary

The Site 30 total estimated volume of contaminated surface soil is 558 yd^3 and of subsurface soil is 2,871 yd^3 for a combined total of 3,429 yd^3. An additional 67 yd^3 of nonimpacted soil lies above the contaminated subsurface soil. Also, there is approximately 1,672 yd^3 of contaminated soil presently covered by concrete/asphalt. Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil exceeding PRGs.

5.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 5.2.

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

5.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The COCs at Site 30 consist of arsenic and TPH. Soil contamination extends from the surface to a depth of approximately 20 feet bgs. The total estimated volume of contaminated soil is 3,429 yd^3.

The following GRAs apply to contaminated soils at Site 30.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

5.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing the RAOs identified for Site 30. Each technology is then screened based on site- and waste-limiting characteristics. See Section 2.3.2 for additional information.

Table 5-5 presents the remedial technologies/process options applicable for addressing the RAOs for Site 30. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 5-6 summarizes the technologies/process options passing the screening criteria. Table 5-6 also shows the RPO selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 5.3.4.

TABLE 5-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No Action	No Action	None	No remedial actions taken. Five-year reviews would be required.	Retained[1]
Minimal action	LUCs	LUCs	LUCs for property in the area of soil contamination would include restrictions on excavation/construction and future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic degradation	In situ degradation of organics using microorganisms in an oxygen-enriched environment. Would be used in combination with bioventing/soil venting.	Retained
		Anaerobic degradation	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[2]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[3]
		Vapor extraction/bioventing/ Soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Retained[4]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[5]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[6]
	Thermal	Vitrification	Immobilization of inorganic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[7]

TABLE 5-5
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[8]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[8]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[8]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for this site; however, it will be retained as a baseline consideration.

[2]Anaerobic biodegradation is not suitable for treating TPH.

[3]Soil flushing may make inorganics more mobile.

[4]Vapor extraction is not suitable for nonvolatile organics such as TPH. Bioventing/soil venting would be suitable.

[5]Steam stripping has limited effectiveness on the organic COCs.

[6]Solidification is not effective at decreasing the mobility of organics.

[7]The use of vitrification would severely limit potential futures uses.

[8]On-site landfills are not a viable option at Site 30 due to the groundwater beneath the site.

TABLE 5-6
SOIL TECHNOLOGIES AND PROCESS OPTIONS THAT PASSED PRELIMINARY SCREENING FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Minimal action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Treatment	Physical/chemical	Bioventing/Soil Venting	Bioventing/Soil Venting
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology.

5.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated. The range of alternatives developed for soil remediation is presented in Table 5-7, and Section 2.3.3 provides a discussion of the range of alternatives.

TABLE 5-7
RANGE OF ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment – Minimizes Long-Term Management

5.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized in Section 2.3.4.

The COCs for Site 30 are organic (TPH) from the surface down to 20 feet bgs and inorganic (arsenic) from the surface down to approximately 4 feet bgs. In addition, all alternatives (except No Action) address removal of the USTs because they are potential future sources of contamination. Four soil alternatives are assembled into the appropriate alternative types for this site, which are listed in Table 5-8.

Site 30 alternatives S30-1, S30-2, and S30-4 contain the same RPOs (with the addition of UST removal) as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Alternative S30-3 contains the same RPOs (with the addition of UST removal) as Site 4 alternative S4-3. Refer to the discussion in Sections 2.3.4 and 3.3.4 for a brief description of these alternatives.

5.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

TABLE 5-8

SITE 30 SOIL REMEDIAL ALTERNATIVES

NAS WHITING FIELD
MILTON, FLORIDA

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S30-1 No Action	No Action	None	• Five-year Reviews.
Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Source Removal/ Containment/ Limited Action – No or Minimal Treatment	LUCs, Remove USTs, Excavation, Disposal, Soil Cover	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Excavate, remove, and dispose of USTs. • Excavation/disposal of surface soil (0-2 feet bgs) containing TPH and arsenic exceeding PRGs at 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Backfill excavations with clean fill. • Replace concrete/asphalt and establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.
Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Source Removal/ Containment/ Limited/ Treatment Action – Minimal Treatment	LUCs, Remove USTs, Excavation, Disposal, Soil Cover, Soil Venting	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Excavate, remove, and dispose of USTs. • Excavation/disposal of surface soil (0-2 feet bgs) containing TPH and arsenic exceeding PRGs at 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Backfill excavations with clean fill. • Replace concrete/asphalt and establish vegetative cover. • Install, operate, and monitor a soil venting system for subsurface soil at locations 30SB01 and 30SB04. • Posting of warning signs. • Five-Year site reviews.
Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Remove USTs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 30SB01, 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Excavate, remove, and dispose of USTs. • Demolition and removal/disposal of asphalt and concrete pavement and uncontaminated surface soil. • Excavation/disposal of surface and subsurface soil containing arsenic and TPH exceeding PRGs at 30SB01, 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. • Backfill excavations with clean fill. • Replace asphalt or concrete pavement. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.

5.4.1 Site 30 Alternatives

The four alternatives for Site 30 represent a range of actions including no action, source removal and containment/limited action addressing principal threats, and aggressive actions minimizing the need for long-term management. The four alternatives providing a range of treatment options for Site 30 are listed below.

- Alternative S30-1: No Action
- Alternative S30-2: UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs
- Alternative S30-3: UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs
- Alternative S30-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs

5.4.1.1 Alternative S30-1: No Action

5.4.1.1.1 Description

In an FS the No Action alternative serves as a baseline consideration or to address sites that do not require any active remediation. The No Action alternative assumes that no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions would remain or be implemented under the No Action alternative. Natural attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, would be expected to occur over long periods of time but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

5.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S30-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S30-1 would provide no long-term effectiveness or permanence for Site 30. Inorganic and organic COCs present in Site 30 would pose a continuing risk to human health. The magnitude of and potential for residual risk within Site 30 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S30-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 30 would not change significantly and the risk posed to human health would be expected to continue because Alternative S30-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it is not expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituent for natural attenuation would be TPH. The process would be expected to be less effective in meeting remedial objectives and may be applicable to only some of the compounds within these chemical groups. The processes of natural attenuation and natural biodegradation could provide irreversible treatment. Natural attenuation would have a limited effect on the reduction of inorganic concentrations contained within Site 30 soil.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during the implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be

no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There would be no need to coordinate with other agencies or acquire permits. Services or materials would not be required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost for the No Action alternative would be the cost for the 5-year reviews because no remedial action would occur. The estimated present worth total project cost is $18,008 including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

5.4.1.2 Alternative S30-2: UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs

5.4.1.2.1 Description

Alternative S30-2 would address the principal threats through removal of the USTs, implementation of LUCs, surface soil excavation, a soil cover (e.g., soil, concrete, or asphalt horizontal barrier), and off-base disposal. LUCs are described in Appendix C.

The underground storage tanks would be removed and impacted surface soil (to a depth of 2 feet bgs) exceeding PRGs in the areas surrounding sample locations 30SB02, 30SB03, 30SB04, and 30SB13 would be excavated to remove approximately 266 yd^3. Because impacted soil exists below the depth of the excavation, the excavated area would be backfilled with clean native backfill material, compacted, and paved or revegetated to create the soil cover. For these areas long-term monitoring and maintenance would be required. All contaminated surface soil areas currently covered with concrete or asphalt (near sample locations 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13) would not require excavation and the existing pavement material would be the barrier. USTs removed would be cleaned and recycled or properly disposed of off-base. The liquid and solids contents of the USTs and contaminated soil excavated during UST removal activities would also be disposed of off-base. Disposal in an off-base TSDF and/or landfill would be used for the soil excavated from Site 30. Some pretreatment of the excavated soil may be necessary to meet LDRs and would be provided by the TSDF, if required.

5.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S30-2 would provide protection to human health and the environment by minimizing all exposure pathways through the removal of the USTs and impacted surface soils, restricting access to remaining impacted soil by LUCs, and installation of a soil cover (e.g., soil, concrete, or asphalt barrier). Immediate risk from potential exposure during maintenance activities would be reduced by the removal of impacted surface soil and its subsequent off-base disposal. LUCs would be partially effective in the protection of human health. The soil cover would protect humans and the environment by containment. There would be no significant risks to human health or the environment during implementation of Alternative S30-2 if normal dust-control procedures are conducted and direct worker contact with impacted materials is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S30-2 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S30-2 if confirmational sampling and analyses determine source areas greater than 2 feet bgs are stable and relatively stationary. Alternative S30-2 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs for exposed surface soil, and LUCs would prevent unacceptable exposure to covered surface and subsurface soil. Excavated soil may require pretreatment to meet LDRs which would be provided by the TSDF, if required. Although containment (e.g., soil cover) is not an active remedial process, exposure to the constituents would be prevented. Removal of the USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S30-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S30-2 would be low since contaminants are not treated. However, removal of the USTs, a potential source, and excavation, disposal, and containment of surface soil exceeding PRGs lead to the overall long-term effectiveness and

permanence by minimizing sources and exposure pathways. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and the soil cover remain in place. The magnitude of constituent concentrations would be reduced as a result of UST removal, surface soil excavation, off-base disposal, and natural attenuation. Five-year reviews would be required to assess the effectiveness of excavation of surface soils, the effectiveness of the soil cover to contain remaining inorganic constituents, and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs would be sufficient to restrict access to impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. The life expectancy for the Site 30 soil cover would be 20 to 30 years; however, the service life of the soil cover would be greatly affected by weather and the level of maintenance performed. Long-term reliability would be maintained because natural surface flow patterns would be returned to near original conditions and erosion would be minimized. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of impacted surface soils would reduce mobility of constituents by physically removing the constituents from the site to a TSDF permitted landfill. The soil cover would also reduce the mobility of inorganic constituents that may pose a risk through fugitive dust. Excavation and disposal of surface soil and containment of subsurface soil utilizing a soil cover would minimize exposure pathways, but reduction of the concentrations of the remaining constituents would rely on natural attenuation. Toxicity of excavated soils may be reduced through treatment in an off-base TSDF before land disposal. This alternative would provide a low degree of irreversible treatment through natural attenuation processes, but would significantly reduce the mobility of the constituents by the excavation of impacted surface soils, off-base disposal, and the introduction of a soil cover as a horizontal barrier. Minor inorganic constituent residuals would remain above action levels after the implementation of Alternative S30-2. The implementation of Alternative S30-2 would produce no treatment residuals.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S30-2 would be controllable and would result from UST removal; surface soil excavation, transportation, and off-base disposal; construction of a soil cover; and O&M of the remedial alternative. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction

time to implement Alternative S30-2 would be approximately 90 days. A more detailed evaluation during design may identify (1) other components required for containment material, (2) concurrent constructability of components, and (3) individual source area excavation and containment construction details. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S30-2 would be effective in minimizing all exposure pathways. The time required to achieve remedial response objectives by minimizing all exposure pathways is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S30-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and location of the soil cover. UST removal, surface soil excavation, and installation of the soil cover for Site 30 would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. Monitoring of the integrity of the soil cover would also be required. By excavating the impacted surface soil and backfilling with clean native soil, the ground surface grade would be returned to near original grade. The long-term integrity of vegetated soil cover would be increased because surface flow patterns would be returned to near normal conditions, which would reduce the erosion of the containment material. O&M activities are of low intensity and may involve regrading, compaction, revegetation, erosion control, and monitoring. All components of Alternative S30-2 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S30-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S30-2; however, modification of LUCs and soil cover removal/replacement may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $189,635 including a capital cost of $129,063, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

5.4.1.3 Alternative S30-3: UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs

5.4.1.3.1 Description

This alternative would address principal threats through UST removal, surface soil excavation, and in situ soil venting to promote volatilization and biodegradation of organic constituents, and implementation of LUCs. LUCs are described in Appendix C.

UST removal, and soil excavation and disposal activities are described in Section 5.4.1.2.1. Subsurface soil in the areas surrounding sample locations 30SB01 and 30SB04 would be treated using in situ soil venting (as described in Section 3.4.1.3.1). A description of in situ soil venting is provided in Section 3.2.3.1.

The in situ soil venting system would treat a surface area of approximately 3,632 ft^2 to a depth of approximately 20 feet bgs. The conceptual design would consist of 6 wells installed to a depth of 20 feet bgs with a vapor recovery system and gas phase carbon treatment. The system would operate for approximately 3 years.

5.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S30-3 would provide protection of human health and the environment by minimizing all exposure pathways through the removal and off-base disposal of USTs and all impacted surface soil containing COCs exceeding PRGs at Site 30 as well as in situ treatment using soil venting. Access to any residuals would be restricted by LUCs. The removal, off-base disposal, and in situ treatment of impacted soil exceeding PRGs would reduce immediate and future risk from exposure. The reliability of excavation, off-base disposal, and soil venting would be high in the protection of human health and the environment because the source of risk would be permanently removed from the site and/or irreversibly treated in place. There would be no significant risks to human health and the environment during implementation of Alternative S30-3 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S30-3 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing the risk to human health would be satisfied by Alternative S30-3. Over time Alternative S30-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives on base including the State of Florida SCTLs for organic compounds and LUCs would prevent unacceptable exposure to inorganics in surface and subsurface soil. Pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Removal of the USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S30-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence of Alternative S30-3 through in situ soil venting would be high assuming soil venting is successful in treating organic constituents. Soil venting would enhance in situ biodegradation and provide long-term effectiveness once surface soil excavations are backfilled and venting has begun as well as when the soil venting system's operation has ceased. Removal of the USTs as a potential source would prevent future contamination of soil and lead to the overall long-term effectiveness and permanence of the remedy. Excavation, off-base disposal, and construction of a containment barrier provide long-term effectiveness and permanence in minimizing exposure pathways. Five-year reviews would be required to assess the effectiveness of excavation, off-base disposal, and the containment for arsenic and the effectiveness of soil venting in removing organic constituents from the soil.

The adequacy and reliability of LUCs would be sufficient to restrict access to remaining impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. Constituent concentrations and residual risks would decrease with the operation of the soil venting system and would continue to decrease after system operation has ceased because of the promotion of in situ biodegradation. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal in a secure landfill of impacted surface soil containing COCs exceeding PRGs within Site 30 would reduce the mobility of constituents. The toxicity and volume of excavated constituents may be reduced through treatment at the TSDF, if required, before landfilling. Containment would reduce the mobility of arsenic that might pose a risk through fugative dust. Soil venting would also reduce the toxicity and volume of organic constituents through volatilization, biodegradation, and the removal of the constituents from the vadose zone under a vacuum. Any carbon adsorption units used for soil venting offgas capture would require treatment to reduce the volume and ensure proper disposal of the adsorbed organic constituents. Minor organic constituent residuals below action levels would remain after implementation and operation of Alternative S30-3; however, these residuals would naturally degrade over time through the promotion of in situ biodegradation provided by in situ soil venting.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from construction of Alternative S30-3 would be controllable and would result from UST removal; soil excavation, transportation, soil staging, off-base disposal, containment; and in situ soil venting. Health and safety issues include dust control, runoff control, emissions control, and proper decontamination procedures. Air emissions from the soil venting system would be controlled through the use of carbon adsorption units. Construction time to implement Alternative S30-3 would be approximately 1 year. A more detailed evaluation during design may identify individual source area construction/excavation details. Minimal risk to the community would be expected from UST removal, excavation of impacted soil, off-base disposal, and in situ soil venting system operation during Alternative S30-3 implementation. The time required to achieve remedial response objectives is estimated to be less than 3 years.

Implementability

The RPOs associated with Alternative S30-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and the location of the soil cover. UST removal and excavation and off-base disposal of Site 30 surface soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation would be required around utilities. In situ soil venting would require drilling, trenching, and treatment area construction. O&M activities associated with Alternative S30-3 would be of low intensity, involving periodic sampling and analysis of excavated soils,

soil venting system O&M, offgas adsorption material handling and/or treatment, and monitoring. All components of Alternative S30-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S30-3 in minimizing exposure pathways and reducing constituent concentrations. Future remedial actions would not be hindered by the implementation of Alternative S30-3; however, modifications of LUCs and/or the addition or closure of soil venting systems may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $365,566 including a capital cost of $199,304, $39,539 per year for short-term O&M, $7,375 for 5-year reviews, and $3,092 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

5.4.1.4 Alternative S30-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs

5.4.1.4.1 Description

Alternative S30-4 would minimize the need for long-term management because the USTs and all surface and subsurface soil containing COCs exceeding PRGs would be removed. LUCs are described in Appendix C. Monitoring will consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted surface and subsurface soil exceeding PRGs surrounding sample locations 30SB01, 30SB02, 30SB03, 30SB04, 30SB06, and 30SB13. The excavation would consist of removing soil from the surface down to approximately 20 feet bgs. The estimated excavation would be approximately 3,429 yd^3. An additional 67 yd^3 would have to be excavated to access the contaminated subsurface at sample location 30SB01. After all impacted soil within the excavation areas containing COCs exceeding PRGs would be removed, the excavated area would be backfilled with clean, native material; compacted; and revegetated with no long-term maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil and USTs from Site 30. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

5.4.1.4.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S30-4 would provide protection of human health and the environment by removal and off-base disposal of the USTs and soil containing COCs exceeding PRGs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial land use exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk would be permanently removed from the site. There would be no significant risks to human health and the environment during implementation of Alternative S30-4 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized. Therefore, Alternative S30-4 would provide a high level of protection of human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health and the environment would be satisfied by Alternative S30-4. Alternative S30-4 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Removal of the USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S30-4.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S30-4 would be low since contaminants are not treated. However, excavation and off-base disposal provide long-term effectiveness and permanence by minimizing exposure pathways assuming all impacted soil exceeding PRGs is identified, excavated, and disposed. Removal of the USTs, as potential sources, would prevent

future contamination of soil and lends to the overall long-term effectiveness and permanence of the remedy.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would consist of LUCs and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically removing them from the site to a secure landfill. The toxicity of the excavated constituents may be reduced through treatment in an off-base TSDF before landfill disposal. Minor inorganic constituent residuals would remain below action levels after the implementation of Alternative S30-4. No treatment residuals would be produced by the implementation of Alternative S30-4.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from the implementation of Alternative S30-4 would be controllable and would result from the excavation, transportation, and off-base disposal of impacted soil and the USTs. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S30-4 would be approximately 90 days. Minimal risk to the community would be expected from excavation, transportation, and disposal of the USTs and impacted soil. Alternative S30-4 would be immediately effective in minimizing all exposure pathways. The time required until remedial response objectives are achieved is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S30-4 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. UST removal and excavation and disposal of Site 30 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S30-4 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S30-4 in minimizing the source areas. Future remedial actions would not be

hindered by the implementation of Alternative S30-4; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $680,746 including a capital cost of $623,656, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

5.4.2 Summary of Site 30 Soil

As part of the detailed analyses of alternatives for Site 30, one alternative involving no action, one alternative involving source removal and containment/limited action, and two alternatives minimizing long-term management have been evaluated. Alternative S30-1 is the only alternative that does not satisfy the threshold criteria to the full extent but is retained for comparison purposes. Alternatives S30-2 through S30-4 provide varying degrees of protection and treatment and would be viable for selection as a preferred alternative. The relative merits of all Site 30 alternatives are evaluated in Section 5.5.

5.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 5.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1). Additional discussion of the comparative analysis is provided in Section 2.5.

A summary of the comparative analyses and costs for the Site 30 alternatives is presented in Table 5-9. This comparison between alternatives is based on the CERCLA evaluation criteria.

5.5.1 Overall Protection Of Human Health And The Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

The existing exposure pathways to humans for Site 30 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological receptors. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the Site 40 Basewide Groundwater FS. For an alternative to be protective of human health and the environment, it must protect humans from all potential exposure pathways.

Alternative S30-4 would provide the highest levels of overall protection through UST removal, LUCs, and physical removal of the COCs exceeding PRGs in surface and subsurface soil within Site 30, reducing the risks associated with all potential exposure pathways in a short period of time.

Alternatives S30-2 and S30-3 would provide protection of human health and the environment through institutional controls, physical removal of the impacted surface soil exceeding PRGs, UST removal, and containment of the remaining impacted soil. Containment would ensure reduced risk from all potential pathways but would not provide active remediation. Alternative S30-3 would also protect human health and the environment to some extent through in situ soil venting. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs.

Table 5-9 presents a summary for the overall protectiveness of human health and the environment for all Site 30 alternatives.

5.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S30-2 through S30-4 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. PRGs are numerical values representing chemical-specific ARARs. Over time, all alternatives except Alternative S30-1 would meet PRGs for exposed surface soil within Site 30. LUCs would prevent unacceptable exposure to covered surface and subsurface soil. Alternative S30-4 will meet PRGs for both surface and subsurface soil. Table 5-9 presents a summary of ARARs compliance for each alternative.

5.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

TABLE 5-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Criteria	Alternative S30-1 No Action	Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No reduction in risk.	Provides a high level of protection. LUCs reduce risk from residuals. UST removal, soil, excavation, disposal, and the soil cover reduce risk of potential exposure.	Provides a high level of protection. LUCs and soil treatment reduce risk from residuals. UST removal, soil, excavation, and disposal, and the soil cover reduce risk of potential exposure.	Provides highest level of protection. LUCs reduce risk from residuals. UST removal, soil, excavation, and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Excavation and capping stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Natural attenuation and soil venting reduce constituent concentrations of impacted soils over time.	Excavation and disposal will reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs in exposed surface soil. LUCs prevent exposure to capped surface and subsurface soil.	Meets ARARs for organics in 2 years. LUCs prevent exposure to inorganics.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs if proper PPE used during excavation, disposal, and construction of the soil cover.	Meets ARARs if proper PPE used during excavation, disposal, and construction of the soil cover in situ venting system.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	Natural attenuation decreases risk; however, risk is significant for >30 years.	Provides high level of long-term residual risk reduction. Risk reduced by excavation and disposal of surface-impacted soil and UST removal. Natural attenuation decreases remaining risk; however, risk due to subsurface impacted soil is significant for an estimated 30 years.	Provides medium level of long-term residual risk reduction. Risk reduced by soil venting of the impacted soil and UST removal. Any residual concentrations will be reduced over time through natural attenuation; however, risks from inorganics will remain for an estimated 30 years.	Provides highest level of long-term residual risk reduction. Risk reduced by UST removal and soil excavation and off-site disposal.

TABLE 5-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 2 OF 4

Criteria	Alternative S30-1 No Action	Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting and LUCs)	Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability if cap is maintained.	Provides a high level of reliability because of proven technology, and if the cap is maintained.	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Direct contact and incidental ingestion are not controlled.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and capping.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and capping.	Exposure to residuals is reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	Capping may require replacement or repair.	Capping may require replacement or repair.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Management required for estimated 30 years.	Minimal required for estimated 30 years.
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	None	Excavated surface soil is disposed of off-site. Remaining contaminants may naturally attenuate over time. Capping is for containment only.	Organic compound removal is about 90%. Arsenic and TPH in surface soil would be excavated and disposed of off-site. Capping is for containment only.	All impacted soil exceeding PRGs is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by excavation and capping. Toxicity of excavated soils may be reduced in an off-site TSDF.	Mobility reduced by excavation and capping. Toxicity is reduced by treatment and natural attenuation.	Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Off-site TSDF treatment and natural attenuation are irreversible processes.	Off-site TSDF treatment, soil venting and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of inorganics left from natural attenuation.	Minor inorganic and organic residuals remain above industrial action levels in subsurface soil.	Residuals of inorganics left from soil venting and natural attenuation remain above industrial action levels.	No residuals remain above action levels.

TABLE 5-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 3 OF 4

Criteria	Alternative S30-1 No Action	Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting and LUCs)	Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	Not applicable	Temporary increase in dust emissions through excavation of surface soils and soil cover installation can be controlled by proper construction techniques.	Temporary increase in dust emissions during installation of soil venting system. Excavation of soils and capping can be controlled by proper construction techniques.	Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	Continued impact from existing conditions.	Excavation of surface soils and capping installation can generate impacted soil, runoff, and fugitive dust.	Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time [a]	Not applicable	Less than 1 year	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Estimated at 30 years.	Estimated at 1 year.	Estimated at 2 years.	Estimated at 1 year.
Implementability				
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to provide UST removal, soil excavation, and capping. Fewer contractors accept impacted soil for disposal.	Many contractors available to construct and operate soil venting system, UST removal, soil excavation, and capping. Fewer contractors accept impacted soil for disposal.	Many contractors available to provide UST removal and soil excavation. Fewer contractors accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation. The soil cover is reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Soil venting is a reliable technology for treating organic contaminants. The soil cover is reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable	Implementable

TABLE 5-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 4 OF 4

Criteria	Alternative S30-1 No Action	Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting and LUCs)	Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring gives notice of treatment efficiency and progress of remediation.	Monitoring indicates excavation effectiveness and removal of contaminated areas.
Permitting Requirements	Not applicable	Transportation and Disposal Permit will be required.	Transportation and Disposal Permit will be required. Permit for air emissions may be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Available	Readily Available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Available	Readily Available
Cost[b]				
Capital Costs	$0	$129,063	$199,304	$623,656
Short-Term O&M	$0	$0	$39,539	$0
Long-Term O&M				
5-Year Review	$7,375	$7,375	$7,375	$7,375
Land-Use Controls	$0	$3,092	$3,092	$2,839
Total Project Present Worth Cost	$18,008	$189,635	$365,566	$680,746

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

Magnitude of Residual Risks

Alternative S30-4 would provide a higher level of long-term effectiveness and permanence than Alternatives S30-2 and S30-3 by providing active removal of all soil within Site 30 exceeding PRGs, thereby reducing residual risk from impacted soil left at the site. Alternative S30-4 would minimize all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of impacted soil and UST removal. Alternative S30-3 would provide a higher level of long-term effectiveness and permanence than Alternative S30-2 due to the in situ treatment of the TPH-impacted soil. Alternative S30-2 would include removal of the USTs and surface-impacted soil and provide containment for any remaining constituents. No alternative, except No Action, for Site 30 would produce or leave residuals requiring treatment and/or disposal posing any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur. Alternatives S30-2 and S30-3 would leave some contaminants untreated; thus, the effectiveness for residual risk reduction would be low. Evaluation, modeling, and sampling would be required to determine residual risk reduction by Alternatives S30-2 and S30-3. Alternative S30-2 would require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives (except No Action) would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternative S30-4 would permanently remove the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternative S30-4 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal and off-base disposal of all of the impacted soil and the USTs. Alternatives S30-2 and S30-3 would involve the use of a soil cover, which is adequate and reliable in controlling exposure to any remaining constituents. Because Alternatives S30-2 and S30-3 would reduce the risks through containment, future maintenance and monitoring of the soil cover would be required. Alternative S30-3 would rely on enhanced biodegradation of subsurface organic contaminants and would only require controls for inorganics once the treatment is complete.

Table 5-9 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 30 alternative.

5.5.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternative S30-4 would permanently and significantly reduce the mobility of chemical constituents to the highest level of the alternatives evaluated for Site 30. Alternative S30-4 would be considered a permanent remedy and is designed to provide the greatest reduction of risk through removal and off-base disposal. No COCs at concentrations greater than PRGs would remain at the site under Alternative S30-4. Alternatives S30-2 and S30-3 would both reduce the mobility of impacted soil through containment but only S30-3 would provide active treatment of remaining soils to reduce toxicity and volume. Alternatives S30-2 and S30-3 would remove the COCs present in surface soils at concentrations greater than PRGs. Alternative S30-3 would decrease toxicity through treatment of the organics. All the alternatives (except No Action) would include removal of the USTs. The concentrations of residual toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 5-9 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 30 alternative.

5.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives, such as Alternatives S30-2 through S30-4, would take progressively longer to protect human health because of the time needed for UST removal and soil treatment, excavation, and capping. Alternatives S30-2 and S30-4 have an estimated remedial time to reach objectives of less than 1 year. Alternative S30-3 has an estimated time to reach the objective of 3 years. Alternatives S30-2 through S30-4 would create short-term risks of worker exposure and the potential of fugitive dust during excavation, transportation, and/or soil cover construction. These risks appear manageable using appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust and runoff) are expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 5-9 provides a

summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 30 alternative.

5.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternatives S30-2 through S30-4 may require Federal, state, or local permits because they include excavation, transportation, and off-base disposal of impacted USTs and soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternatives S30-2 through S30-4 would require coordination with other agencies for LUCs and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S30-4 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternatives S30-2 and S30-3.

Alternatives S30-2 and S30-3 would require monitoring of the soil cover for erosion and potential exposure. Alternative S30-4 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate PPE. Exposure from dermal contact and ingestion of soil during construction would be minimized by use of appropriate PPE.

Alternatives S30-2 through S30-4 would require the use of a TSDF or landfill or its services for excavated impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 5-9 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of services and capacities; and availability of equipment, specialists, and materials, for each Site 30 alternative.

5.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. Alternative S30-4 has the highest cost, followed by Alternatives S30-3 and S30-2, respectively. Table 5-9 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 30 alternative. Detailed cost estimates are provided in Appendix E.

5.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments and Navy responses to the comments are provided in Appendix F.

5.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS Report and the Proposed Plan for Site 30.

6.0 SITE 32 - NORTH FIELD MAINTENANCE HANGAR

Site 32 is located at the North Field Maintenance Hangar, Building 1424 (see Figure 1-1). The site includes Building 1424, the adjacent wash rack area, and the location of the abandoned waste oil tanks east of Building 1424.

The North Field Maintenance Hangar was constructed in the mid-1940s to support maintenance service to training aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning. These activities generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids. Before Aircraft Intermediate Maintenance Department activities began, aircraft maintenance wastes from Hangar 1424 were reportedly sent to base landfills; however, spills and uncontrolled disposal of solvents at or near the sites of generation were common occurrences in the 1940s and 1950s.

Oil changes were routinely performed on the fixed-wing aircraft as part of the normal maintenance activities. The waste oil was reportedly poured into the underground waste oil tanks located adjacent to the wash rack area until the tanks were abandoned in the 1980s. The waste oil was removed from the tanks by a contractor for off-base disposal.

Other wastes generated by maintenance activities included mineral spirits, MEK, hydraulic fluids, APU thinner, and paint strippers. Contaminated fuel obtained during the collection of fuel samples was placed in a line shack tank or in 55-gallon drums. The fuel was routinely collected by the fuels contractor and hauled to the Firefighter Training Area for use in fire drills. A summary of the estimated quantities and ultimate disposition of these wastes is presented in the Initial Assessment Study (IAS) (Envirodyne Engineers, 1985).

Fixed-wing aircraft are still washed at the wash rack area located east of Building 1424. Aircraft washing is performed on each aircraft on a 14-day cycle. The aircraft cleaning solution (detergent/soap) is consumed at a rate of about 4,200 gallons/year. Before approximately 1972, the wastewater from this operation was discharged to the storm sewer. Subsequently the wash rack was disconnected from the storm sewer and connected to the sanitary sewer system, allowing the wastewater to be treated at the sewage treatment plant.

The remedial investigation for Site 32 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

6.1 ENVIRONMENTAL CONDITIONS

6.1.1 Nature and Extent of Contamination

The source of chemicals in the surface and subsurface soils at Site 32 can be attributed to aircraft maintenance activities at the North Field Hangar, the former waste oil tanks, and aircraft cleaning at the wash rack area located on the east side of the hangar. Chemicals detected in the surface and subsurface soils include VOCs, SVOCs, and inorganics. Pesticides/PCBs were detected in surface soils but not in subsurface soils.

Samples collected from the wash rack area contained the highest number of VOCs and SVOCs at Site 32. The concentrations of VOCs and SVOCs were also highest in the vicinity of the wash rack. The majority of the VOC contamination was located within 20 feet bgs. The deepest detection of VOCs in the wash rack area was acetone at a depth of 97 feet bgs at 32SB5. The deepest detection of VOC analytes other than acetone or 2-butanone in the area of the wash rack was 30 to 32 feet bgs at 32SB7.

Organic compounds were also detected at soil borings 32SB16 near the sanitary sewer and at 32SB17. The deepest detection of VOCs outside the wash rack area was acetone at 90 to 92 feet bgs at 32SB14. Low levels of several VOCs were detected at 85 to 87 feet bgs at 32SB16 located along the sanitary sewer line. Because few compounds were detected in the higher soil samples, the detection of these compounds may be the result of volatilization of VOCs into the vadose zone from dissolved constituents in perched groundwater at a depth of approximately 87 feet bgs encountered in 32SB16 and 32SB17.

SVOCs were detected almost exclusively around the wash rack area in the surface and subsurface soil. Soil boring 32SB07 contained the highest number of SVOC analytes, while WR-SB01 contained two analytes at their highest concentrations in the subsurface soils. The only analyte detected outside the wash rack was bis(2-ethylhexyl)phthalate. The deepest sample to exhibit SVOCs was at 95 to 97 feet bgs at 32SB05.

Pesticide/PCB compounds are confined to the surface soil at 32SB06 and 32SB07. Inorganic analytes were infrequently detected above background.

6.1.2 Risk Assessment Results

Two separate risk evaluations were conducted for Site 32 during the RI (Tetra Tech NUS, 1999). The first risk evaluation considered the concrete pads remain in place and the second risk assessment considered the hypothetical removal of the concrete pads overlying the contaminated soil. It is unlikely that the concrete pads will be removed from Site 32, but if they were removed, it is likely clean fill would be used

to replace the concrete. Risk assessment results from the RI (Tetra Tech NUS, 1999) are presented for surface soil and subsurface soil, assuming the concrete remains in place and for the hypothetical future conditions, assuming concrete is removed.

Surface Soil: Assuming Concrete Remains in Place

The concentrations of six analytes (aluminum, antimony, arsenic, iron, TPH, and vanadium) exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (residential). These analytes were selected as COPCs and were used to evaluate the human health risk associated with the surface soil at Site 32, assuming the existing concrete pavement was removed (Table 6-1).

TABLE 6-1

SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Antimony	✓	
Arsenic	✓	
Iron	✓	
Vanadium	✓	
TPH	✓	✓

The RME cancer risk was 7.5×10^{-7} for the older child trespasser, 1.2×10^{-6} for the adult trespasser, 3.4×10^{-6} for the occupational worker, 5.2×10^{-7} for the maintenance worker, 6.5×10^{-8} for the construction worker, and 1.9×10^{-5} for the on-site resident (child/adult). The RME cancer risk for the older child trespasser, the maintenance worker, and the construction worker were less than both the USEPA and FDEP target risks. The RME cancer risk for the adult trespasser, the occupational worker, and the on-site resident (child/adult) exceeded the FDEP target risk of 1×10^{-6}, but were within the USEPA acceptable range of 1×10^{-4} to 1×10^{-6}. Arsenic is the carcinogenic risk driver.

The RME noncancer risks were below the USEPA and FDEP target HI of 1.0 for all receptors.

Subsurface Soil: Assuming Concrete Remains in Place

No chemicals were detected in subsurface soil (2-15 bgs) exceeding site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (industrial/commercial) in the RI. However, TPH is present in subsurface soil, deeper than 15 feet bgs, at sample location 32SB07 at concentrations exceeding USEPA Region III RBCs or SCTLs. Therefore, TPH is shown as a COPC in Table 6-1. A human health risk assessment was not performed for the

subsurface soil at Site 32 because no chemicals exceeding USEPA or Florida screening criteria were present within the normal 2-15 feet bgs construction depth evaluated for human health risk assessments.

Ecological: Assuming Concrete Remains in Place

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 32 is limited and of poor quality since the site is almost entirely covered by concrete and buildings. The area is surrounded by intensive development except for some turfgrass to the north of the site. As a result of the heavy human activity and vehicle and aircraft noise, terrestrial wildlife is deterred from using the site. Although some types of wildlife can become accustomed to heavy human activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival, and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

Hypothetical Future Conditions Assuming Concrete Removal at Site 32

Although it is unlikely the concrete will be removed from Site 32 in the future, exposure to soil beneath the concrete was evaluated as surface soil. The following conclusions were drawn based on this scenario.

- The COPCs in surface soil do not pose unacceptable carcinogenic risk to the evaluated receptors, according to the USEPA acceptable risk range of 10^{-4} to 10^{-6}.
- According to the FDEP acceptable risk of 10^{-6}, the COPCs in surface soil at Site 32 pose unacceptable RME carcinogenic risks for the adult trespasser, occupational worker, and on-site resident (adult/child). The CTE carcinogenic risk was acceptable for all Site 32 receptors. HIs for all Site 32 receptors were less than 1.0 for the RME case.
- Arsenic is the carcinogenic risk driver for Site 32.
- TPH is a noncarcinogenic risk driver for the child resident and for the adult resident at Site 32. The RME noncarcinogenic risk for the child receptor was 6.0 at Site 32; the CTE noncarcinogenic risk for this receptor was 1.9 at Site 32. The RME noncarcinogenic risk for the adult resident was 1.1 at Site 32, but the CTE noncarcinogenic risk for the receptor was 0.24. For all other receptors the TPH HI did not exceed unity.

6.2 REMEDIAL ACTION OBJECTIVES

The objectives and goals for remedial actions at Site 30 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information presented in this section is used to identify and evaluate appropriate remedial technologies for Site 32 (Section 6.3).

6.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs. A complete discussion of ARARs is provided in Section 2.2.1.

6.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and the receptors present at the site. RAOs are identified for surface and subsurface soil and consider the results of the RI (discussed in Section 6.1), particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida STCL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of chemicals by rainwater from soils will be evaluated as part of Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, three RAOs have been developed for Site 32.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

RAO 3: To remove potential contamination sources (USTs), reducing future risks to human health and the environment.

6.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Section 2.2.3 provides the basis for the selection of PRGs.

The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.
2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 6-2 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 32.

6.2.4 Chemicals Of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration that exceeds the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 6-3 shows the COC selections for Site 32.

6.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

TABLE 6-2

DETERMINATION OF PRGs AT SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Antimony	mg/kg	240	8200	240	N	8	240	4.4	240
Iron	mg/kg	480,000	61,00	61,000	N	8,832	61,000	18,110	61,000
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
TPH	mg/kg	2,500		2,500	NA	NA	2,500	NA	2,500

[1]Combined list of all COPCs for Site 32.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, GIR, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

*Chemical is not a health concern for the commercial/industrial exposure scenario.

mg/kg – milligrams per kilogram
NA – Not Applicable

TABLE 6-3

CHEMICAL OF CONCERN EVALUATION FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

Surface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	21,900	--	21,900	Maximum	n<10	200,000	No
Antimony	mg/kg	6		6	Maximum	n<10	240	No
Arsenic	mg/kg	2.8	--	2.8	Maximum	n<10	3.7	No
Iron	mg/kg	13,200	--	13,200	Maximum	n<10	61,000	No
Vanadium	mg/kg	36.8	--	36.8	Maximum	n<10	1,440	No
TPH	mg/kg	12,300	--	12,300	Maximum	n<10	2,500	**Yes**

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
TPH	mg/kg	2,650	--	2,650	Maximum	n<10	2,500	**Yes**

[1]For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.
[2]Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).
mg/kg = milligrams per kilogram
UCL = upper confidence limit
UCL-T = UCL of log-transformed data
N/A = not applicable

The only COC at Site 32 is TPH in both the surface soil and the subsurface soil (Figure 6-1). Two of the 22 sample locations have TPH concentrations exceeding the PRG. Those two samples locations are in the area of the four abandoned USTs.

Sample 32SB06 had a TPH concentration of 12,300 mg/kg (PRG = 2,500 mg/kg) in the surface soil. No TPH was detected above the PRG in any of the deeper samples collected at 32SB06, which start at 5 feet bgs.

Sample 32SB07 had a TPH concentration of 7,180 mg/kg (PRG = 2,500 mg/kg) in the surface soil, 2,580 mg/kg in the sample collected at 15-17 feet bgs, and 2,650 mg/kg in the sample collected at 30-32 feet bgs. No samples were collected at 32SB07 deeper than 32 feet bgs.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 6-4.

Samples 32SB06 and 32SB07 are approximately 20 feet apart and both have TPH impact above the PRG in the surface soil; therefore, they were considered as one impact area. The area including those two sample locations is estimated to be a 70 ft x 30 ft rectangle (or 2,100 ft^2) (see Figure 6-1). Sample 32SB06 did not have any TPH impact above the PRG in the deeper samples starting at 5 feet bgs, so the surface impact was estimated to extend to 4 feet bgs. The estimated volume of TPH-impacted surface soil for this impact area is 311 yd^3.

Sample 32SB06 did not have any TPH impact above the PRG in the deeper samples starting at 5 feet bgs. Sample 32SB07 also has TPH impact in the subsurface soil to a depth of 32 feet bgs. Therefore, subsurface impact is considered localized (15-ft radius or 707 ft^2) at 32SB07. There were no deeper samples collected at this location, so the depth of impact was estimated at an additional 5 feet bgs (not including the 4 vertical feet of impact estimated in the paragraph above). The estimated volume of TPH-impacted subsurface soil for 32SB07 is 864 yd^3.

Summary

The Site 32 total estimated volume of contaminated surface soil is 156 yd^3 and 1,019 yd^3 of subsurface soil for a combined total of 1,175 yd^3. All of the contaminated surface and subsurface soil is presently

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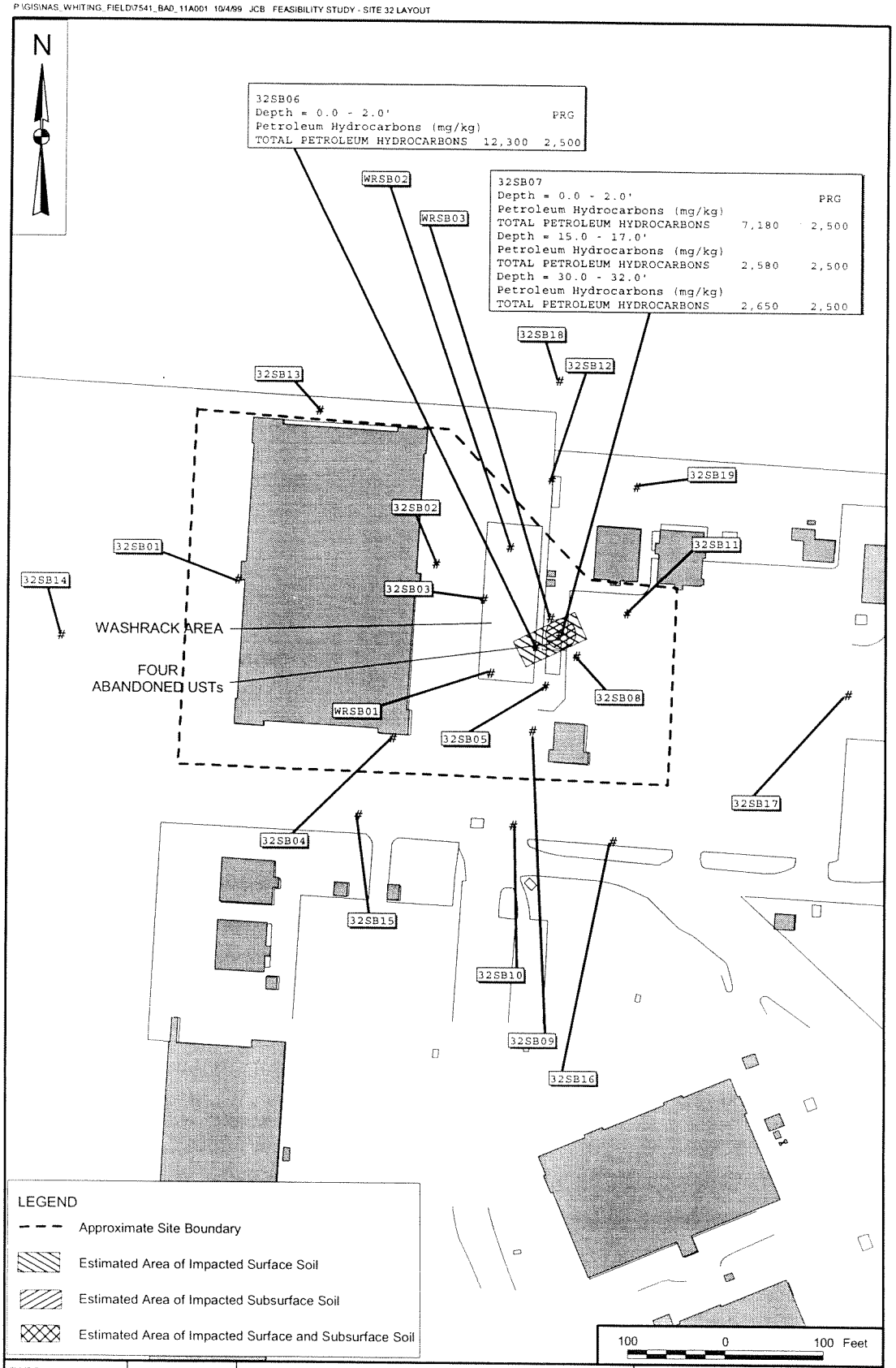

DRAWN BY J BELLONE DATE 10/1/99	AREAS IMPACTED BY CHEMICIALS OF CONCERN IN SURFACE AND SUBSURFACE SOIL SITE 32 NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER	
CHECKED BY DATE		APPROVED BY DATE	
COST/SCHEDULE AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO FIGURE 6-1	REV 0

TABLE 6-4

VOLUME OF SOIL EXCEEDING PRGS AT SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered Soil[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	vol (yd^3)	radius[f] (ft)	area (ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
32SB06	TPH – 12,300 @ 0-2	26	2,100	156	26	2,100	155	0	2,100*	311*	0	0
32SB07	TPH – 7,180 @ 0-2	0	0	0	15	707*	864	0	707*	864	0	0
	TPH – 2,580 @ 15-17											
	TPH-2,650 @ 30-32											
Total Site 32			2,100	156		2,100	1,019	0	2,100	1,175	0	0

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius
* Overlapping areas

covered by concrete/asphalt. Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil.

6.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 6.2.

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

6.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The only COC at Site 32 is TPH. Soil contamination extends from the surface to a depth of approximately 37 feet bgs. The total estimated volume of contaminated soil is 1,175 yd^3.

The following GRAs apply to contaminated soil at Site 32.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

6.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing RAOs identified for Site 32. Each technology is then screened based on site- and waste-limiting characteristics. See Section 2.3.2 for additional information.

Table 6-5 presents the remedial technologies/process options applicable for addressing the RAOs for Site 32. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 6-6 summarizes the technologies/process options passing the screening criteria. Table 6-6 also shows the RPO selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 6.3.4.

6.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated. The range of alternatives developed for soil remediation is presented in Table 6-7, and Section 2.3.3 provides a discussion of the range of alternatives.

6.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized in Section 2.3.4.

The COCs for Site 32 are organic (TPH) from the surface down to approximately 37 feet bgs. In addition, all alternatives (except No Action) include removal of the USTs because they are a potential future source of contamination. Four soil alternatives are assembled into the appropriate alternative types for this site, which are listed in Table 6-8.

Site 32 alternatives S32-1, S32-2, and S32-4 contain the same RPOs (with the addition of the removal of the USTs) as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Alternative S32-3 contains the same RPOs as Site 4 alternative S4-3. Refer to the discussion in Sections 2.3.4 and 3.3.4 for a brief description of these alternatives.

6.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in

TABLE 6-5

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No action	No action	None	No remedial actions taken. Five-year reviews would be required.	Retained[1]
Limited action	LUCs	LUCs	LUCs for property in the area of soil contamination would include restrictions on excavation/construction and future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic	In situ degradation of organics using microorganisms in an oxygen-enriched environment. Would be used in combination with bioventing/soil venting.	Retained
		Anaerobic	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[2]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[3]
		Vapor extraction/bioventing/ soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Retained[4]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[5]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[6]
	Thermal	Vitrification	Immobilization of organic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[7]

TABLE 6-5

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 32

NAS WHITING FIELD, MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[8]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[8]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[8]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for this site; however, it will be retained as a baseline consideration.

[2]Anaerobic biodegradation is not suitable for treating TPH.

[3]Soil flushing is not effective for TPH.

[4]Vapor extraction is not suitable for nonvolatile organics such as TPH. Bioventing/soil venting would be suitable.

[5]Steam stripping has limited effectiveness on the TPH.

[6]Solidification is not effective at decreasing the mobility of TPH.

[7]The use of vitrification would severely limit potential futures uses.

[8]On-site landfills are not a viable option at Site 32 due to the groundwater beneath the site.

TABLE 6-6

SOIL TECHNOLOGIES AND PROCESS OPTIONS PASSING PRELIMINARY SCREENING FOR SITE 32

NAS WHITING FIELD, MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Limited action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Treatment	Physical/chemical	Bioventing/Soil Venting	Bioventing/Soil Venting
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology

TABLE 6-7

RANGE OF ALTERNATIVES FOR SITE 32

NAS WHITING FIELD, MILTON, FLORIDA

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment – Eliminates or Minimizes Long-Term Management

TABLE 6-8

SITE 32 SOIL REMEDIAL ALTERNATIVES

**NAS WHITING FIELD,
MILTON, FLORIDA**

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S32-1	No Action	None	• Five-year Reviews.
Alternative S32-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Source Removal, Containment/Limited Action – No or Limited Treatment	LUCs, Remove USTs, Excavation, Disposal, Soil Cover	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 32SB06 and 32SB07. • Excavate and remove USTs. • Excavation/disposal of surface soil (0-2 feet bgs) exceeding PRGs at 32SB06 and 32SB07. • Backfill excavation with clean fill. • Replace concrete cover. • Posting of warning signs. • Five-Year site reviews.
Alternative S32-3 UST Removal, Soil Venting, and LUCs	Source Removal, Containment/Limited/ Treatment Action – Treatment	LUCs, Remove USTs, In-Situ Soil Venting	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface soil adjacent to 32SB06 and 32SB07. • Excavate and remove USTs. • Replace concrete cover. • Install and operate an in situ soil venting system for subsurface soil at locations 32SB06 and 32SB07. • Posting of warning signs. • Five-Year site reviews.
Alternative S32-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Remove USTs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 32SB06 and 32SB07. • Excavate and remove USTs. • Demolition and removal/disposal of asphalt and concrete pavement. • Excavation/disposal of surface and subsurface soil exceeding PRGs at 32SB06 and 32SB07. • Backfill excavation with clean fill. • Replacement of asphalt or concrete pavement. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.

USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be

protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

6.4.1 Site 32 Alternatives

The four alternatives for Site 32 represent a range of actions including no action, source removal and containment/limited action addressing principal threats, and aggressive actions eliminating or minimizing the need for long-term management. The four alternatives providing a range of treatment options for Site 32 are listed below.

- Alternative S32-1: No Action
- Alternative S32-2: UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs
- Alternative S32-3: UST Removal, Soil Venting, and LUCs
- Alternative S32-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs

6.4.1.1 Alternative S32-1: No Action

6.4.1.1.1 Description

In an FS the No Action alternative is typically considered to serve as a baseline consideration or to address sites that do not require any active remediation. The No Action alternative assumes that no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions would remain or be implemented under the No Action alternative. Natural attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, would be expected to occur over long periods of time, but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

6.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S32-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S32-1 would provide no long-term effectiveness or permanence for Site 32. TPH would pose a continuing risk to human health. The magnitude of and potential for residual risk within Site 32 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S32-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 32 would not change significantly and the risk posed to human health and the environment would be expected to continue because Alternative S32-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it would not be expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituent for natural attenuation is TPH. The processes of natural attenuation and natural biodegradation can provide irreversible treatment.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There is no need to coordinate with other agencies or acquire permits. Services or materials are not required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost associated with the No Action alternative is the cost for 5-year reviews because no remedial action will occur. The estimated present worth total project cost is $18,008 including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

6.4.1.2 Alternative S32-2: UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs

6.4.1.2.1 Description

Alternative S32-2 would address the principal threats through removal of the USTs, implementation of LUCs, surface soil excavation, and off-base disposal. LUCs are described in Appendix C.

The USTs would be removed along with an estimated 40-60 yd^3 of contaminated soil. Impacted surface soil (to a depth of 2 feet bgs) exceeding PRGs would only be excavated in the tank pit area, since concrete or asphalt covers the rest of the site and serves as a barrier to prevent humans from contacting the soil exceeding PRGs. Because impacted soil exists below the depth of the USTs being removed, the excavated area would be backfilled with clean, native backfill material, compacted, and the concrete surface replaced to create a barrier. Site inspections and long-term maintenance would be required for this area. Disposal in an off-base TSDF and/or landfill would be used for the soil excavated from Site 32. Some pretreatment of the excavated soil may be necessary to meet LDRs and would be provided by the TSDF, if required.

6.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S32-2 would provide protection to human health and the environment by minimizing all exposure pathways through the removal of the USTs and impacted surface soil (UST tank pit area) restricting access to remaining impacted soil by LUCs, and installing a concrete/asphalt barrier. Immediate risk from potential exposure during maintenance activities would be reduced by the removal of impacted surface soil and the USTs and their subsequent off-base disposal. LUCs are partially effective in the protection of human health. The concrete/asphalt barrier would protect humans and the environment by containment. There would be no significant risks to human health or the environment during implementation of Alternative S32-2 if normal dust-control procedures are conducted and direct worker contact with impacted materials is minimized; therefore, overall protection of human health and environmental resources both on and off base is high.

Compliance with ARARs

All ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S32-2 if confirmational sampling and analyses determine source areas greater than 2 feet bgs are stable and relatively stationary. Alternative S32-2 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs by elimination of exposure pathways; however, any excavated soil may require pretreatment to meet LDRs which would be provided by the TSDF, if required. Although containment (e.g., soil cover, concrete, asphalt) is not an active remedial process, exposure to the constituents would be prevented. Removal of USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S32-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S32-2 would be low since contaminants are not treated. However, excavation, disposal, and containment provides long-term effectiveness and permanence in minimizing exposure pathways, assuming the concrete barrier is maintained above contamination areas. Removal of the USTs, a potential source, prevents future soil

contamination and for this reason lends to the overall long-term effectiveness and permanence of the remedy. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and containment barriers remain in place. The magnitude of constituent concentrations would be reduced as a result of UST removal, soil excavation, off-base disposal, and natural attenuation. Five-year reviews would be required to assess the effectiveness of excavation of USTs and surface soils, the effectiveness of containment to contain remaining organic constituents, and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs would be sufficient to restrict access to impacted soils. The design life expectancy for the Site 32 concrete barrier would be 20 to 30 years. Long-term management would consist of LUCs and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of impacted surface soils would reduce mobility of constituents by physically moving the constituents from the site to a permitted TSDF. Containment would also reduce the mobility of organic constituents posing a risk through fugitive dust. Excavation and disposal of surface soil and containment of subsurface soil utilizing a soil cover would minimize exposure pathways, but reduction of the concentrations of the remaining constituents would rely on natural attenuation. Toxicity of excavated soils may be reduced through treatment in an off-base TSDF before land disposal. This alternative would provide a low degree of irreversible treatment through natural attenuation processes, but would significantly reduce the mobility of the constituents by the excavation of impacted surface soils, off-base disposal, and the introduction of a concrete cover as a horizontal barrier. Minor organic constituent residuals would remain above action levels after the implementation of Alternative S32-2. The implementation and operation of Alternative S32-2 would produce no treatment residuals.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S32-2 would be controllable and would result from UST removal; soil excavation, transportation, and off-base disposal; construction of a concrete cover, and O&M of the remedial alternative. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S32-2 would be approximately 90 days. A more detailed evaluation during design may identify (1) other components required for concrete cover material, (2) concurrent constructability of components, and (3) individual source area excavation and concrete cover construction details. Minimal risk to the community would be expected from excavation and transportation of impacted soil during excavation and off-base disposal. Alternative S32-2 would be effective in minimizing all exposure

pathways. The time required to achieve remedial response objectives by minimizing all exposure pathways is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S32-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs, excavation of surface soils, and location of the concrete cover. UST removal, surface soil excavation (UST removal area), and installation of the concrete cover at Site 32 would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. Monitoring of the integrity of the concrete cover would also be required. O&M activities would be of low intensity and may involve repairing the concrete and monitoring. All components of Alternative S32-2 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S32-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S32-2; however, modification of LUCs and concrete cover removal/replacement may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $125,135 including a capital cost of $68,044, $0 per year from short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

6.4.1.3 Alternative S32-3: UST Removal, Soil Venting, and LUCs

6.4.1.3.1 Description

This alternative would minimize long-term management. LUCs are described in Appendix C. Areas surrounding sample locations 32SB06 and 32SB07 are to be treated using in situ soil venting (as described in Section 3.4.1.2.1). This alternative would address principal threats through UST removal and in situ soil venting to promote volatilization and biodegradation of organic constituents and to reduce remediation time. A description of in situ soil venting is provided in Section 3.2.3.1.

The in situ soil venting system would treat a surface area of approximately 2,100 ft^2 to a depth of approximately 37 feet bgs. The conceptual design would consist of one well installed to a depth of

37 feet bgs with a vapor recovery system and gas phase carbon treatment. The system would operate for approximately 3 years.

6.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S32-3 would provide protection of human health and the environment by minimizing all exposure pathways through UST removal and in situ treatment using soil venting. The in situ treatment of all impacted soil containing TPH exceeding PRGs would reduce immediate and future risk from exposure. The reliability of soil venting would be high in the protection of human health and the environment because the source of risk is irreversibly treated in place. There would be no significant risks to human health and the environment during implementation of Alternative S32-3 if normal dust control procedures are conducted, the discharge of the soil venting system is properly treated, and direct worker contact with impacted soils is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S32-3 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing the risk to human health would be satisfied by Alternative S32-3. Over time Alternative S32-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives on base including the State of Florida SCTLs for organic compounds and LUCs would prevent unacceptable exposure to inorganics in surface and subsurface soil. Removal of USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S32-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence of Alternative S32-3 in situ soil venting would be high assuming (1) all impacted surface soil is identified and (2) soil venting is successful in treating organic constituents. Soil venting would enhance in situ biodegradation and provide long-term effectiveness. Removal of the UST would lend to overall long-term effectiveness and permanence of the remedy because of the removal of a potential source of contamination. Five-year reviews would be required to assess the effectiveness of soil venting in removing organic constituents from the soil.

The adequacy and reliability of LUCs would be sufficient to restrict access to remaining impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. Constituent concentrations and residual risks would decrease with the operation of the soil venting system and would continue to decrease after system operation has ceased because of the promotion of in situ biodegradation. Long-term management would consist of LUCs and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Soil venting would reduce the toxicity and volume of organic constituents through volatilization, biodegradation, and the removal of the constituents from the vadose zone under a vacuum. Any carbon adsorption units used for soil venting offgas capture would require treatment to reduce the volume and ensure proper disposal of the adsorbed organic constituents. Minor organic constituent residuals below action levels would remain after implementation and operation of Alternative S32-3; however, these residuals would naturally degrade over time through the promotion of in situ biodegradation provided by in situ soil venting.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from construction of Alternative S32-3 would be controllable and would result from the removal of the USTs and the installation and operation of in situ soil venting. Health and safety issues include dust control, emissions control, and proper decontamination procedures. Air emissions from the soil venting system would be controlled through the use of carbon adsorption units, if necessary. Construction time to implement Alternative S32-3 would be less than 1 year. Minimal risk to the community would be expected from in situ soil venting system operation during Alternative S32-3 implementation. The time required to achieve remedial response objectives is estimated to be less than 3 years.

Implementability

The RPOs associated with Alternative S32-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs. In situ soil venting would require drilling, trenching, and treatment area construction. O&M activities associated with Alternative S32-3 would be of low intensity, involving periodic sampling and analysis of the soil venting system, O&M, offgas adsorption material handling and/or treatment, and monitoring. All components of Alternative S32-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S32-3 in minimizing exposure pathways and reducing constituent concentrations. Future remedial actions would not be hindered by the implementation of Alternative S32-3; however, modifications of

LUCs and/or the addition or closure of soil venting systems may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $217,055 including a capital cost of $94,410, $24,525 per year for short-term O&M, $7,375 for 5-year reviews and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

6.4.1.4 Alternative S32-4: UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs

6.4.1.4.1 Description

Alternative S32-4 would minimize the need for long-term management because the USTs and all surface and subsurface soil containing COCs exceeding PRGs would be removed. Monitoring would consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted surface and subsurface soil with COCs exceeding PRGs surrounding sample locations 32SB06 and 32SB07. The excavation would consist of removing soil from the surface down to approximately 37 feet bgs. The estimated excavation would be approximately 1,175 yd^3. After all impacted soil within the excavation area containing COCs exceeding PRGs is removed, the excavated area would be backfilled with clean, native material, compacted, and a concrete cover installed with no long-term monitoring or maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil and USTs from Site 32. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

6.4.1.4.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S32-4 would provide protection of human health and the environment by removal and off-base disposal of the USTs and all soil containing COCs exceeding PRGs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial land use exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk would be permanently removed from the site. There would be no significant risks to human health and the environment during implementation of Alternative S32-4 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is

minimized. Therefore, Alternative S32-4 would provide a high level of protection of human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health and the environment would be satisfied by Alternative S32-4. Alternative S32-4 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Removal of the USTs would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S32-4.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S32-4 would be low since contaminants are not treated. However, excavation and off-base disposal of all impacted soils provide long-term effectiveness and permanence by minimizing exposure pathways assuming all impacted soil exceeding PRGs is identified, excavated, and disposed. Removal of the USTs as a potential source would prevent future contamination of soil once the USTs are removed and for this reason lends to the overall long-term effectiveness and permanence of the remedy.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would consist of LUCs and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically moving them from the site to a secure landfill. The toxicity of the excavated constituents may be reduced through treatment in an off-base TSDF before landfill disposal. Minor organic constituent residuals would remain below action levels after the implementation of Alternative S32-4. No treatment residuals would be produced by the implementation of Alternative S32-4.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from the implementation of Alternative S32-4 would be controllable and would result from the excavation, transportation, and off-base

disposal of the USTs and impacted soil. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S32-4 would be approximately 90 days. Minimal risk to the community would be expected from excavation, transportation, and disposal of USTs and impacted soil. Alternative S32-4 would be immediately effective in minimizing all exposure pathways. The time required until remedial response objectives are achieved is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S32-4 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. UST removal and excavation and disposal of Site 32 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S32-4 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S32-4 in minimizing the source areas. Future remedial actions would not be hindered by the implementation of Alternative S32-4; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $424,558 including a capital cost of $367,468, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

6.4.2 Summary of Site 32 Soil

As part of the detailed analyses of alternatives for Site 32, one alternative involving no action, one alternative involving source removal and containment/limited action, one alternative with source removal and minimal treatment, and one alternative minimizing long-term management have been evaluated. Alternative S32-1 is the only alternative that does not satisfy the threshold criteria to the full extent but is retained for comparison purposes. Alternatives S32-2 through S32-4 provide varying degrees of protection and treatment and would be viable for the selection as a preferred alternative. The relative merits of all Site 32 alternatives are evaluated in Section 6.5.

6.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 6.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1). Additional discussion of the comparative analysis is provided in Section 2.5.

A summary of the comparative analyses and costs for the Site 32 alternatives is presented in Table 6-9. This comparison between alternatives is based on the CERCLA evaluation criteria.

6.5.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

The existing exposure pathways to humans for Site 32 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological receptors. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the Site 40 Basewide Groundwater RI/FS. For an alternative to be protective of human health and the environment, it must protect humans from all potential exposure pathways.

Alternatives S32-4 and S32-3 would provide the highest levels of overall protection through UST removal, LUCs, and physical removal or treatment of the COCs exceeding PRGs in surface and subsurface soil within Site 32, reducing the risks associated with all potential exposure pathways in a short period of time. Alternative S32-3 would protect human health and the environment by treatment of organics through in situ soil venting.

Alternative S32-2 would provide protection of human health and the environment through LUCs, physical removal of the USTs and associated impacted surface soil exceeding PRGs, and containment (by covering with concrete) of the remaining impacted soil. Containment would ensure reduced risk from all potential pathways but would not provide active remediation. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs.

Table 6-9 presents a summary for the overall protectiveness of human health and the environment for all Site 32 alternatives.

TABLE 6-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 1 OF 4

Criteria	Alternative S32-1 No Action	Alternative S32-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S32-3 UST Removal, Soil Venting, and LUCs	Alternative S32-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No reduction in risk.	Provides a high level of protection. LUCs reduce risk from residuals. UST removal, soil, excavation, disposal, and a concrete cover reduce risk of potential exposure.	Provides a high level of protection. LUCs, UST removal, and in situ soil treatment reduce risk from residuals.	Provides highest level of protection. LUCs reduce risk from residuals. UST removal, soil, excavation and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Excavation and a concrete cover stop fugitive dust. Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Natural attenuation and soil venting reduce constituent concentrations of impacted soils over time.	Excavation and disposal will eliminate or reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs by using LUCs to minimize exposure pathways.	Meets ARARs for organics in 2 years. LUCs prevent exposure to inorganics.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs if proper PPE used during excavation, disposal, and construction of a concrete cover.	Meets ARARs if proper PPE used during construction of in situ venting system.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	Natural attenuation may decrease risk; however, risk is significant for >30 years.	Risk reduced by excavation and disposal of surface-impacted soil and UST removal. Natural attenuation may decrease remaining risk; however, risk due to subsurface impacted soil is significant for an estimated 30 years.	Provides medium level of long-term residual risk reduction. Risks reduced by soil venting of the impacted soil and UST removal. Any residual concentrations will be reduced over time through natural attenuation.	Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by UST removal and soil excavation and off-site disposal.

TABLE 6-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

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Criteria	Alternative S4-1 No Action	Alternative S4-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S4-3 UST Removal, Soil Venting, and LUCs	Alternative S4-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability if soil cover is maintained.	Provides a high level of reliability because of proven technology, and if the soil cover is maintained.	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Direct contact and incidental ingestion are not controlled.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs and a soil cover.	Direct excavation and disposal of surface-impacted soil reduce exposure to residuals. Exposure risk reduced by LUCs.	Exposure to residuals is reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	Soil cover may require replacement or repair.	No technical components required.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Management required for estimated 30 years.	Minimum management required for estimated 30 year.
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	None	Excavated surface soil is disposed of off-site. Remaining contaminants may naturally attenuate over time. A soil cover is for containment only.	Organic compound removal is about 90%.	All impacted soil exceeding PRGs is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by excavation and a concrete cover. Toxicity of excavated soils may be reduced in an off-site TSDF. Toxicity of remaining soils may be reduced through natural attenuation.	Toxicity is reduced by treatment and natural attenuation. Soil venting reduces mobility.	Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Off-site TSDF treatment and natural attenuation are irreversible processes.	Off-site TSDF treatment, soil venting, and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of organics left from natural attenuation.	Minor organic residuals remain above industrial action levels in subsurface soil.	No residuals remain above industrial action levels.	No residuals remain above industrial action levels.

TABLE 6-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

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Criteria	Alternative S4-1 No Action	Alternative S4-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S4-3 UST Removal, Soil Venting, and LUCs	Alternative S4-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	Not applicable	Temporary increase in dust emissions through excavation of surface soils and soil cover installation can be controlled by proper construction techniques.	Temporary increase in dust emissions during installation of soil venting system. Excavation of soils and soil cover can be controlled by proper construction techniques.	Temporary increase in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	Continued impact from existing conditions.	Excavation of surface soils and soil cover installation can generate impacted soil, runoff, and fugitive dust.	Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time [a]	Not applicable	Less than 1 year	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Estimated at 30 years.	Estimated at 1 year.	Estimated at 3 years.	Estimated at 1 year.
Implementability				
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to provide UST removal, soil excavation, and concrete cover. Fewer contractors accept impacted soil for disposal.	Many contractors available to construct and operate soil venting system and UST removal, soil excavation and concrete cover. Fewer contractors accept impacted soil for disposal.	Many contractors available to provide UST removal and soil excavation. Fewer contractors accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation. The soil cover is reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Soil venting is a reliable technology for treating organic contaminants. The soil cover is reliable upon construction completion.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable	Implementable

TABLE 6-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 32

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 4 OF 4

Criteria	Alternative S4-1 No Action	Alternative S4-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative S4-3 UST Removal, Soil Venting, and LUCs	Alternative S4-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring gives notice of treatment efficiency and progress of remediation.	Monitoring indicates excavation effectiveness and removal of contaminated areas.
Permitting Requirements	Not applicable	Transportation and Disposal Permit will be required.	Transportation and Disposal Permit will be required. Permit for air emissions may be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Available	Readily Available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Available	Readily Available
Cost[b]				
Capital Cost	$0	$68,044	$94,410	$367,468
Short-Term O&M	$0	$0	$24,525	$0
Long-Term O&M				
5-Year Review	$7,375	$7,375	$7,375	$7,375
Land-Use Controls	$0	$2,839	$2,839	$2,839
Total Project Present Worth Cost	$18,008	$125,135	$217,055	$424,558

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

6.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S32-2 through S32-4 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. PRGs are numerical values representing chemical-specific ARARs. Over time, these alternatives would meet PRGs within Site 32 by implementation of LUCs which prevent unacceptable exposure to covered surface and subsurface soil. Table 6-9 presents a summary of ARARs compliance for each alternative.

6.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

Magnitude of Residual Risks

Alternatives S32-3 and S32-4 would provide a higher level of long-term effectiveness and permanence than Alternative S32-2 by providing active removal or treatment of all COCs within Site 32 exceeding PRGs, thereby reducing residual risk from all impacted soil left at the site. Alternative S32-4 would be expected to minimize all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of the USTs and impacted soil. Alternative S32-3 would provide a higher level of long-term effectiveness and permanence due to the in situ treatment of the TPH. Alternative S32-2 would include removal of the USTs and associated surface-impacted soil and provide containment for any remaining constituents. No alternative, except No Action, for Site 32 would produce or leave residuals requiring treatment and/or disposal posing any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur. Alternative S32-2 would minimize risks to the receptors from direct exposure to contaminants at depth, but, because it would be only a containment alternative, the effectiveness for residual risk reduction and remediation of impacted soil at the surface exceeding PRGs would be moderate. Alternative S32-2 would leave some contaminants untreated; thus, the effectiveness for residual risk reduction would be low. Evaluation, modeling, and sampling would be required to determine residual risk reduction by Alternatives S32-2 and S32-3. Alternative S32-2 would

require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives (except No Action) would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternatives S32-3 and S32-4 would permanently remove or treat the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternatives S32-3 and S32-4 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal or treatment of all or a portion of the impacted soil and the USTs. Alternative S32-3 would rely on enhanced biodegradation of contaminants and would not require any controls once the treatment is complete. Alternative S32-2 would involve the use of a concrete cover, which would not actively remediate constituents but would be adequate and reliable in controlling exposure to any remaining constituents. Because Alternative S32-2 would reduce the risks through the installation of a concrete cover, future maintenance and monitoring of the soil cover would be required.

Table 6-9 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 32 alternative.

6.5.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternatives S32-3 and S32-4 would permanently and significantly reduce mobility of chemical constituents to the highest level of the alternatives evaluated for Site 32. Alternatives S32-3 and S32-4 are considered permanent remedies and are designed to provide the greatest reduction of risk through removal. No COCs at concentrations greater than PRGs would remain at the site under Alternatives S32-3 and S32-4. Alternative S32-2 would reduce the mobility of impacted soil through containment, but would not provide active treatment of remaining soils to reduce toxicity and volume. Alternative S32-2 would remove the COCs present in surface soil at concentrations greater than PRGs. Alternative S32-3 would decrease toxicity through treatment of the organics more than Alternative S32-2. All the alternatives (except No Action) would include removal of the USTs. The concentrations of toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 6-9 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 32 alternative.

6.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives would take progressively longer to protect human health because of the time needed for UST removal and soil excavation and treatment, and constructing a concrete cover. Alternatives S32-2 and S32-4 have an estimated remedial time to reach objectives of less than 1 year. Alternative S32-3 has an estimated remedial time to reach objectives of approximately 2 years. Alternatives S32-2 and S32-4 would create short-term risks of worker exposure and the potential of fugitive dust during excavation, transportation, and/or concrete cover construction. These risks appear manageable using appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust and runoff) would be expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 6-9 provides a summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 32 alternative.

6.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternatives S32-2 and S32-4 may require Federal, state, or local permits because they include excavation, transportation, and off-base disposal of USTs and impacted soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternative S32-3 may require an air discharge permit. Alternatives S32-2 through S32-4 would require coordination with other agencies for LUCs and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S32-4 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternatives S32-2 and S32-3.

Alternative S32-2 would require monitoring of the concrete cover for potential exposure. Alternative S32-4 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate PPE. Exposure from dermal contact and ingestion of soil during construction would be minimized by the use of appropriate PPE.

Alternatives S32-2 and S32-4 would require the use of a TSDF/landfill or its services for excavated impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 6-9 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of services and capacities; and availability of equipment, specialists, and materials, for each Site 32 alternative.

6.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. Alternative S32-4 has the highest cost, followed by Alternatives S32-3 and S32-2, respectively. Table 6-9 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 32 alternative. Detailed cost estimates for each alternative are provided in Appendix E.

6.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments and Navy responses to the comments are provided in Appendix F.

6.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS Report and the Proposed Plan for Site 32.

7.0 SITE 33 - MIDFIELD MAINTENANCE HANGAR

Site 33 is located at the Midfield Maintenance Hangar, Building 1454 (see Figure 1-1). The site includes Building 1454 and the location of the abandoned waste oil tank north of Building 1454. The Midfield Maintenance Hangar was constructed in the mid-1940s to support maintenance service of assigned aircraft and line maintenance on transient aircraft. Activities at this site included engine maintenance, corrosion control, and aircraft cleaning. Maintenance activities typically generated less than 5 gallons/month of mixed waste paint and stripper, methyl isobutyl ketone (MIBK), MEK, toluene, and naphtha.

Oil changes were routinely performed on aircraft as part of the normal maintenance activities. The waste oil from aircraft maintenance was reportedly poured into bowsers (mobile storage tanks) or the underground waste oil tank located north of Building 1454 until the tank was abandoned in the 1980s. The waste oil was removed from the tank by a contractor for off-base disposal.

In the early 1970s the Ground Support Equipment shop moved from Hangar Building 2941 to the Midfield Maintenance Hangar. The Ground Support Equipment shop was responsible for the maintenance on all ground support equipment (e.g., tow tractors, aircraft jacks, and maintenance stands). The shop routinely generated an estimated 30 gallons of waste PD-680 cleaning solvent per month and about 15 gallons of waste aircraft cleaning compound per month. Other wastes generated included lubricating oil (20 gallons/month), antifreeze (9 gallons/month), hydraulic fluid (25 gallons/month), and transmission fluid (6 gallons/month). All of these wastes were disposed of either in a bowser or in the underground waste oil tank.

The remedial investigation for Site 33 was concluded in 1998, and an RI Report was issued in 1999 (Tetra Tech NUS, 1999).

7.1 ENVIRONMENTAL CONDITIONS

7.1.1 Nature and Extent of Contamination

The source of chemicals in the surface and subsurface soils at Site 33 can be attributed to maintenance activities at the Midfield Hangar for aircraft and ground equipment and a possible release near the former underground waste oil tank. Chemicals detected in the surface and subsurface soils include VOCs, SVOCs, pesticides/PCBs, and inorganics (see Figure 1-3 for location of soil borings).

The area around the former underground waste oil tank displays the highest number and concentrations of all chemicals at the site. The horizontal extent of the soil impact around the waste oil tank appears to be the immediate tank vicinity. The high number of metals and SVOCs in the soil in that area suggests a waste oil source for the soil chemicals. The deepest soil impact was from pesticide compounds and TPH at a depth of 120 to 122 feet bgs in 33SB02, a saturated sample. The deepest VOC detected in the subsurface soil was acetone at a depth of 95 to 97 feet bgs.

Soil at the southeast corner of Building 1454 contains VOC, SVOCs, and inorganics. The area of impact is limited to that corner and concentrations do not exceed regulatory limits. The deepest sample where chemicals were detected in this area was 20 to 22 feet bgs. The trace detections of TCE and 1,2-DCE indicate a solvent source used at the facility for engine parts cleaning.

7.1.2 Risk Assessment Results

Two separate risk evaluations were conducted for Site 33 during the RI (Tetra Tech NUS, 1999). The first risk evaluation considered the concrete pads remain in place and the second risk assessment considered the hypothetical removal of the concrete pads overlying the contaminated soil. It is unlikely that the concrete pads will be removed from Site 33, but if they were removed, it is likely clean fill would be used to replace the concrete. Risk assessment results from the RI (Tetra Tech NUS, 1999) are presented for surface soil and subsurface soil, assuming the concrete remains in place and for the hypothetical future conditions, assuming concrete is removed.

Surface Soil: Assuming Concrete Remains in Place

The concentrations of five analytes (aluminum, arsenic, iron, TPH, and vanadium) exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (residential). These analytes were selected as COPCs and were used to evaluate the human health risks associated with the surface soil at Site 33 (Table 7-1).

The RME cancer risk was 3.1 $\times 10^{-6}$ for the older child trespasser, 4.8 $\times 10^{-6}$ for the adult trespasser, 1.4 $\times 10^{-5}$ for the occupational worker, 2.1 $\times 10^{-6}$ for the maintenance worker, 2.7 $\times 10^{-7}$ for the construction worker, and 7.8 $\times 10^{-5}$ for the on-site resident (child/adult). The RME cancer risk for the construction worker was less than both the USEPA and FDEP target risks. The RME cancer risk for the older child trespasser, the adult trespasser, the occupational worker, the maintenance worker, and the on-site resident (child/adult) exceeded the FDEP target risk of 1 $\times 10^{-6}$, but were within the USEPA acceptable range of 1 $\times 10^{-4}$ to 1 $\times 10^{-6}$. Arsenic is the carcinogenic risk driver.

TABLE 7-1

SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT SITE 33

**NAS WHITING FIELD
MILTON, FLORIDA**

Chemicals of Potential Concern	Surface Soil	Subsurface Soil
Aluminum	✓	
Arsenic	✓	✓
Iron	✓	
Vanadium	✓	
TPH	✓	✓

The RME noncancer risks were below the USEPA and FDEP target HI of 1.0 for all receptors except the on-site resident child. The RME noncarcinogenic risk for the on-site child was 1.30.

Subsurface Soil: Assuming Concrete Remains in Place

The concentrations of two analytes (arsenic and TPH) exceeded site–specific background concentrations and either USEPA Region III RBCs or Florida SCTLs for direct soil exposure (industrial/commercial). These analytes were selected as COPCs and were used to evaluate the human health risk associated with the subsurface soil at Site 33. The conclusions of the baseline human health and ecological risk assessments are as follows.

The cancer risk (RME) associated with exposure to subsurface soil (ingestion and dermal contact) for the construction worker is 1.7×10^{-7} which is below the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6} and below the FDEP target level of 1×10^{-6}.

The noncarcinogenic risk (RME) for the construction worker for exposure to subsurface soils is below the USEPA and FDEP target HI of 1.0.

Ecological: Assuming Concrete Remains in Place

The ecological risk assessment identified chromium as a potential risk to biota, mainly through the food chain. However, the quantity and quality of habitat at Site 33 are limited and of poor quality since the site is characterized by mowed turfgrass with no trees and heavy human activity. As a result of the heavy human activity and vehicle and aircraft noise, terrestrial wildlife is deterred from using the site. Although some types of wildlife can become accustomed to heavy human activity, no habitat is present on or near the site to attract anything but an occasional transient songbird or small mammal. Reduction in growth, survival,

and reproduction of small mammal and bird populations at or near the site is not expected. Based on this information, potential risks to ecological receptors appear to be acceptable.

Hypothetical Future Conditions Assuming Concrete Removal at Site 33

Although it is unlikely the concrete would be removed from Site 33 in the future, exposure to soil beneath the concrete was evaluated as surface soil. The following conclusions were drawn based on this scenario.

- The COPCs in surface soil do not pose unacceptable carcinogenic risk to the evaluated receptors, according to the USEPA acceptable risk range of 1×10^{-4} to 1×10^{-6}.
- For Site 33, all receptors except for the construction worker pose unacceptable RME carcinogenic risks using the FDEP acceptable risk of 1×10^{-6}. The CTE carcinogenic risk is acceptable for all Site 33 receptors except the on-site resident (child/adult). HIs for Site 33 receptors were all less than 1.0 under the RME scenario, except for the on-site child resident. The on-site child resident HI was 1.27 for the RME case, but 0.18 for the CTE case. When the effect to target organs was evaluated for the on-site child resident, none of the target organs had an HI exceeding 1.0.
- Arsenic is the carcinogenic risk driver for Site 33.
- TPH is a noncarcinogenic risk driver for the child resident at Site 33. The RME noncarcinogenic risk for the child receptor was 1.1 at Site 33; the CTE noncarcinogenic risk for this receptor was 0.38 at Site 33. For all receptors at Site 33, the TPH HI did not exceed unity.

7.2 REMEDIAL ACTION OBJECTIVES

The objectives and goals for remedial actions at Site 33 provide the basis for selecting RAOs and identifying remedial technologies to address unacceptable human health risks associated with direct exposure to surface and subsurface soil contamination at the sites. RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40, Basewide Groundwater.

To establish RAOs, regulatory requirements, or ARARs, are first identified. RAOs are then defined primarily on consideration of ARARs and the results and conclusions of the RI. Next, action levels, or PRGs, for each media of concern are defined. Volumes of affected media above action levels are then calculated. Finally, general response actions satisfying the RAOs are identified. The information

presented in this section is used to identify and evaluate appropriate remedial technologies for Site 33 (Section 3.3).

7.2.1 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 remedial actions to comply with state ARARs when more stringent than Federal ARARs. A complete discussion of ARARs is provided in Section 2.2.1.

7.2.2 Identification of Remedial Action Objectives

RAOs are defined in USEPA RI/FS Guidance as media-specific goals established to protect human health and the environment (USEPA, 1988). RAOs are based on the COPCs, the exposure pathway, and the receptors present at the site. RAOs are identified for surface and subsurface soil and consider the results of the RI (discussed in Section 3.1), particularly the human health and ecological risk assessments, as well as the ARARs and TBCs identified in Table 2-2.

For this FS, RAOs have been formulated based on the following criteria:

- Unacceptable human health risk exists for direct exposure to surface or subsurface soil based on the current and anticipated future commercial/industrial use of the site.
- State of Florida STCL.
- USEPA Region III RBC values (commercial/industrial land use).

The potential for the leaching of chemicals by rainwater from soils will be evaluated as part of the FS for Site 40, Basewide Groundwater. The current and future use of the property at this site is industrial. The current and future receptors are occupational and construction workers in direct contact with the soil. Based on the current and future use receptors, three RAOs have been developed for Site 33.

RAO 1: To protect human health from carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.

RAO 2: To comply with Federal and state ARARs and TBCs in accordance with accepted USEPA and State of Florida guidelines.

RAO 3: To remove potential contamination sources (UST), reducing potential risks to human health and the environment.

7.2.3 Preliminary Remediation Goals

PRGs establish acceptable exposure levels protective of human health and the environment. PRGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Section 2.2.3 provides the basis for selection of PRGs.

The PRG selection process is summarized below.

1. The State of Florida SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region III SSLs for Commercial/Industrial Direct Exposure, whichever is lower, will be used as PRGs.

2. Background concentration will be used as the lower limit for the PRG of inorganic COCs.

Table 7-2 provides a list of the surface and subsurface soil, direct-contact PRGs for Site 33.

7.2.4 Chemicals of Concern

The COCs have been determined by comparing the soil PRG values against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). Any COPC with a site-specific representative concentration exceeding the PRG becomes a COC. The site-specific representative concentration determined in the RI has been used in this evaluation. Table 7-3 shows the COC selections for Site 33.

7.2.5 Areas and Volumes of Soil Requiring Remedial Action

The areas and volumes of soil with COCs exceeding PRGs are estimated by comparing the direct contact soil PRGs for all COCs to the site-specific analytical data. This information, in addition to chemical data from nearby locations not exceeding PRGs, is used to estimate the areas and volumes of soil requiring remedial action.

TABLE 7-2

DETERMINATION OF PRGs AT SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

Chemical of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region III Industrial SSLs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil PRG	Subsurface Soil Background[5]	Subsurface Soil PRG
Aluminum	mg/kg	*	200,000	200,000	N	15,848	200,000	27,834	200,000
Arsenic	mg/kg	3.7	3.8	3.7	C	3.2	3.7	6.2	6.2
Iron	mg/kg	480,000	61,000	61,000	N	8,832	61,000	18,110	61,000
Vanadium	mg/kg	7,400	1,400	1,400	N	21.8	1,400	45	1,400
TPH	mg/kg	2,500	NA	2,500	NA	NA	2,500	NA	2,500

[1]Combined list of all COPCs for Site 33.

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C.

[3]USEPA Region III Risk-Based Concentration Table, April 12, 1999. (Note: 1/10th of the value is used for noncarcinogens).

[4]Soil Basis Codes: N = Noncarcinogen, C = Carcinogen

[5]Table 3-18, GIR, Remedial Investigation and Feasibility Study, ABB-ES, 1998. Background screening value for inorganics is two times the mean detected concentration.

*Chemical is not a health concern for the commercial/industrial exposure scenario.

mg/kg – milligrams per kilogram

NA – Not Applicable

TABLE 7-3

CHEMICAL OF CONCERN EVALUATION FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

Surface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Aluminum	mg/kg	28,400	--	28,400	Maximum	n<10	200,000	No
Arsenic	mg/kg	3.3	--	3.3	Maximum	n<10	3.7	No
Iron	mg/kg	14,400	--	14,400	Maximum	n<10	61,000	No
Vanadium	mg/kg	39.6	--	39.6	Maximum	n<10	1440	No
TPH	mg/kg	2,340	--	2,340	Maximum	n<10	2,500	No

Subsurface Soil

Chemical of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			PRG	COC
				Value	Statistic[2]	Rationale		
Arsenic	mg/kg	11.5	--	7.3	95%UCL-T	UCL<Max	6.2	**Yes**
TPH	mg/kg	7,790	--	7,790	Maximum	n<10	2,500	**Yes**

[1] For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the average value was used in the calculation.
[2] Statistics: Maximum value used since the sample size was <10 samples.
95% UCL of log-transformed data (95% UCL-T).
mg/kg = milligrams per kilogram
UCL = upper confidence limit
UCL-T = UCL of log-transformed data

Sample 33SB02 had an arsenic concentration of 11.5 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 2-4 feet bgs. Sample 33SB02 also had TPH concentrations of 7,790 mg/kg (PRG = 2,500 mg/kg) in the sample collected at 5-7 feet bgs and 2,980 mg/kg in the duplicate sample collected at 35-37 feet bgs. Arsenic was not detected above the PRG in the deeper samples collected at 33SB02, which start at 5-7 feet bgs. TPH was not detected above the PRG in 33SB02 in the sample collected at 2-4 feet bgs, the samples collected at 10-12 feet bgs and 15-17 feet bgs, and any of the deeper samples, which start at 60 feet bgs.

Sample 33SB09 had arsenic concentrations of 6.8 mg/kg (PRG = 6.2 mg/kg) in the sample collected at 14-16 feet bgs and 7.5 mg/kg in the duplicate sample collected at 14-16 feet bgs. No other samples were collected at that location.

Areas and Volumes

The volume of impacted soil at each location, with one or more COCs exceeding PRGs, has been calculated by estimating the area and vertical extent of contamination. The rationale for estimating the

area and vertical extent of impacted soil at each location is presented in the following paragraphs. The estimated volume of impacted soil calculated for each location exceeding PRGs is summarized in Table 7-4.

The two sample locations with chemical concentrations exceeding PRGs are not clustered in any one area and have sample locations between them without chemical concentrations above the PRGs. Therefore, the two locations were considered as localized areas of impact.

At sample 33SB02, TPH was detected at a concentration of 7,790 mg/kg at 5-7 feet bgs, but the samples collected at 10-12 feet bgs and 15-17 feet bgs did not have TPH concentrations above the PRG; therefore, the impact area was estimated to extend to 9 feet bgs (Figure 7-1). In addition, TPH was detected above the PRG in the sample collected at 35-37 feet bgs. The deeper samples, starting at 60 feet bgs, did not have impact above the PRG; therefore, the impact was estimated to extend to 50 feet bgs. Based on a localized area, the total estimated volume of impact at 33SB02 is 559 yd^3. Arsenic impact in the sample collected at 2-4 feet bgs would be included in both previous estimated volumes of impacted soil.

Sample 33SB09 had arsenic impact above PRG to a depth of 16 feet bgs. There were no deeper samples collected at this location, so the depth of impact was estimated at an additional 5 feet bgs. Based on a localized area of 1,257 ft^2, the estimated volume of arsenic-impacted soil at 33BS09 is 558 yd^3.

Summary

The Site 33 total estimated volume of contaminated surface and subsurface soil (above PRGs) is 0 yd^3 and 1,117 yd^3, respectively. An additional 442 yd^3 of soil would have to be removed to access the deep contaminated subsurface soil. Approximately 1,320 ft^2 or 669 yd^3 of the impacted soil is covered by concrete/asphalt. Prior to beginning remedial action, soil samples should be collected and analyzed for the COCs at each location with soil exceeding PRGs to confirm the estimated volume of impacted soil exceeding PRGs.

7.3 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

The development of remedial alternatives for CERCLA sites consists of identifying GRAs, identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives accomplishing the RAOs identified in Section 3.2.

TABLE 7-4

VOLUME OF SOIL EXCEEDING PRGs AT SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

Location	Description	Contaminated Surface Soil[a]			Contaminated Subsurface Soil[b]			Uncontaminated Soil Excavation[c]	Concrete Covered Soil[d]		Building Covered Soil[e]	
	(mg/kg) @ feet bgs	radius[f] (ft)	area (ft^2)	Vol (yd^3)	radius[f] (ft)	area (ft^2)	vol (yd^3)	vol (yd^3)	area (ft^2)	vol (yd^3)	area (ft^2)	vol (yd^3)
33SB02	As – 11.5 @2-4		0	0	10	314	559	23	63	111	0	0
	TPH – 7,790 @5-7											
	TPH – 2,980 @35-37D											
33SB09	As – 6.8 @14-16		0	0	20	1,257	558	419	1,257	558	0	0
	As – 7.5 @14-16D											
Total Site 33			0	0		1,571	1,117	442	1320	669	0	0

[a] Contaminated soil exceeding PRGs within 2 feet of ground surface.
[b] Contaminated soil exceeding PRGs located from 2 feet bgs down to the water table.
[c] Volume of noncontaminated soil located above contaminated subsurface soil that would be excavated during removal of contaminated material.
[d] Contaminated soil presently covered by concrete or asphalt.
[e] Contaminated soil presently covered by a building.
[f] Equivalent Radius

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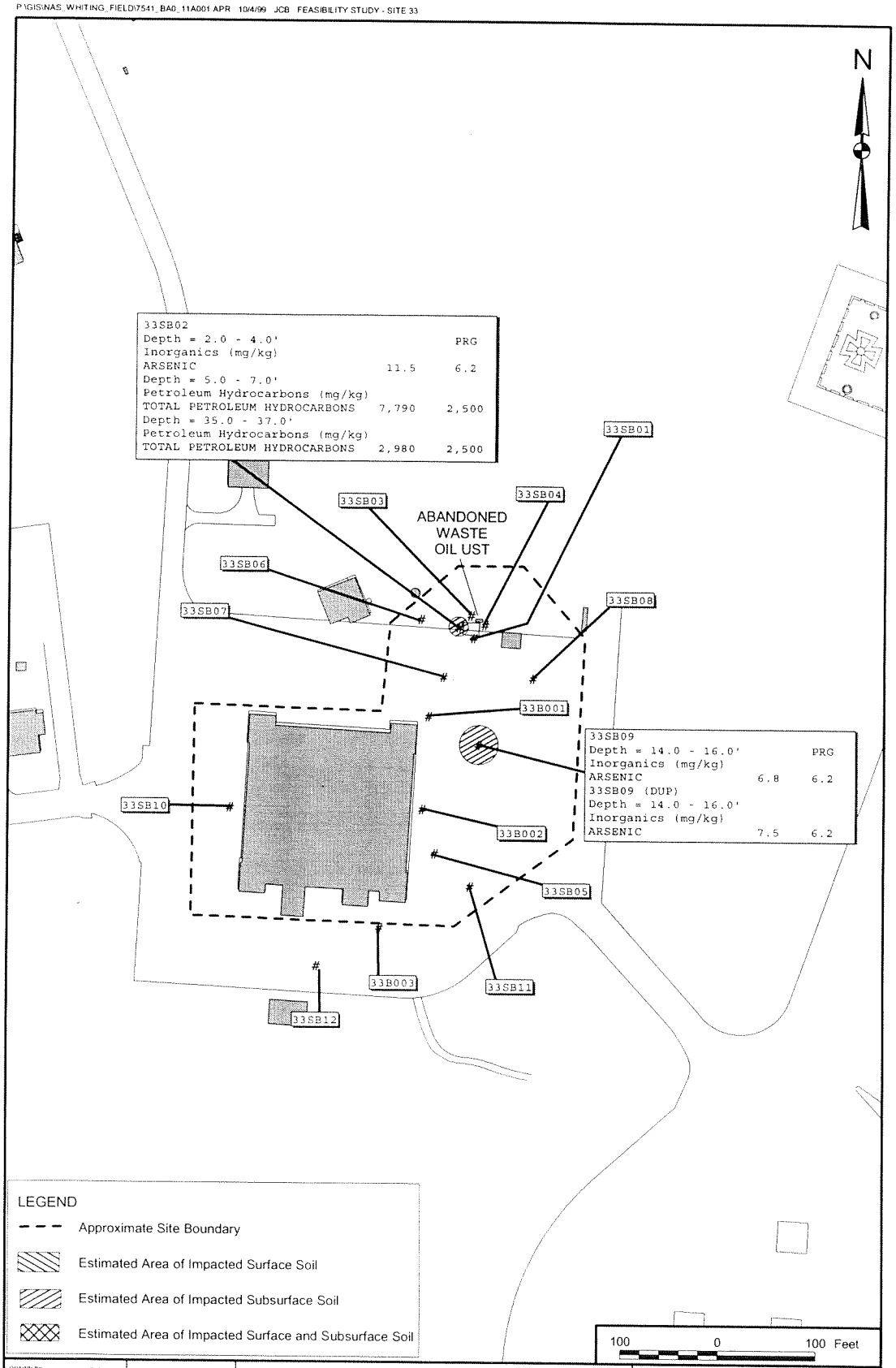

DRAWN BY: J. BELLONE DATE: 10/4/99	AREAS IMPACTED BY CHEMICALS OF CONCERN IN SURFACE AND SUBSURFACE SOIL SITE 33 NAS WHITING FIELD, MILTON, FLORIDA	CONTRACT NUMBER	
CHECKED BY: DATE:		APPROVED BY: DATE:	
COST/SCHEDULE AREA		APPROVED BY: DATE:	
SCALE: AS NOTED		DRAWING NO: FIGURE 7-1	REV: 0

The NCP requires a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those minimizing the need for long-term management to those reducing toxicity, mobility, or volume of contaminants.

7.3.1 General Response Actions

GRAs describe those actions that will satisfy the remedial objectives. GRAs may include no action, minimal action, treatment, containment, removal, disposal, or a combination of these. Like RAOs, GRAs are media specific.

The COCs at Site 33 consist of arsenic and TPH. Soil contamination extends from the surface to a depth of approximately 50 feet bgs. The total estimated volume of contaminated soil is 1,117 yd^3.

The following GRAs apply to contaminated soils at Site 33.

- No action
- Limited action
- Containment
- Treatment
- Removal
- Disposal

Soil GRAs are discussed in Appendix C.

7.3.2 Identification and Screening of Remedial Technologies

The purpose of this section is to identify and screen appropriate technologies for remedial alternatives addressing the RAOs identified for Site 33. Each technology is then screened based on site- and waste-limiting characteristics. See Section 2.3.2 for additional information.

Table 7-5 presents the remedial technologies/process options applicable for addressing the RAOs for Site 33. This table also presents the results of the screening of those technologies. 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 were eliminated from further consideration. Table 7-6 summarizes the technologies/process options passing the screening criteria. Table 7-6 also shows the RPO selected for alternative evaluations. The RPOs are assembled into remedial alternatives in Section 7.3.4.

TABLE 7-5

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

General Response Action	Remedial Technology	Process Option	Description	Screening Result
No Action	No Action	None	No remedial actions taken. Five-year review would be required.	Retained[1]
Minimal action	LUCs	LUCs	LUCs for property in the area of soil contamination would include restrictions on excavation/construction and future land use. LUCs include access controls (e.g., fences, security guards, warning signs, etc.), institutional controls (e.g., public advisories, Base Master Plan notations, etc.), and site monitoring to ensure compliance with the provisions of the LUCs.	Retained
Containment	Horizontal barriers	Soil cover	Use of soil to provide a physical barrier and to promote vegetation.	Retained
		Clay capping	Use of compacted clay over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Asphalt capping	Application of a layer of asphalt over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
		Concrete capping	Installation of concrete slabs over areas of contamination to reduce infiltration and provide a physical barrier.	Retained
Treatment	Biological	Aerobic degradation	In situ degradation of organics using microorganisms in an oxygen-enriched environment.	Retained
		Anaerobic degradation	In situ degradation of organics using microorganisms in an oxygen-deficient environment.	Eliminated[2]
	Physical/chemical	Soil flushing	In situ flushing of contaminants using a solvent and an injection/extraction well system around contaminated area.	Eliminated[3]
		Vapor extraction/bioventing/ soil venting	Uses an induced vacuum created by an extraction/injection well system around the contaminated area to desorb, transport, and collect volatile organic contaminants above the saturated zone.	Retained[4]
		Steam stripping	A drilling and steam dispensing system injects steam and hot air into soil to remove volatile organic contaminants. Organics are collected at the surface for treatment.	Eliminated[5]
		Stabilization/solidification	Pressure injection of cement materials into contaminated media to immobilize contaminants.	Eliminated[6]
	Thermal	Vitrification	Immobilization of inorganic contaminants using electrically generated heat by electrodes to convert soils to a glass/crystalline product. High temperatures destroy organics through pyrolysis and combustion.	Eliminated[7]

TABLE 7-5

IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 2 OF 2

General Response Action	Remedial Technology	Process Option	Description	Screening Result
Removal	Excavation	Bulk excavation	Excavation is the removal of soils using common construction equipment such as a high lift and backhoe.	Retained
Disposal	On-site landfill	Hazardous landfill	Double-lined and capped permanent disposal facility.	Eliminated[8]
		Hybrid landfill	Unlined but capped permanent disposal facility.	Eliminated[8]
		Nonhazardous landfill	Unlined and uncapped permanent disposal facility.	Eliminated[8]
	Off-site landfill	Hazardous waste landfill	Existing RCRA hazardous waste disposal site.	Retained
		Nonhazardous waste landfill	Existing nonhazardous waste disposal site.	Retained

[1]No Action may not be effective for this site; however, it will be retained as a baseline consideration.
[2]Anaerobic biodegradation is not suitable for treating arsenic or TPH.
[3]Soil flushing may make arsenic more mobile.
[4]Vapor extraction is not suitable for nonvolatile organics such as TPH. Bioventing/soil venting would be suitable.
[5]Steam stripping has limited effectiveness on TPH.
[6]Solidification is not effective at decreasing the mobility of organics.
[7]The use of vitrification would severely limit potential futures uses.
[8]On-site landfills are not a viable option at Site 33 due to the groundwater beneath the site.

TABLE 7-6

SOIL TECHNOLOGIES AND PROCESS OPTIONS PASSING PRELIMINARY SCREENING FOR SITE 33

**NAS WHITING FIELD
MILTON, FLORIDA**

General Response Action	Remedial Technology	Process Option[1]	Representative Process Option
No action	No action	None	None
Limited action	LUCs	LUCs	LUCs
Containment	Horizontal barriers	Soil cover Clay capping Asphalt capping Concrete capping	Soil cover
Treatment	Physical/chemical	Bioventing/Soil Venting	Bioventing/Soil Venting
Removal	Excavation	Excavation	Excavation
Disposal	Off-site landfill	Hazardous waste landfill Nonhazardous waste landfill	Nonhazardous waste landfill

[1]At least one process option was retained as the representative process option for each acceptable remedial technology.

7.3.3 Alternative Range Development

CERCLA requires the selected RPOs to be assembled into alternatives representing a range of treatment and containment combinations, as appropriate (USEPA, 1988). The purpose of providing a range of alternatives is to ensure all reasonable GRAs are represented and evaluated. The range of alternatives developed for soils remediation is presented in Table 7-7, and Section 2.3.3 provides a discussion of the range of alternatives.

7.3.4 Assembly of Soil Alternatives

Alternatives are developed to provide an appropriate range of options. Sufficient information is included to adequately evaluate and compare alternatives and to determine which alternative would be the most appropriate. Alternatives are developed around USEPA's expectations pertaining to remediation of CERCLA sites. These expectations have been listed in the NCP [40 CFR 300.430(a)(1)(iii) and 55 FR 8846, March 8, 1990] and are summarized in Section 2.3.4.

The COCs for Site 33 are inorganics (arsenic) from 2 feet bgs down to approximately 16 feet and organics (TPH) at 5 to 37 feet bgs. In addition all alternatives (except No Action) address the removal of the UST because it is a potential source of contamination. Four soil alternatives are assembled into the appropriate alternative types for this site, which are listed in Table 7-8.

TABLE 7-7

RANGE OF ALTERNATIVES FOR SITE 33

**NAS WHITING FIELD
MILTON, FLORIDA**

Alternative Type
No Action (Baseline)
Containment/Limited Action – No or Minimal Treatment
Treatment – Addresses the Principal Threats
Treatment – Minimizes Long-Term Management

TABLE 7-8

SITE 33 SOIL REMEDIAL ALTERNATIVES

**NAS WHITING FIELD
MILTON, FLORIDA**

Alternative Number	Alternative Type	Representative Process Options Combined Into Alternatives	Alternative Description
Alternative S33-1 No Action	No Action	None	• Five-year Reviews.
Alternative S33-2 UST Removal and LUCs	Source Removal, Containment/Limited Action – No or Limited Treatment	LUCs, Remove UST	• LUCs including LUCAP and LUCIP. • Excavate and remove UST. • Posting of warning signs. • Five-Year site reviews.
Alternative S33-3 UST Removal, Soil Venting, and LUCs	Source Removal, Containment/Limited /Treatment Action – Treatment	LUCs, Remove UST, In Situ Soil Venting	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02. • Excavate and remove UST. • Install and operate an in situ soil venting system for subsurface soil at location 33SB02. • Posting of warning signs. • Five-Year site reviews.
Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Remove UST, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP. • Delineation/confirmatory sampling of subsurface soil adjacent to 33SB02 and 33SB09. • Demolition and removal/disposal of asphalt and concrete pavement. • Excavate and remove UST. • Excavation/disposal of subsurface soil exceeding PRGs at 33SB02 and 33SB09. • Backfill excavation with clean fill. • Replacement of asphalt or concrete pavement. • Establish vegetative cover. • Posting of warning signs. • Five-Year site reviews.

Site 33 alternatives S33-1, S33-2, and S33-4 contain the same RPOs (with the addition of the removal of the UST) as Site 3 alternatives S3-1, S3-2, and S3-3, respectively. Refer to the discussion in Section 2.3.4 for a brief description of these alternatives. Alternative S33-4 contains the same RPOs (with the addition of the removal of the UST) as S4-3. Refer to Section 3.3.4 for a brief description of this alternative.

7.4 DETAILED ANALYSES OF SOIL ALTERNATIVES

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided in Appendix D.

7.4.1 Site 33 Alternatives

The four alternatives for Site 33 represent a range of actions including no action, source removal and containment/limited action, addressing principal threats, and aggressive actions minimizing the need for long-term management. The four alternatives providing a range of treatment options for Site 33 are listed below.

- Alternative S33-1: No Action
- Alternative S33-2: UST Removal and LUCs
- Alternative S33-3: UST Removal, Soil Venting, and LUCs
- Alternative S33-4: UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs

7.4.1.1 Alternative S33-1: No Action

7.4.1.1.1 Description

In an FS the No Action alternative serves as a baseline or addresses sites that do not require any active remediation. The No Action alternative assumes that no remedial action would occur and establishes a basis for comparison with the other alternatives. No remedial action, treatment, LUCs, or monitoring of conditions would remain or be implemented under the No Action alternative. Natural attenuation, involving natural processes such as dilution, adsorption, and chemical reaction within the subsurface materials, would be expected to occur over long periods of time but would not be documented.

Under CERCLA Section 121(c), any remedial action resulting 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.

7.4.1.1.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

The No Action alternative would allow unacceptable risks to on-base human health. This alternative would do nothing to effectively isolate constituent sources or prevent exposure to constituents.

Compliance with ARARs

On the basis of protecting human health and the environment, Alternative S33-1 would not satisfy ARARs and TBCs, including the SCTLs.

Balancing Criteria

Long-Term Effectiveness and Permanence

Alternative S33-1 would provide no long-term effectiveness or permanence for Site 33. Inorganic and organic COCs present in Site 33 would pose a continuing risk to human health. The magnitude of and

potential for residual risk within Site 33 would be relatively unchanged by the No Action alternative. This alternative offers no reduction in risk except over a long period of time as the constituents leach, migrate, and attenuate. The adequacy and reliability of controls component is not applicable for Alternative S33-1 because no construction, installation, or equipment is associated with the alternative. The No Action alternative would not include provisions for long-term monitoring. A 5-year review would be required, however, to assess the degree of remaining risk.

Reduction of Mobility, Toxicity, or Volume through Treatment

The mobility, toxicity, and volume of constituents in Site 33 would not change significantly, and the risk posed to human health would be expected to continue because Alternative S33-1 involves no action. Natural attenuation involves natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions within the subsurface materials; however, it would not be expected to reduce constituent concentrations within the site at rates consistent with remedial objectives.

The target constituents for natural attenuation are TPH as well as inorganics. The processes of natural attenuation and natural biodegradation can provide irreversible treatment. Natural attenuation is estimated to have a limited effect on the reduction of inorganic concentrations contained within Site 33 soil.

Short-Term Effectiveness

The No Action alternative would provide no short-term effectiveness or short-term risks during the implementation of the No Action alternative. There would be no short-term risks to workers, the community, or the environment because no construction or implementation would occur. There would be no implementation time associated with the No Action alternative. The time required to achieve remedial objectives under the No Action alternative is estimated to be greater than 30 years.

Implementability

No technical implementability issues exist because no remedial action would occur. There is no need to coordinate with other agencies or acquire permits. Services or materials are not required. Future actions, if needed, would not be hindered by the No Action alternative.

Cost

The only cost for the No Action alternative is the cost for the 5-year reviews because no remedial action would occur. The estimated present worth total project cost is $18,008, including $7,375 for 5-year reviews. Appendix E presents the estimated cost for implementing this alternative.

7.4.1.2 Alternative S33-2: UST Removal and LUCs

7.4.1.2.1 Description

Alternative S33-2 addresses the principal threats through the removal of the UST and implementation of LUCs. The UST would be excavated and disposed of off-site. LUCs are described in Appendix C.

Impacted soil exists below the surface at sample locations 33SB02 and 33SB09. Some of the impacted subsurface soil surrounding sample location 33SB02 would be removed as part of the UST removal. Existing soil cover (e.g., soil, concrete, or asphalt horizontal barrier) over impacted areas will be maintained. Any areas with subsurface soil exceeding the PRGs after the UST removal will require long-term monitoring.

7.4.1.2.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S33-2 would provide protection to human health and the environment by minimizing all exposure pathways through removal of the UST and restricting access to remaining impacted soil by LUCs. LUCs are effective in the protection of human health. The existing soil cover will protect humans and the environment by containment. There will be no significant risks to human health or the environment during implementation of Alternative S33-2; therefore, overall protection of human health and environmental resources both on and off base is high.

Compliance with ARARs

All ARARs applying to source control and reducing risk to humans would be satisfied by Alternative S33-2 if confirmational sampling and analyses determine any source areas greater than 2 feet bgs are stable

and relatively stationary. Alternative S33-2 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs by use of LUCs to minimize exposure pathways. Although containment (e.g., the existing soil cover) is not an active remedial process, exposure to the constituents would be prevented. Removal of the UST would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S33-2.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S33-2 would be low since contaminants are not treated. However, surface barriers/containment provides long-term effectiveness and permanence in minimizing exposure pathways assuming the existing soil cover (e.g. soil, concrete, or asphalt horizontal barrier) is maintained at a depth greater than 2 feet above remaining impacted areas. Removal of the UST as a potential source would prevent future soil contamination once the USTs are removed and for this reason lends to the overall long-term effectiveness and permanence of the remedy. The magnitude and potential of residual risk would be unchanged for on-base receptors, but the exposure pathways would be minimized as long as LUCs and the existing soil cover remain in place. The magnitude of constituent concentrations would be reduced as a result of natural attenuation. Five-year reviews would be required to assess the effectiveness of the existing soil cover to contain remaining inorganic and organic constituents and the degree of natural attenuation that has taken place.

The adequacy and reliability of LUCs would be sufficient to restrict access to impacted soils. The life expectancy for the existing soil cover would be 20 to 30 years; however, the service life of the soil cover would be affected by weather and the level of maintenance performed. Long-term reliability would be maintained because natural surface flow patterns would be returned to near original conditions and erosion would be minimized. Long-term management would consist of LUCs and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

The existing soil cover would reduce the mobility of inorganic constituents that may pose a risk through fugitive dust. The existing soil cover of subsurface soil would minimize exposure pathways but reduction of the concentrations of the remaining constituents would rely on natural attenuation. This alternative

would provide a low degree of irreversible treatment through natural attenuation processes. Minor inorganic constituent residuals would remain above action levels after the implementation of Alternative S33-2. The implementation and operation of Alternative S33-2 would produce no treatment residuals.

Short-Term Effectiveness

There would be minimal short-term risk to workers, on-base personnel, and the public from implementation of Alternative S33-2 during removal of the UST. Construction time to implement Alternative S33-2 is approximately 6 days. Alternative S33-2 would be effective in minimizing all exposure pathways. The time required to achieve remedial response objectives by minimizing all exposure pathways is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S33-2 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs. Monitoring of the integrity of the existing soil cover would also be required. O&M activities would be of low intensity and may involve regrading, compaction, revegetation, erosion control, and monitoring. All components of Alternative S33-2 would be reliable in the protection of human health. The need for future remedial actions would depend on the effectiveness of Alternative S33-2 in minimizing exposure pathways and on the reduction of constituent concentrations as a result of natural attenuation. Future remedial actions would not be hindered by the implementation of Alternative S33-2; however, modification of LUCs and cover removal/replacement may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $103,316 including a capital cost of $46,226, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

7.4.1.3 Alternative S33-3: UST Removal, Soil Venting, and LUCs

7.4.1.3.1 Description

This alternative would minimize the need for long-term management through removal of the UST, implementation of LUCs, and in situ soil venting. LUCs are described in Appendix C. A description of in situ soil vesting is provided in Section 3.2.3.1.

The in situ soil venting system would treat a surface area of approximately 314 ft^2 to a depth of approximately 50 feet bgs in the area surrounding sample location 33SB02. The conceptual design would consist of 3 wells installed to a depth of 50 feet bgs with a vapor recovery system and gas phase carbon treatment. The system would operate for approximately 3 years.

7.4.1.3.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S33-3 would provide protection of human health and the environment by minimizing all exposure pathways through in situ treatment of location 33SB02 using soil venting, UST removal, and LUCs. The reliability of soil venting would be high in the protection of human health and the environment because the source of risk would be permanently removed from the site and/or irreversibly treated in place. There would be no significant risks to human health and the environment during implementation of Alternative S33-3 if normal dust control procedures are conducted, the discharge of the soil venting system is properly treated, and direct worker contact with impacted soils is minimized; therefore, for overall protection of human health and environmental resources both on and off base, Alternative S33-3 would provide a high level of protection.

Compliance with ARARs

All ARARs applying to source control and reducing the risk to human health would be satisfied by Alternative S33-3. Over time Alternative S33-3 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives on base including the State of Florida SCTLs by treatment of organics and minimizing exposure pathways for inorganics. Removal of the UST would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public would define the degree of worker protection and emission control required during implementation of Alternative S33-3.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence of Alternative S33-3 through in situ soil venting would be high assuming (1) all impacted soil near sample location 33SB02 is identified and (2) soil venting is successful in treating the organic constituents. Soil venting would enhance in situ

biodegradation and provide long-term effectiveness. Removal of the USTs as a potential source would prevent future soil contamination once the USTs are removed and for this reason lends to the overall long-term effectiveness and permanence of the remedy. Five-year reviews would be required to assess the effectiveness of soil venting in removing organic constituents from the soil.

The adequacy and reliability of LUCs would be sufficient to restrict access to remaining impacted soils. Existing fencing may require replacement and/or repair as a result of wear, weather damage, vehicular accidents, and/or vandalism. Constituent concentrations and residual risks would decrease with the operation of the soil venting system and would continue to decrease after system operation has ceased because of the promotion of in situ biodegradation. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Soil venting would reduce the toxicity and volume of organic constituents through volatilization, biodegradation, and the removal of the constituents from the vadose zone under a vacuum. Any carbon adsorption units used for soil venting offgas capture would require treatment to reduce the volume and ensure proper disposal of the adsorbed organic constituents. Minor organic constituent residuals below action levels would remain after implementation and operation of Alternative S33-3; however, these residuals would naturally degrade over time through the promotion of in situ biodegradation provided by in situ soil venting.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from construction of Alternative S33-3 would be controllable and would result from the removal of the USTs and the installation and operation of in situ soil venting. Health and safety issues include dust control, emissions control, and proper decontamination procedures. Construction time to implement Alternative S33-3 would be approximately 1 year. Minimal risk to the community would be expected from in situ soil venting system operation. The time required to achieve remedial response objectives is estimated to be less than 3 years.

Implementability

The RPOs associated with Alternative S33-3 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs. In situ soil venting would require drilling, trenching, and treatment area construction.

O&M activities associated with Alternative S33-3 would be of low intensity, involving periodic sampling and analysis of the soil venting system, offgas adsorption material handling and/or treatment, and monitoring. All components of Alternative S33-3 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S33-3 in minimizing exposure pathways and reducing constituent concentrations. Future remedial actions would not be hindered by the implementation of Alternative S33-3; however, modifications of LUCs, and/or the addition or closure of soil venting systems may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $203,140 including a capital cost of $80,495, $24,525 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

7.4.1.4 Alternative S33-4: UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs

7.4.1.4.1 Description

Alternative S33-4 would minimize the need for long-term management because the UST and all subsurface soil containing COCs exceeding PRGs would be removed. LUCs are described in Appendix C. Monitoring would consist of ensuring LUCs remain in place. Bulk excavation would be used to remove all impacted subsurface soil exceeding PRGs. The excavation would consist of removing soil from the surface down to approximately 50 feet bgs. The estimated excavation would be approximately 1,559 yd^3 of which approximately 1,117 yd^3 would be contaminated. After all impacted soil within the excavation areas containing COCs exceeding PRGs is removed, the excavated area would be backfilled with clean, native material, compacted, and revegetated or paved with no long-term monitoring or maintenance required. Disposal in an off-base TSDF and/or landfill would be used for the excavated soil from Site 33. The UST would be cleaned and recycled or otherwise properly disposed. Some pretreatment of the excavated soils may be necessary to meet LDRs and would be provided by the TSDF, if required.

7.4.1.4.2 Assessment

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative S33-4 would provide protection of human health and the environment by removal and off-base disposal of the UST and all soil containing COCs exceeding PRGs and by minimizing all exposure pathways. Immediate and future risk from any potential industrial land use exposure would be reduced by the removal of all impacted soil and its subsequent off-base disposal. The reliability of excavation and off-base disposal is certain in the protection of human health and the environment because the source of risk would be permanently removed from the site. There would be no significant risks to human health and the environment during implementation of Alternative S33-4 if normal dust control, runoff control, excavation, and transportation procedures are conducted and direct worker contact with impacted soils is minimized. Therefore, Alternative S33-4 would provide a high level of protection of human health and environmental resources both on and off base.

Compliance with ARARs

All ARARs applying to source control and reducing risk to human health and the environment would be satisfied by Alternative S33-4. Alternative S33-4 would satisfy chemical- and action-specific ARARs and TBCs for achieving remedial objectives including the State of Florida SCTLs; however, pretreatment of excavated soil may be necessary to meet LDRs which would be provided by the TSDF, if required. Removal of the UST would minimize a potential source of contamination. Constituent exposure and chemical-specific ARARs and TBCs for workers and the public will define the degree of worker protection and emission control required during implementation of Alternative S33-4.

Balancing Criteria

Long-Term Effectiveness and Permanence

The degree of long-term effectiveness and permanence provided by Alternative S33-4 would be low since contaminants are not treated. However, excavation and off-base disposal of all impacted soil provides long-term effectiveness and permanence by minimizing exposure pathways, assuming all impacted soil exceeding PRGs is identified, excavated, and disposed. Removal of the UST as a potential source would prevent future soil contamination and for this reason lends to the overall long-term effectiveness and permanence of the remedy.

The adequacy and reliability of LUCs would be sufficient to restrict access to any residuals remaining in the soils. Long-term management would consist of LUCs and monitoring and would be expected to last 30 years.

Reduction of Mobility, Toxicity, or Volume through Treatment

Excavation and off-base disposal of all impacted soil would reduce the mobility of constituents by physically removing them from the site. The toxicity of the excavated constituents may be reduced through treatment in an off-base TSDF before landfill disposal. Minor inorganic constituent residuals would remain below action levels after the implementation of Alternative S33-4. No treatment residuals would be produced by the implementation of Alternative S33-4.

Short-Term Effectiveness

The short-term risk to workers, on-base personnel, and the public from implementation of Alternative S33-4 would be controllable and would result from the excavation, transportation, and off-base disposal of impacted soil. Health and safety issues include dust control, runoff control, and proper decontamination procedures. Construction time to implement Alternative S33-4 would be approximately 90 days. Minimal risk to the community would be expected from excavation, transportation, and disposal of the UST and impacted soil. Alternative S33-4 would be immediately effective in minimizing all exposure pathways. The time required until remedial response objectives are achieved is estimated to be less than 1 year.

Implementability

The RPOs associated with Alternative S33-4 would be implementable, and vendors are available to conduct this work. Soil sampling would be required to finalize the extent of impacted soil for the placement of LUCs and the areas of excavation. UST removal and excavation and disposal of Site 33 soils would require clean, native backfill to replace excavated materials; heavy construction equipment; sufficient area for staging/maneuvering; and accommodation for underground utilities. Excavation may be required around utilities. All components of Alternative S33-4 would be reliable in the protection of human health and the environment. The need for future remedial actions would depend on the effectiveness of Alternative S33-4 in minimizing the source areas. Future remedial actions would not be hindered by the implementation of Alternative S33-4; however, modification of LUCs may be required. Coordination with regulatory agencies would be obtainable.

Cost

The estimated present worth total project cost is $393,959 including a capital cost of $336,869, $0 per year for short-term O&M, $7,375 for 5-year reviews, and $2,839 for monitoring of LUCs. Appendix E presents the estimated cost for implementing this alternative.

7.4.2 Summary of Site 33 Soil

As part of the detailed analyses of alternatives for Site 33, one alternative involving no action, one alternative involving source removal and containment/limited action, one alternative with source removal and minimal treatment, and one alternative minimizing long-term management have been evaluated. Alternative S33-1 is the only alternative that does not satisfy the threshold criteria to the full extent but is retained for comparison purposes. Alternatives S33-2 through S33-4 provide varying degrees of protection and treatment and would be viable for the selection as a preferred alternative. The relative merits of all Site 33 alternatives are evaluated in Section 7.5.

7.5 COMPARATIVE ANALYSIS FOR SOIL ALTERNATIVES

In contrast to the preceding evaluation (Section 7.4) in which each alternative was analyzed independently without consideration of other alternatives, the comparative analysis (presented in this section) evaluates the relative performance of each alternative in relation to each specific evaluation criterion. The comparative analysis focuses on the key differences between the alternatives and attempts to highlight critical issues of concern to the decision maker in selecting the preferred remedial action. The following sections provide a summary of the key comparative features and performance of each site-specific alternative relative to the other alternatives with respect to the CERCLA criteria (see Table 1-1). Additional discussion of the comparative analysis is provided in Section 2.5.

A summary of the comparative analyses and costs for the Site 33 alternatives is presented in Table 7-9. This comparison between alternatives is based on the CERCLA evaluation criteria.

7.5.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether an alternative provides adequate protection of human health and the environment and is described in Appendix D.

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 1 OF 4

Criteria	Alternative S33-1 No Action	Alternative S33-2 UST Removal and LUCs	Alternative S33-3 UST Removal, Soil Venting, and LUCs	Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No reduction in risk.	Provides a high level of protection. UST removal reduces risk by removing potential source. LUCs reduce risk from residuals.	Provides a high level of protection. UST removal reduces risk by removing potential source. LUCs and treatment reduce risk from residuals.	Provides highest level of protection. LUCs reduce risk from residuals. UST removal and soil excavation and disposal reduce risk of potential exposure.
Environmental Protection	Allows potential environmental impacts from fugitive dust.	Natural attenuation reduces constituent concentrations of deeper impacted soils over time.	Natural attenuation and soil venting reduce constituent concentrations of impacted soils over time.	Excavation and disposal will reduce all concentration levels in a short period of time.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	Does not meet ARARs.	Meets ARARs using LUCs to minimize exposure pathways.	Meets ARARs for organics in 2 years and inorganics by minimizing exposure pathways.	Meets ARARs within 1 year.
Compliance with Action-Specific ARARs	Not applicable	Meets ARARs over time.	Meets ARARs if proper PPE used during construction of in situ venting system.	Meets ARARs if proper PPE used during excavation and disposal.
Compliance with Location-Specific ARARs	Not applicable	Not applicable	Not applicable	Not applicable
Compliance with Other Criteria	Not applicable	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements	Meets NAS Whiting Field requirements
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	Natural attenuation may decrease risk; however, risk is significant for >30 years.	UST removal reduces risk by removing potential source. Natural attenuation may decrease remaining risk; however, risk due to subsurface impacted soil is significant for an estimated 30 years.	Provides medium level of long-term residual risk reduction. Risk reduced by soil venting of the impacted soil and UST removal. Any residual concentrations will be reduced over time through natural attenuation; however, risk due to subsurface impacted soil is significant for an estimated 30 years.	Provides highest level of long-term residual risk reduction. Risk eliminated or reduced by UST removal and soil excavation and off-site disposal. Any residual concentrations may be reduced over time through natural attenuation.

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 2 OF 4

Criteria	Alternative S33-1 No Action	Alternative S33-2 UST Removal and LUCs	Alternative S33-3 UST Removal, Soil Venting, and LUCs	Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs
Long-Term Reliability of Controls	Not applicable	Provides a high level of reliability if existing cover is maintained.	Provides a high level of reliability because of proven technology, and if the existing cover is maintained	Provides highest level of reliability. Controls are adequate and reliable.
Need for 5-Year Review	Required	Required	Required	Required
Prevention of Exposure to Residuals	All constituents remain. Direct contact and incidental ingestion are not controlled.	Exposure risk reduced by LUCs and the existing soil cover.	Exposure risk reduced by LUCs and the existing soil cover.	Exposure to residuals is reduced by excavation and disposal as well as enforced LUCs.
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	Not applicable	The existing soil cover may require replacement or repair.	The existing soil cover may require replacement or repair.	No technical components required.
Long-Term Management	Not applicable	Management required for estimated 30 years.	Management required for estimated 30 years.	Minimal management required for estimated 30 years.
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	None	Remaining contaminants may naturally attenuate over time. The existing soil cover is for containment only.	Organic compound removal is about 90%. Inorganic compounds may naturally attenuate over time. The existing soil cover is for containment only.	All impacted soil exceeding Remediation Goals is excavated and disposed. Removal efficiency estimated >95%.
Reduction in Mobility, Toxicity, or Volume	Toxicity may be reduced through natural attenuation.	Mobility reduced by the existing soil cover. Toxicity of remaining soils may be reduced through natural attenuation.	Mobility reduced by the existing soil cover. Toxicity is reduced by treatment and natural attenuation.	Mobility reduced by excavation and disposal. Toxicity of excavated soils may be reduced in an off-site TSDF.
Irreversibility of Treatment	Natural attenuation is an irreversible process.	Natural attenuation is an irreversible process.	Soil venting and natural attenuation are irreversible processes.	Off-site TSDF treatment is an irreversible process.
Type and Quantity of Residuals Remaining after Treatment	All residuals of inorganics left from natural attenuation.	Minor inorganic and organic residuals remain above industrial action levels in subsurface soil.	Residuals of inorganics left from soil venting and natural attenuation remain above industrial action levels.	No inorganic residuals remain above action levels.

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

Criteria	Alternative S33-1 No Action	Alternative S33-2 UST Removal and LUCs	Alternative S33-3 UST Removal, Soil Venting, and LUCs	Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	Not applicable	Not applicable	Temporary increase in dust emissions during installation of soil venting system can be controlled by proper construction techniques.	Temporary increases in dust emissions through excavation and disposal; controlled by proper construction techniques.
Worker Protection During Implementation	Not applicable	Not applicable	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.	Workers use PPE, as required, to prevent dermal contact as well as dust inhalation and ingestion during construction.
Environmental Impacts	No unacceptable impacts from existing conditions.	No unacceptable impacts from existing conditions.	Construction of treatment system can generate impacted soil, runoff, and fugitive dust. Off-gases may contain low concentrations of contaminants.	Excavation of impacted soils can generate runoff and fugitive dust.
Construction Time[a]	Not applicable	Less than 1 year	Less than 1 year	Less than 1 year
Time Until Remedial Response Objectives Are Achieved	Estimated at 30 years.	Estimated at 1 year.	Estimated at 3 years.	Estimated at 1 year.
Implementability				
Ability to Construct and Operate the Technology	Not applicable	Many contractors available to remove USTs	Many contractors available to remove USTs and construct and operate soil venting system.	Many contractors available to remove USTs and provide excavation. Fewer contractors that accept impacted soil for disposal.
Reliability of Technology	Not applicable	LUCs are reliable for restricting soil access immediately after implementation.	LUCs are reliable for restricting soil access immediately after implementation. Soil venting is a reliable technology for treating organic contaminants.	LUCs are reliable for restricting soil access immediately after implementation. Excavation and disposal are reliable.
Ease of Undertaking Additional Remedial Action, if Required	Easily implementable	Implementable	Implementable	Implementable

TABLE 7-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 33

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 4 OF 4

Criteria	Alternative S33-1 No Action	Alternative S33-2 UST Removal and LUCs	Alternative S33-3 UST Removal, Soil Venting, and LUCs	Alternative S33-4 UST Removal, Subsurface Soil (exceeding PRGs) Removal, and LUCs
Ability to Monitor Effectiveness	Not applicable	Monitoring gives notice of potential presence of contaminants in subsurface strata; monitoring also indicates excavation effectiveness.	Monitoring gives notice of treatment efficiency and progress of remediation.	Monitoring indicates excavation effectiveness and removal of contaminated areas.
Permitting Requirements	Not applicable	None	Permit for air emissions may be required.	Transportation and Disposal Permit will be required.
Coordination with Other Agencies	Not applicable	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.	All permits and/or permit modifications are obtainable.
Availability of Services and Capabilities	Not applicable	Readily available	Available	Readily Available
Availability of Equipment, Specialists, and Materials	Not applicable	Readily available	Available	Readily Available
Cost[b]				
Capital Costs	$0	$46,226	$80,495	$336,869
Short-Term O&M	$0	$0	$24,525	$0
Long-Term O&M				
5-Year Review	$7,375	$7,375	$7,375	$7,375
Land-Use Controls	$0	$2,839	$2,839	$2,839
Total Project Present Worth Cost	$18,008	$103,316	$203,140	$393,959

[a] Does not include testing or treatability studies.

[b] Includes capital costs, short- and long-term O&M present worth, and contingency. Present worth cost details are provided in Appendix E.

The existing exposure pathways to humans for Site 33 are dermal contact, inhalation, and incidental ingestion. There are no unacceptable exposure pathways for ecological. Potential for the constituents to leach and impact groundwater is not considered in this FS but will be considered in the Site 40, Basewide Groundwater FS. For an alternative to be protective of human health and the environment, it must protect humans from all potential exposure pathways.

Alternative S33-4 would provide the highest levels of overall protection through UST removal, LUCs, and physical removal of the COCs exceeding PRGs in subsurface soil within Site 33, reducing the risks associated with all potential exposure pathways in a short period of time.

Alternative S33-4 would provide direct and immediate protection, primarily through UST removal, LUCs, and the physical removal of all impacted soil exceeding PRGs. Alternatives S33-3 and S33-2 would provide protection of human health and the environment through UST removal, LUCs, and containment (by the existing soil/concrete cover) of the remaining impacted soil. The existing soil/concrete cover would ensure reduced risk from all potential pathways but would not provide active remediation. This protection would be provided by reducing the risk of exposure to soil from ingestion, inhalation, and dermal contact through LUCs. Alternative S33-3 would also protect human health and the environment to some extent through in situ soil venting.

Table 7-9 presents a summary for the overall protectiveness of human health and the environment for all Site 33 alternatives.

7.5.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether an alternative meets all Federal and state ARARs and is described in Appendix D.

Alternatives S33-2 through S33-4 would comply with chemical-specific ARARs and TBCs concerning worker and public safety by providing worker protection and emission control during construction and operation. Over time, these alternatives would meet PRGs within Site 33. Table 7-9 presents a summary of ARARs compliance for each alternative.

7.5.3 Long-Term Effectiveness and Permanence

This criterion addresses (1) the effectiveness of an alternative in terms of residual risk remaining at the site after response objectives have been completed (e.g., after impacted soil management activities are

concluded) and (2) the reliability and maintenance of controls used to manage the risk posed by treatment residuals and untreated wastes.

Magnitude of Residual Risks

Alternative S33-4 would provide a higher level of long-term effectiveness and permanence than Alternatives S33-2 and S33-3 by providing active removal of impacted soil within Site 33 exceeding inorganic PRGs, thereby reducing residual risk from all impacted soil left at the site. Alternative S33-4 would be expected to significantly reduce all residual risks to acceptable levels to receptors as well as to provide long-term reliability through the physical removal and off-base disposal of impacted soil and the UST. Alternative S33-3 would provide a higher level of long-term effectiveness and permanence than Alternative S33-2 due to the in situ treatment of the TPH. Alternative S33-2 would provide containment for any constituents. Alternatives S33-2 and S33-3 would minimize risks to the receptors from direct exposure to contaminants at depth because they are containment alternatives. Alternatives S33-2 and S33-3 would leave some contaminants untreated; thus, the effectiveness for residual risk reduction would be low. Evaluation, modeling, and sampling would be required to determine residual risk reduction by Alternatives S33-2 and S33-3. Alternative S33-2 would require long-term management. All alternatives would require 5-year reviews for as long as risk from exposure remains.

Adequacy and Reliability of Controls

All alternatives (except No Action) would be adequate and reliable in controlling exposure to any residuals that may remain at the site. Alternative S33-4 would permanently remove the source of risk and, therefore, would require no future controls to prevent exposure for industrial use. Alternative S33-4 would provide the highest level of reliability and lowest level of future maintenance of controls because of the removal and off-base disposal of all of the impacted soil and the UST. Alternatives S33-2 and S33-3 would involve the use of an existing soil cover, which does not actively remediate constituents but would be adequate and reliable in controlling exposure to any remaining constituents. Because Alternatives S33-2 and S33-3 would reduce the risks through containment, future maintenance and monitoring of the cover would be required.

No alternative, except No Action, for Site 33 would produce or leave residuals requiring treatment and/or disposal posing any future potential risk to the environment. Even though no ecological impact is expected, it is not known what long-term effects to the environment may occur.

Table 7-9 provides a summary of the comparative evaluation of the long-term effectiveness and permanence, including magnitude of future residual risk, long-term reliability of controls, prevention of exposure to residuals, potential need for replacement of technical components, and long-term management requirements, of each Site 33 alternative.

7.5.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

This criterion addresses the degree to which alternatives permanently and significantly reduce mobility, toxicity, or volume of hazardous constituents in the soil and is described in Appendix D.

Alternative S33-4 would permanently and significantly reduce mobility of chemical constituents to the highest level of the alternatives evaluated for Site 33. Alternative S33-4 is considered a permanent remedy and is designed to provide the greatest reduction of risk through removal and off-base disposal. No COCs at concentrations greater than PRGs would remain at the site under Alternative S33-4. Alternatives S33-2 and S33-3 would reduce the mobility of impacted soil through containment, but the existing soil cover would not provide active treatment of remaining soils to reduce toxicity and volume. Alternative S33-3 would decrease toxicity through treatment of the organics while Alternative S33-2 would not. All the alternatives (except No Action) include removal of the USTs. The concentrations of toxic constituents may eventually be reduced through natural attenuation. Neither of the alternatives would produce any residuals from treatment (e.g., sludges or soil-washing solutions).

Table 7-9 provides a summary of the comparative evaluation of the constituents destroyed; reduction of toxicity, mobility, or volume; irreversibility of treatment; and residuals remaining after treatment for each Site 33 alternative.

7.5.5 Short-Term Effectiveness

This criterion addresses the effects of each alternative during the implementation and construction phases until remedial response objectives are achieved (e.g., cleanup levels are achieved) and is described in Appendix D.

More complex and involved alternatives, such as Alternatives S33-3 and S33-4, would take progressively longer to protect human health because of the time needed for treatment. Alternatives S33-2 and S33-4 have an estimated remedial time to reach objectives of less than 1 year; Alternative S33-3 has an estimated time of 3 years. Alternative S33-4 would create short-term risks of worker exposure and the potential of fugitive dust during excavation and transportation. These risks appear manageable using

appropriate engineering and construction management controls. The environmental impacts (e.g., fugitive dust, and runoff) are expected to be minimal during implementation of all alternatives. Engineering controls would minimize any environmental impacts. Table 7-9 provides a summary of the comparative evaluation of the short-term effectiveness, including construction time, remedial time to completion, community protection during implementation, and worker protection during implementation, of each Site 33 alternative.

7.5.6 Implementability

This criterion addresses whether there are any technical problems or administrative issues associated with an alternative that would halt or delay the remediation and is described in Appendix D.

All the alternatives would be easily implementable. Alternative S33-4 may require Federal, state, or local permits because it includes excavation, transportation, and off-base disposal of the UST and impacted soils. In addition, any alternative involving phased construction would require appropriate integrated scheduling of any required permits and construction. Alternatives S33-2 through S33-4 would require coordination with other agencies for LUCs and any required permitting. All remedial technologies are proven and reliable.

Future remedial actions would be easily implementable for Alternative S33-4 because the site would remain at or be returned to original conditions. Future actions would also be implementable for Alternatives S33-2 and S33-3.

Alternatives S33-2 and S33-3 would require monitoring of the existing soil/concrete cover for erosion and potential exposure. Alternative S33-4 would not require any long-term monitoring once the remediation is complete. In addition, monitoring for inhalation of fugitive dust would be performed during construction to protect workers and determine appropriate PPE. Exposure from dermal contact and ingestion of soil during construction would be minimized by use of appropriate PPE.

Alternative S33-4 would require the use of a TSDF or landfill for excavated impacted soils. TSDFs are available and have sufficient capacity to meet the requirements of all alternatives. Equipment, specialists, and materials for all alternatives are readily available.

Table 7-9 provides a summary of the comparative evaluation of implementability, including the ability to construct and operate the technology; reliability of the technology; ease of implementation of future remedial actions; ability to monitor effectiveness; ability to coordinate with other agencies; availability of

services and capacities; and availability of equipment, specialists, and materials, for each Site 33 alternative.

7.5.7 Cost

This criterion addresses the "study estimate" cost for each alternative and is described in Appendix D. Costs evaluated include capital, O&M, and present worth.

The estimated total project present worth values reflect a common degree of complexity and/or remedial time between the alternatives. Alternative S33-4 has the highest cost, followed by Alternatives S33-3 and S33-2, respectively. Table 7-9 provides the capital, short- and long-term O&M, and total project present worth costs for each Site 33 alternative. Detailed cost estimates for each alternative are provided in Appendix E.

7.5.8 State Acceptance

The state regulatory agency, FDEP, has reviewed and approved the FS. The FDEP and USEPA comments and Navy responses to the comments are provided in Appendix F.

7.5.9 Community Acceptance

The information concerning this modifying criterion will be provided in the ROD following comments on the FS report and the Proposed Plan for Site 33.

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APPENDIX A

STATE OF FLORIDA
(CHAPTER 62-777, F.A.C.)
SOIL CLEANUP TARGET LEVELS

Table 2 - Technical Report

Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Acenaphthene	83-32-9	1900	18000	2.1	0.7	0.7	21	-Liver
Acenaphthylene	208-96-8	1100	11000	27	0.7	0.7	270	-Body Weight -Liver
Acephate	30560-19-1	64	130	0.03	0.8	0.8	0.3	-Carcinogen -Neurological
Acetone	67-64-1	780	5500	2.8	6.8	6.8	28	-Kidney -Liver -Neurological
Acetonitrile	75-05-8	120	960	2	80	80	20	-Blood -Liver
Acetophenone	98-86-2	2700	24000	3.9	44	44	39	-None Specified
Acrolein	107-02-8	0.04	0.3	0.06	0.002	0.002	0.6	-Nasal
Acrylamide	79-06-1	0.1	0.3	0.004	0.02	0.02	0.04	-Carcinogen -Neurological
Acrylonitrile	107-13-1	0.3	0.5	0.004	0.2	0.2	0.04	-Carcinogen -Nasal -Reproductive
Alachlor	15972-60-8	12	36	0.02	0.006	0.006	0.2	-Blood -Carcinogen
Aldicarb [or Temik]	116-06-3	56	760	0.03	0.004	0.004	0.3	-Neurological
Aldrin	309-00-2	0.07	0.3	0.5	0.01	0.01	5	-Carcinogen -Liver
Allyl alcohol	107-18-6	62	460	1	0.02	0.02	10	-Kidney -Liver
Aluminum	7429-90-5	72000	*	***	***	***	***	-Body Weight
Aluminum phosphide	20859-73-8	31	730	***	***	***	***	-Body Weight
Ametryn	834-12-8	590	9300	0.8	0.08	0.08	8	-Liver
Ammonia (a)	7664-41-7	550	3700	570	4	NA	5700	-Respiratory
Aniline	62-53-3	14	100	0.03	0.02	0.02	0.3	-Blood -Carcinogen
Anthracene	120-12-7	18000	260000	2500	0.7	0.7	25000	-None Specified

Table 2 - Technical Report

Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Antimony (b)	7440-36-0	26	240	5	***	***	50	-Blood -Mortality
Arsenic (b)	7440-38-2	0.8	3.7	29	***	***	290	-Carcinogen -Cardiovascular -Skin
Atrazine	1912-24-9	4	12	0.06	0.04	0.04	0.6	-Body Weight -Carcinogen
Azobenzene	103-33-3	8.2	24	0.4	0.06	0.06	4	-Carcinogen
Barium (b)	7440-39-3	110**	87000	1600	***	***	16000	-Cardiovascular
Bayleton	43121-43-3	2000	29000	4.8	11	11	48	-Blood -Body Weight
Benomyl	17804-35-2	3600	64000	3.1	0.03	0.03	31	-Developmental
Bentazon	25057-89-0	1500	18000	1.2	NA	NA	12	-Blood
Benzaldehyde	100-52-7	2200	18000	4.8	0.4	0.4	48	-Gastrointestinal -Kidney
Benzene	71-43-2	1.1	1.6	0.007	0.5	0.5	0.07	-Carcinogen
Benzenethiol	108-98-5	0.1	1	0.3	NA	NA	3	-Liver
Benzo(a)anthracene	56-55-3	1.4	5	3.2	0.7	0.7	32	-Carcinogen
Benzo(a)pyrene	50-32-8	0.1	0.5	8	1.2	1.2	80	-Carcinogen
Benzo(b)fluoranthene	205-99-2	1.4	4.8	10	1.6	1.6	100	-Carcinogen
Benzo(g,h,i)perylene	191-24-2	2300	41000	32000	4.8	4.8	320000	-Neurological
Benzo(k)fluoranthene	207-08-9	15	52	25	1.6	1.6	250	-Carcinogen
Benzoic acid	65-85-0	150000	*	110	36	36	1100	-None Specified
Benzotrichloride	98-08-7	0.04	0.07	0.003	0.0002	0.0002	0.03	-Carcinogen
Benzyl alcohol	100-51-6	23000	610000	9.5	2.3	2.3	95	-Gastrointestinal

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Benzyl chloride	100-44-7	0.8	1.2	0.006	0.03	0.03	0.06	-Carcinogen
Beryllium (b)(c)	7440-41-7	120	800	63	***	***	630	-Carcinogen -Gastrointestinal -Respiratory
Bidrin [or Dicrotophos]	141-66-2	5.5	67	0.005	0.1	0.1	0.05	-Developmental
Biphenyl, 1,1- [or Diphenyl]	92-52-4	2300	26000	0.2	5.8	5.8	2	-Kidney
Bis(2-chloroethyl)ether	111-44-4	0.3	0.4	0.02	0.05	0.05	0.2	-Carcinogen
Bis(2-chloroisopropyl)ether	108-60-1	4.4	7.3	0.07	0.003	0.003	0.7	-Blood -Carcinogen
Bis(2-ethylhexyl)phthalate [or DEHP]	117-81-7	76	280	3600	12	12	36000	-Carcinogen -Liver
Bisphenol A	80-05-7	3300	51000	11	1.7	1.7	110	-Body Weight
Boron	7440-42-8	7000	160000	***	NA	NA	***	-Reproductive -Respiratory
Bromacil	314-40-9	5700	72000	0.6	0.6	0.6	6	-Body Weight
Bromochloromethane	74-97-5	57	390	0.6	NA	NA	6	-None Specified
Bromodichloromethane	75-27-4	1.4	2	0.004	0.1	0.1	0.04	-Carcinogen -Kidney
Bromoform	75-25-2	48	84	0.03	2.7	2.7	0.3	-Carcinogen -Liver
Bromomethane [or Methyl bromide]	74-83-9	2.2	15	0.05	0.2	0.2	0.5	-Gastrointestinal
Butanol, 1-	71-36-3	1300	10000	3	110	110	30	-Neurological
Butanone, 2- [or MEK]	78-93-3	3100	21000	17	490	490	170	-Developmental
Butyl benzyl phthalate, n-	85-68-7	15000	320000	310	56	56	3100	-Liver
Butylate	2008-41-5	2100	22000	5.2	0.2	0.2	52	-Liver
Butylphthalyl butylglycolate	85-70-1	74000	*	4200	NA	NA	42000	-None Specified

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Cadmium (b)	7440-43-9	75**	1300	8	***	***	80	-Carcinogen -Kidney
Calcium cyanide	592-01-8	3100	73000	***	NA	NA	***	-Body Weight -Neurological -Thyroid
Captan	133-06-2	190	410	3.6	0.03	0.03	36	-Body Weight -Carcinogen
Carbaryl [or Sevin]	63-25-2	6800	120000	8.7	0.0007	0.0007	87	-Kidney -Liver
Carbazole	86-74-8	53	190	0.6	6.5	6.5	6	-Carcinogen
Carbofuran	1563-66-2	58	430	0.2	0.0006	0.0006	2	-Neurological -Reproductive
Carbon disulfide	75-15-0	200	1400	5.6	0.8	0.8	56	-Developmental -Neurological
Carbon tetrachloride	56-23-5	0.4	0.6	0.04	0.06	0.06	0.4	-Carcinogen -Liver
Carbophenothion [or Trithion]	786-19-6	9.8	180	13	1.5	1.5	130	-Neurological
Chlordane	57-74-9	3.1	12	9.6	0.003	0.003	96	-Carcinogen -Liver
Chlorine	7782-50-5	7800	200000	***	***	***	***	-Body Weight
Chlorine cyanide [or Cyanogen chloride]	506-77-4	910	7200	71	0.3	0.3	710	-Body Weight -Neurological -Thyroid
Chloro-1,3-butadiene [or Chloroprene]	126-99-8	2.6	17	1.5	NA	NA	15	-Body Weight -Hair Loss -Nasal
Chloro-m-cresol, p- [or 4-chloro-3-methylphenol]	59-50-7	410	4400	0.4	0.6	0.6	4	-Body Weight
Chloroacetic acid	79-11-8	87	920	0.07	NA	NA	0.7	-Cardiovascular
Chloroaniline, 4-	106-47-8	190	2000	0.2	0.02	0.02	2	-Spleen
Chlorobenzene	108-90-7	30	200	1.3	0.2	0.2	13	-Liver
Chlorobenzilate	510-15-6	3.9	14	0.08	0.07	0.07	0.8	-Body Weight -Carcinogen
Chloroform	67-66-3	0.4	0.5	0.03	2.8	2.8	0.3	-Carcinogen -Liver

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Chloromethane	74-87-3	1.7	2.3	0.01	2.3	2.3	0.1	-Carcinogen
Chloronaphthalene, beta-	91-58-7	4000	49000	260	NA	NA	2600	-Liver -Respiratory
Chloronitrobenzene, p-	100-00-5	28	55	3.7	1.6	1.6	37	-Carcinogen
Chlorophenol, 2-	95-57-8	82	640	0.7	2.5	2.5	7	-Reproductive
Chlorophenol, 3-	108-43-0	280	3400	0.2	3.1	3.1	2	-None Specified
Chlorophenol, 4-	106-48-9	220	2400	0.04	1.2	1.2	0.4	-None Specified
Chlorothalonil [or Bravo]	1897-45-6	88	280	0.2	0.06	0.06	2	-Carcinogen -Kidney
Chlorotoluene, o-	95-49-8	120	850	2.8	7.7	7.7	28	-Body Weight
Chlorotoluene, p-	106-43-4	100	730	2.5	NA	NA	25	-None Specified
Chlorpropham	101-21-3	13000	200000	51	7	7	510	-Bone Marrow -Kidney -Liver -Spleen
Chlorpyrifos	2921-88-2	220	4200	15	0.001	0.001	150	-Neurological
Chromium (hexavalent) (b)	18540-29-9	210	420	38	***	***	380	-Carcinogen -Respiratory
Chrysene	218-01-9	140	450	77	0.7	0.7	770	-Carcinogen
Cobalt	7440-48-4	4700	110000	***	NA	NA	***	-Cardiovascular -Immunological -Neurological -Reproductive
Copper	7440-50-8	110**	76000	***	***	***	***	-Gastrointestinal
Coumaphos	56-72-4	18	300	0.3	0.0007	0.0007	3	-Neurological
Crotonaldehyde	123-73-9	0.07	0.1	17	NA	NA	170	-Carcinogen
Cumene [or Isopropyl benzene]	98-82-8	160	1100	0.2	56	56	2	-Adrenals -Kidney
Cyanide (potassium salt) (b)	57-12-5	30**	39000	40	***	***	400	-Body Weight -Neurological -Thyroid

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Cyanogen	460-19-5	340	2500	2000	NA	NA	20000	-None Specified
Cycloate	1134-23-2	240	2600	0.7	2.5	2.5	7	-Neurological
Cyclohexanone	108-94-1	68000	510000	150	110	110	1500	-Body Weight
Cypermethrin	52315-07-8	750	14000	70	0.005	0.005	700	-Gastrointestinal
DDD, 4,4'-	72-54-8	4.6	18	4	0.1	0.1	40	-Carcinogen
DDE, 4,4'-	72-55-9	3.3	13	18	0.1	0.1	180	-Carcinogen
DDT, 4,4'-	50-29-3	3.3	13	11	0.06	0.06	110	-Carcinogen -Liver
Di-n-butylphthalate	84-74-2	7300	140000	47	1.5	1.5	470	-Mortality
Di-n-octylphthalate	117-84-0	1500	27000	480000	NA	NA	4800000	-Kidney -Liver
Diallate	2303-16-4	17	56	0.6	NA	NA	6	-Carcinogen
Diazinon	333-41-5	55	760	0.02	0.00005	0.00005	0.2	-Neurological
Dibenz(a,h)anthracene	53-70-3	0.1	0.5	30	4.7	4.7	300	-Carcinogen
Dibenzofuran	132-64-9	280	5000	15	36	36	150	-None Specified
Dibromo-3-chloropropane, 1-2- [or DBCP]	96-12-8	0.8	2.7	0.001	NA	NA	0.01	-Carcinogen -Reproductive
Dibromochloromethane	124-48-1	1.4	2.1	0.003	0.2	0.2	0.03	-Carcinogen -Liver
Dibromoethane, 1,2- [or EDB]	106-93-4	0.01	0.04	0.0001	0.07	0.07	0.001	-Carcinogen -Reproductive
Dicamba	1918-00-9	1800	24000	2.6	2.4	2.4	26	-Developmental
Dichloroacetic acid	79-43-6	200	2300	0.2	8.1	8.1	2	-None Specified
Dichloroacetonitrile	3018-12-0	170	1400	0.03	NA	NA	0.3	-None Specified

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Dichlorobenzene, 1,2-	95-50-1	650	4600	17	2.8	2.8	170	-Body Weight
Dichlorobenzene, 1,3-	541-73-1	27	180	0.3	2.8	2.8	3	-None Specified
Dichlorobenzene, 1,4-	106-46-7	6	9	2.2	2.9	2.9	22	-Carcinogen -Liver
Dichlorobenzidine, 3,3'-	91-94-1	2.1	6.3	0.4	0.002	0.002	4	-Carcinogen
Dichlorodifluoromethane	75-71-8	56	370	44	NA	NA	440	-Body Weight -Liver
Dichloroethane, 1,1-	75-34-3	290	2000	0.4	NA	NA	4	-Kidney
Dichloroethane, 1,2- [or EDC]	107-06-2	0.5	0.7	0.01	0.02	0.02	0.1	-Carcinogen
Dichloroethene, 1,1-	75-35-4	0.09	0.1	0.06	0.03	0.03	0.6	-Carcinogen -Liver
Dichloroethene, cis-1,2-	156-59-2	19	130	0.4	NA	NA	4	-Blood
Dichloroethene, trans-1,2-	156-60-5	31	210	0.7	75	75	7	-Blood -Liver
Dichlorophenol, 2,3-	576-24-9	180	2500	0.2	1.2	1.2	2	-None Specified
Dichlorophenol, 2,4-	120-83-2	130	1300	0.005	0.1	0.1	0.05	-Immunological
Dichlorophenol, 2,5-	583-78-8	200	3000	0.5	4.3	4.3	5	-None Specified
Dichlorophenol, 2,6-	87-65-0	170	2200	0.1	2.5	2.5	1	-None Specified
Dichlorophenol, 3,4-	95-77-2	200	3100	0.03	3.9	3.9	0.3	-None Specified
Dichlorophenoxy acetic acid, 2,4-	94-75-7	670	11000	0.7	0.9	0.9	7	-Kidney -Liver
Dichloropropane, 1,2-	78-87-5	0.6	0.8	0.03	15	15	0.3	-Carcinogen -Nasal
Dichloropropene, 1,3-	542-75-6	0.2	0.2	0.001	0.09	0.09	0.01	-Carcinogen -Kidney -Nasal
Dichlorprop	120-36-5	270	3300	0.3	0.3	0.3	3	-None Specified

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Dichlorvos	62-73-7	0.2	0.3	0.0005	0.00002	0.00002	0.005	-Carcinogen -Neurological
Dicofol [or Kelthane]	115-32-2	2.3	7.6	0.05	0.0004	0.0004	0.5	-Adrenals -Carcinogen
Dieldrin	60-57-1	0.07	0.3	0.004	0.0001	0.0001	0.04	-Carcinogen -Liver
Diethylphthalate	84-66-2	54000	920000	86	5.9	5.9	860	-Body Weight
Dimethoate	60-51-5	8.4	86	0.0004	0.0004	0.0004	0.004	-Neurological
Dimethrin	70-38-2	19000	270000	2500	1.3	1.3	25000	-Liver
Dimethylformamide, N,N-	68-12-2	1100	7800	3	210	210	30	-Gastrointestinal -Liver
Dimethylphenol, 2,4-	105-67-9	910	9800	1.7	3.2	3.2	17	-Blood -Neurological
Dimethylphthalate	131-11-3	590000	*	380	7.8	7.8	3800	-Kidney
Dinitrobenzene, 1,2- (o)	528-29-0	13	130	1	0.2	0.2	10	-Spleen
Dinitrobenzene, 1,3- (m)	99-65-0	3.5	33	0.04	0.4	0.4	0.4	-Spleen
Dinitrophenol, 2,4-	51-28-5	66	620	0.06	0.01	0.01	0.6	-Eye
Dinitrotoluene, 2,4-	121-14-2	1.3	3.7	0.0008	0.07	0.07	0.008	-Carcinogen -Liver -Neurological
Dinitrotoluene, 2,6-	606-20-2	1	2.1	0.0007	0.03	0.03	0.007	-Blood -Carcinogen -Kidney -Mortality -Neurological
Dinoseb	88-85-7	55	740	0.03	0.03	0.03	0.3	-Developmental
Dioxane, 1,4-	123-91-1	12	18	0.02	1	1	0.2	-Carcinogen
Dioxin [or 2,3,7,8-TCDD]	1746-01-6	0.000007	0.00003	0.003	0.000001	0.000001	0.03	-Carcinogen
Diphenamid	957-51-7	1800	25000	2.6	20	20	26	-Liver
Diphenylhydrazine, 1,2-	122-66-7	1.2	3.7	0.4	0.01	0.01	4	-Carcinogen

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Disulfoton	298-04-4	2.9	56	0.1	0.1	0.1	1	-Neurological
Diuron	330-54-1	130	2000	0.3	0.2	0.2	3	-Blood
Endosulfan	115-29-7	410	6700	3.8	0.005	0.0008	38	-Body Weight -Cardiovascular -Kidney
Endothall	145-73-3	780	7800	0.4	0.4	0.4	4	-Gastrointestinal
Endrin	72-20-8	21	340	1	0.001	0.001	10	-Liver
Epichlorohydrin	106-89-8	11	74	0.03	2.4	2.4	0.3	-Carcinogen -Kidney -Nasal
Ethion	563-12-2	38	780	1.7	0.003	0.003	17	-Neurological
Ethoprop	13194-48-4	5.5	69	0.005	0.002	0.002	0.05	-Neurological
Ethoxyethanol, 2-	110-80-5	8100	65000	120	NA	NA	1200	-Body Weight -Reproductive
Ethyl acetate	141-78-6	5500	39000	26	26	26	260	-Body Weight -Mortality
Ethyl acrylate	140-88-5	1.6	2.2	25	0.6	0.6	250	-Carcinogen
Ethyl chloride [or Chloroethane]	75-00-3	2.9	4	0.06	NA	NA	0.6	-Carcinogen -Developmental
Ethyl dipropylthiocarbamate, S- [or EPTC]	759-94-4	1100	13000	11	15	15	110	-Cardiovascular
Ethyl ether	60-29-7	150	1000	5	850	850	50	-Body Weight
Ethyl methacrylate	97-63-2	380	2600	3.5	NA	NA	35	-Kidney
Ethyl p-nitrophenyl phenylphosphorothioate [or EPN]	2104-64-5	0.7	15	0.04	0.003	0.003	0.4	-Neurological
Ethylbenzene	100-41-4	1100	8400	0.6	12	12	6	-Developmental -Kidney -Liver
Ethylene diamine	107-15-3	610	5500	40	3.2	3.2	400	-Blood -Cardiovascular
Ethylene glycol	107-21-1	24000	180000	56	65	65	560	-Kidney

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Ethylene oxide	75-21-8	0.3	0.4	0.05	20	20	0.5	-Carcinogen
Fenamiphos	22224-92-6	15	210	0.02	0.003	0.003	0.2	-Neurological
Fensulfothion	115-90-2	14	180	0.01	0.004	0.004	0.1	-Neurological
Fluometuron	2164-17-2	750	9700	0.9	1.8	1.8	9	-None Specified
Fluoranthene	206-44-0	2900	48000	1200	1.3	1.3	12000	-Blood -Kidney -Liver
Fluorene	86-73-7	2200	28000	160	17	17	1600	-Blood
Fluoride	7782-41-4	500**	120000	***	***	***	***	-Teeth
Fonofos	944-22-9	120	1800	0.4	0.003	0.003	4	-Liver -Neurological
Formaldehyde	50-00-0	21	29	2.4	0.4	0.4	24	-Body Weight -Carcinogen -Gastrointestinal
Furfural	98-01-1	160	2000	1	2.7	2.7	10	-Liver -Nasal
Guthion [or Azinphos, methyl]	86-50-0	110	2000	0.2	0.0002	0.0002	2	-Neurological
Heptachlor	76-44-8	0.2	0.9	23	0.1	0.1	230	-Carcinogen -Liver
Heptachlor epoxide	1024-57-3	0.1	0.4	0.6	0.006	0.006	6	-Carcinogen -Liver
Hexachloro-1,3-butadiene	87-68-3	6.3	12	1.1	110	110	11	-Carcinogen -Kidney
Hexachlorobenzene	118-74-1	0.5	1.1	2.2	0.0008	0.0008	22	-Carcinogen -Liver
Hexachlorocyclohexane, alpha-	319-84-6	0.2	0.5	0.0003	0.0006	0.0006	0.003	-Carcinogen
Hexachlorocyclohexane, beta-	319-85-7	0.6	2.1	0.001	0.003	0.003	0.01	-Carcinogen
Hexachlorocyclohexane, delta-	319-86-8	22	420	0.2	NA	NA	2	-Kidney -Liver
Hexachlorocyclohexane, gamma- [or Lindane]	58-89-9	0.7	2.2	0.009	0.003	0.003	0.09	-Carcinogen -Kidney -Liver

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Hexachlorocyclopentadiene	77-47-4	2.4	16	400	24	24	4000	-Gastrointestinal
Hexachloroethane	67-72-1	34	78	0.2	0.08	0.08	2	-Carcinogen -Kidney
Hexahydro-1,3,5-trinitro-1,3,5-triazine [or RDX]	121-82-4	6.7	16	0.007	1.3	1.3	0.07	-Carcinogen -Reproductive
Hexane, n-	110-54-3	500	3600	3.5	1200	1200	35	-Neurological
Hexanone, 2- [or Methyl butyl ketone]	591-78-6	5.1	34	1.4	NA	NA	14	-None Specified
Hexazinone	51235-04-2	1600	18000	1.1	5	5	11	-Body Weight
Hydroquinone	123-31-9	1800	19000	1.4	0.02	0.02	14	-Blood
Indeno(1,2,3-cd)pyrene	193-39-5	1.5	5.3	28	4.3	4.3	280	-Carcinogen
Iron	7439-89-6	23000	480000	***	***	***	***	-Blood -Gastrointestinal
Isobutyl alcohol	78-83-1	4100	31000	8.9	200	200	89	-Neurological
Isophorone	78-59-1	340	580	0.2	3.8	3.8	2	-Carcinogen
Lead (d)	7439-92-1	400	920	***	***	***	***	-Neurological
Linuron	330-55-2	130	2000	0.04	1.4	1.4	0.4	-Blood
Lithium	7439-93-32	1600	40000	***	NA	NA	***	-None Specified
Malathion	121-75-5	1300	20000	4.2	0.003	0.003	42	-Neurological
Maneb	12427-38-2	350	5500	6.3	0.5	0.5	63	-Thyroid
Manganese	7439-96-5	1600	22000	***	NA	NA	***	-Neurological
Mercury	7439-97-6	3.4	26	2.1	0.01	0.01	21	-Neurological
Mercury, methyl	22967-92-6	0.8	5.4	0.002	NA	NA	0.02	-Neurological

Table 2 - Technical Report
Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Merphos	150-50-5	2.2	41	0.5	NA	NA	5	-Body Weight -Neurological
Methacrylonitrile	126-98-7	0.8	5.4	0.02	NA	NA	0.2	-Liver
Methamidophos	10265-92-6	1.9	19	0.02	0	0	0.2	-Neurological
Methanol	67-56-1	5800	43000	20	180	180	200	-Liver -Neurological
Methidathion	950-37-8	47	530	0.003	0.0001	0.0001	0.03	-Liver
Methomyl	16752-77-5	22	150	1.2	0.007	0.007	12	-Kidney -Spleen
Methoxy-5-nitroaniline, 2-	99-59-2	17	41	0.4	NA	NA	4	-Carcinogen
Methoxychlor	72-43-5	370	7500	160	0.1	0.1	1600	-Developmental -Reproductive
Methyl acetate	79-20-9	4100	28000	26	NA	NA	260	-Liver
Methyl acrylate	96-33-3	99	680	0.9	NA	NA	9	-None Specified
Methyl isobutyl ketone [or MIBK]	108-10-1	220	1500	2.6	110	110	26	-Kidney -Liver
Methyl methacrylate	80-62-6	1400	9400	0.1	32	32	1	-Nasal
Methyl parathion [or Parathion, methyl]	298-00-0	18	310	0.06	0.0003	0.0003	0.6	-Blood -Neurological
Methyl tert-butyl ether [or MTBE]	1634-04-4	3200	22000	0.2	150	150	2	-Eye -Kidney -Liver
Methyl-4-chlorophenoxy acetic acid, 2-	94-74-6	30	440	0.02	0.4	0.4	0.2	-Kidney -Liver
Methylaniline, 2-	95-53-4	1.8	3.3	0.3	0.2	0.2	3	-Carcinogen
Methylene bis(2-chloroaniline), 4,4-	101-14-4	6.4	17	0.2	NA	NA	2	-Carcinogen -Liver -Bladder
Methylene bromide	74-95-3	58	400	0.3	NA	NA	3	-Blood
Methylene chloride	75-09-2	16	23	0.02	7.3	7.3	0.2	-Carcinogen -Liver

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Methylnaphthalene, 1-	90-12-0	68	470	2.2	10	10	22	-Body Weight -Nasal
Methylnaphthalene, 2-	91-57-6	80	560	6.1	9.1	9.1	61	-Body Weight -Nasal
Methylphenol, 2- [or o-Cresol]	95-48-7	2400	28000	0.3	1.9	1.9	3	-Body Weight -Neurological
Methylphenol, 3- [or m-Cresol]	108-39-4	2500	29000	0.3	3.3	3.3	3	-Body Weight -Neurological
Methylphenol, 4- [or p-Cresol]	106-44-5	250	3000	0.03	0.5	0.5	0.3	-Maternal Death -Neurological -Respiratory
Metolachlor	51218-45-2	9100	120000	1.2	0.01	0.01	12	-Body Weight
Metribuzin	21087-64-9	32	210	2.2	0.8	0.8	22	-Body Weight -Kidney -Liver -Mortality
Mevinphos	7786-34-7	16	240	0.01	0.0003	0.0003	0.1	-Neurological
Molinate	2212-67-1	100	1200	0.1	0.1	0.1	1	-Reproductive
Molybdenum	7439-98-7	390	9700	***	NA	NA	***	-Gout
Naled	300-76-5	130	2100	0.1	0.0002	0.0002	1	-Neurological
Naphthalene	91-20-3	40	270	1.7	2.2	2.2	17	-Body Weight -Nasal
Nickel (b)	7440-02-0	110**	28000	130	***	***	1300	-Body Weight
Nitrate	14797-55-8	120000	*	***	***	***	***	-Blood
Nitrite	14797-65-0	7800	180000	***	***	***	***	-Blood
Nitroaniline, o-	88-74-4	5.7	66	0.3	NA	NA	3	-Blood
Nitroaniline, p-	100-01-6	5.2	56	0.1	5.9	5.9	1	-None Specified
Nitrobenzene	98-95-3	14	120	0.03	0.6	0.6	0.3	-Adrenals -Blood -Kidney -Liver
Nitrophenol, 4-	100-02-7	390	4400	0.3	0.3	0.3	3	-None Specified

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Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Nitroso-di-ethylamine, N-	55-18-5	0.003	0.005	0.02	0.0007	0.0007	0.2	-Carcinogen
Nitroso-di-n-butylamine, N-	924-16-3	0.05	0.07	0.05	0.002	0.002	0.5	-Carcinogen
Nitroso-di-n-propylamine, N-	621-64-7	0.09	0.2	0.04	0.008	0.008	0.4	-Carcinogen
Nitroso-dimethylamine, N-	62-75-9	0.009	0.02	0.008	0.002	0.002	0.08	-Carcinogen
Nitroso-diphenylamine, N-	86-30-6	170	440	0.4	2.5	2.5	4	-Carcinogen
Nitroso-N-methylethylamine, N-	10595-95-6	0.01	0.02	0.03	0.005	0.005	0.3	-Carcinogen
Nitrotoluene, m-	99-08-1	210	1800	2.4	3.6	3.6	24	-Spleen
Nitrotoluene, o-	88-72-2	280	2500	3.3	7.3	7.3	33	-Spleen
Nitrotoluene, p-	99-99-0	640	9700	3.3	7.3	7.3	33	-Spleen
Octamethylpyrophosphoramide	152-16-9	83	860	4	NA	NA	40	-Neurological
Oxamyl	23135-22-0	1100	12000	0.9	0.04	0.04	9	-Body Weight
Paraquat	1910-42-5	310	4000	160	230	230	1600	-Respiratory
Parathion	56-38-2	450	9100	10	0.01	0.01	100	-Neurological
PCBs [Aroclor miture]	1336-36-3	0.5	2.1	17	0.002	0.002	170	-Carcinogen -Immunological
Pebulate	1114-71-2	1600	15000	8.5	7.4	7.4	85	-Blood
Pendimethalin	40487-42-1	2500	36000	28	1	1	280	-Liver
Pentachlorobenzene	608-93-5	27	250	3.9	1.2	1.2	39	-Kidney -Liver
Pentachloronitrobenzene	82-68-8	3	7.7	0.7	0.06	0.06	7	-Carcinogen -Liver
Pentachlorophenol	87-86-5	7.7	23	0.03	0.2	0.2	0.3	-Carcinogen -Kidney -Liver

Table 2 - Technical Report
Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Permethrin	52645-53-1	3700	67000	880	0.003	0.003	8800	-Liver
Phenanthrene	85-01-8	2000	30000	250	0.7	0.7	2500	-Kidney
Phenol	108-95-2	900**	390000	0.05	0.03	0.03	0.5	-Developmental
Phenylenediamine, p-	106-50-3	8000	83000	6.2	NA	NA	62	-Whole Body
Phenylphenol, 2-	90-43-7	460	1300	0.4	0.8	0.8	4	-Carcinogen
Phorate	298-02-2	14	280	0.3	0.001	0.001	3	-Neurological
Phosmet	732-11-6	1400	21000	5	0.004	0.004	50	-Body Weight -Liver -Neurological
Phthalic anhydride	85-44-9	8300	57000	76	NA	NA	760	-Kidney -Nasal -Respiratory
Prometon	1610-18-0	980	14000	2.4	14	14	24	-None Specified
Prometryn	7287-19-6	260	3900	0.7	0.5	0.5	7	-Bone Marrow -Kidney -Liver
Propachlor	1918-16-7	770	10000	1.1	0.1	0.1	11	-Body Weight -Liver
Propanil	709-98-8	300	4100	0.4	0.2	0.2	4	-Spleen
Propazine	139-40-2	1200	17000	0.2	2.7	2.7	2	-Body Weight
Propylene glycol	57-55-6	710000	*	560	140	140	5600	-Blood -Bone Marrow
Propylene oxide	75-56-9	3.2	8.1	22	NA	NA	220	-Carcinogen -Nasal -Respiratory
Pydrin [or Fenvalerate]	51630-58-1	1800	32000	700	0.0001	0.0001	7000	-Neurological
Pyrene	129-00-0	2200	37000	880	1.3	1.3	8800	-Kidney
Pyridine	110-86-1	13	95	0.03	5.4	5.4	0.3	-Liver
Resmethrin	10453-86-8	2200	39000	1200	0.01	0.01	12000	-Reproductive

Table 2 - Technical Report

Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Ronnel	299-84-3	3600	59000	1300	0.2	0.2	13000	-Liver
Selenium (b)	7782-49-2	390	10000	5	***	***	50	-Hair Loss -Neurological -Skin
Silver (b)	7440-22-4	390	9100	17	***	***	170	-Skin
Simazine	122-34-9	7.4	21	0.08	0.1	0.1	0.8	-Blood -Body Weight -Carcinogen
Strontium	7440-24-6	47000	*	***	NA	NA	***	-Bone
Strychnine	57-24-9	17	210	0.7	0.3	0.3	7	-Mortality
Styrene	100-42-5	2700	21000	3.6	16	16	36	-Blood -Liver -Neurological
Terbacil	5902-51-2	660	7700	0.5	14	14	5	-Liver -Thyroid
Terbufos	13071-79-9	1.4	17	0.02	0.001	0.001	0.2	-Neurological
Tetrachlorobenzene, 1,2,4,5-	95-94-3	6.3	51	0.5	0.5	0.5	5	-Kidney
Tetrachloroethane, 1,1,1,2-	630-20-6	4	5.7	0.01	NA	NA	0.1	-Carcinogen -Kidney -Liver
Tetrachloroethane, 1,1,2,2-	79-34-5	0.7	1.1	0.002	0.08	0.08	0.02	-Carcinogen
Tetrachloroethene [or PCE]	127-18-4	8.9	17	0.03	0.1	0.1	0.3	-Body Weight -Carcinogen -Liver
Tetrachlorophenol, 2,3,4,6-	58-90-2	1500	17000	3.2	0.07	0.07	32	-Liver
Tetraethyl dithiopyrophosphate	3689-24-5	31	420	0.1	0.0004	0.0004	1	-Bone Marrow -Neurological
Thiram	137-26-8	330	4900	1.1	0.005	0.005	11	-Neurological
Tin	7440-31-5	44000	660000	***	NA	NA	***	-Kidney -Liver
Toluene	108-88-3	380	2600	0.5	5.6	5.6	5	-Kidney -Liver -Neurological
Toluidine, p-	106-49-0	1.4	2.2	0.7	NA	NA	7	-Carcinogen

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		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Toxaphene	8001-35-2	1	3.7	31	0.002	0.002	310	-Carcinogen -Developmental
Triallate	2303-17-5	740	9500	8.4	6	6	84	-Liver -Spleen
Tributyltin oxide	56-35-9	22	400	36	0.2	0.2	360	-Immunological
Trichloro-1,2,2-trifluoroethane, 1,1,2- [or CFC 113]	76-13-1	13000	88000	27000	NA	NA	270000	-Body Weight -Neurological
Trichloroacetic acid	76-03-9	480	4600	1.2	400	400	12	-None Specified
Trichlorobenzene, 1,2,3-	87-61-6	560	7400	4.6	5.6	5.6	46	-Adrenals -Body Weight
Trichlorobenzene, 1,2,4-	120-82-1	560	7500	5.3	1.7	1.7	53	-Adrenals -Body Weight
Trichlorobenzene, 1,3,5-	108-70-3	190	1800	16	NA	NA	160	-None Specified
Trichloroethane, 1,1,1- [or Methyl chloroform]	71-55-6	400	3300	1.9	2.6	2.6	19	-None Specified
Trichloroethane, 1,1,2-	79-00-5	1.3	1.8	0.03	0.2	0.2	0.3	-Carcinogen -Liver
Trichloroethene [or TCE]	79-01-6	6	8.5	0.03	0.9	0.9	0.3	-Carcinogen
Trichlorofluoromethane	75-69-4	200	1300	33	NA	NA	330	-Cardiovascular -Kidney -Mortality -Respiratory
Trichlorophenol, 2,4,5-	95-95-4	6000	82000	0.3	1.5	1.5	3	-Kidney -Liver
Trichlorophenol, 2,4,6-	88-06-2	72	180	0.06	0.1	0.1	0.6	-Carcinogen
Trichlorophenoxy acetic acid, 2,4,5-	93-76-5	590	8300	0.4	0.8	0.8	4	-Kidney
Trichlorophenoxy propionic acid [or Silvex]	93-72-1	590	12000	5.4	NA	NA	54	-Liver
Trichloropropane, 1,2,3-	96-18-4	0.01	0.02	0.001	0.002	0.002	0.01	-Body Weight -Carcinogen -Kidney -Liver -Mortality
Trifluralin	1582-09-8	94	220	3.5	0.6	0.6	35	-Blood -Carcinogen -Liver
Trimethyl phosphate	512-56-1	15	30	0.2	NA	NA	2	-Carcinogen

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Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
Trimethylbenzene, 1,2,3-	526-73-8	13	89	0.3	NA	NA	3	-None Specified
Trimethylbenzene, 1,2,4-	95-63-6	13	88	0.3	7.2	7.2	3	-None Specified
Trimethylbenzene, 1,3,5-	108-67-8	11	74	0.3	6.7	6.7	3	-None Specified
Trinitrobenzene, 1,3,5-	99-35-4	1300	14000	1	0.09	0.09	10	-Blood -Spleen
Trinitrotoluene, 2,4,6-	118-96-7	24	55	0.06	0.3	0.3	0.6	-Carcinogen -Liver
TRPH	NOCAS#	340	2500	340	340	340	3400	-Multiple Endpoints Mixed Contaminants
Uranium, natural	7440-61-1	120	470	***	NA	NA	***	-None Specified
Vanadium (b)	7440-62-2	15**	7400	980	NA	NA	9800	-None Specified
Vernam	1929-77-7	29	260	0.1	0.2	0.2	1	-Body Weight
Vinyl acetate	108-05-4	230	1600	0.4	3	3	4	-Body Weight -Kidney -Nasal
Vinyl chloride	75-01-4	0.03	0.04	0.007	NA	NA	0.07	-Carcinogen
Xylenes, total	1330-20-7	5900	40000	0.2	3.9	3.9	2	-Body Weight -Mortality -Neurological
Zinc (b)	7440-66-6	23000	560000	6000	***	***	60000	-Blood
Zinc phosphide	1314-84-7	23	550	***	NA	NA	***	-Body Weight
Zineb	12122-67-7	3400	53000	19	0.7	0.7	190	-Thyroid

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Soil Cleanup Target Levels

Contaminant	CAS#	Direct Exposure		Leachability Based on Groundwater Criteria	Leachability Based on Freshwater Surface Water Criteria	Leachability Based on Marine Surface Water Criteria	Leachability Based on Groundwater of Low Yield/ Poor Quality	Target Organ/System or Effect
		Residential	Commercial/ Industrial					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	

Values rounded to two significant figures if >1 and to one significant figure if <1.

* Contaminant is not a health concern for this exposure scenario.

** Direct exposure value based on acute toxicity considerations.

*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.

(a) = See discussion on the development of SCTLs for Ammonia in the Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-777, F.A.C., Final Report dated XXXX, 1999.

(b) = Leachability values derived from USEPA Soil Screening Guidance (1996). These values were derived assuming soil pH 6.8. These leachability values are dependent upon both the metal concentration in soil and soil characteristics. Thus, if site-specific soil characteristics are different than the defaults, these leachability values may not apply. If this is the case, site-specific leachability values should be derived using methods such as TCLP or SPLP.

(c) = Phytotoxicity must be considered.

(d) = Residential direct exposure value from USEPA Revised Interim Soil Guidance for CERCLA Sites and BCRA Corrective Action Facilities. OSWER Directive 9355.4-12 (1994). The industrial direct exposure value was derived using methodologies outlined in USEPA 'Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil', December 1996.

None Specified = Target organ(s) not available at time of rule adoption.

Note: If more than one contaminant is present at a site, the direct exposure values are to be modified, if necessary, such that the sum of the hazard quotients for non-carcinogenic contaminants affecting the same organ(s) is 1 or less. For carcinogens, the direct exposure values shall be modified such that the cummulative lifetime risk level posed by the contaminants is 1.0E-06.

NA = Not available at time of rule adoption

APPENDIX B

USEPA REGION III
RISK-BASED CONCENTRATION SCREENING TABLE

Sources: I = IRIS, H = HEAST, A = HEAST Alternate, W = Withdrawn from IRIS or HEAST
E = EPA NCEA provisional value, O = other

Basis: C = Carcinogenic effects, N = Noncarcinogenic effects, * = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
**ACETALDEHYDE	75070			2.57E-03 I	7.7E-03 I	y	1.6E+00 C	8.1E-01 C			
ACETOCHLOR	34256821	2E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
**ACETONE	67641	1.00E-01 I				y	6.1E+02 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
**ACETONITRILE	75058			1.7E-02 I		y	1.2E+02 N	6.2E+01 N			
ACETOPHENONE	98862	1.00E-01 I		5.70E-06 W		y	4.2E-02 N	2.1E-02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
ACROLEIN	107028	2.00E-02 H		5.70E-06 I		y	4.2E-02 N	2.1E-02 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
ACRYLAMIDE	79061	2.00E-04 I	4.50E+00 I		4.50E+00 I		1.5E-02 C	1.4E-03 C	7.0E-04 C	1.3E+00 C	1.4E-01 C
**ACRYLONITRILE	107131	1.00E-03 H	5.40E-01 I	5.70E-04 I	2.40E-01 I	y	3.7E-02 C	2.6E-02 C	5.8E-03 C	1.1E+01 C	1.2E+00 C
ALACHLOR	15972608	1.00E-02 I	8.00E-02 H				8.4E-01 C	7.8E-02 C	3.9E-02 C	7.2E+01 C	8.0E+00 C
ALAR	1596845	1.50E-01 I					5.5E+03 N	5.5E+02 N	2.0E+02 N	3.1E+05 N	1.2E+04 N
ALDICARB	116063	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
ALDICARB SULFONE	1646884	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
ALDRIN	309002	3.00E-05 I	1.70E+01 I		1.70E+01 I		3.9E-03 C	3.7E-04 C	1.9E-04 C	3.4E-01 C	3.8E-02 C
ALUMINUM	7429905	1.00E+00 E		1.00E-03 E			3.7E+04 N	3.7E+00 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
AMINODINITROTOLUENES		6.00E-05 E					2.2E+00 N	2.2E-01 N	8.1E-02 N	1.2E+02 N	4.7E+00 N
4-AMINOPYRIDINE	504245	2.00E-05 H					7.3E-01 N	7.3E-02 N	2.7E-02 N	4.1E+01 N	1.6E+00 N
AMMONIA	7664417			2.86E-02 I		y	2.1E+02 N	1.0E+02 N			
**ANILINE	62533	7.00E-03 E	5.70E-03 I	2.90E-04 I			1.2E+01 C	1.1E+00 N	5.5E-01 C	1.0E+03 C	1.1E+02 C *
ANTIMONY	7440360	4.00E-04 I					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
ANTIMONY PENTOXIDE	1314609	5.00E-04 H					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
ANTIMONY TETROXIDE	1332816	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
ANTIMONY TRIOXIDE	1309644	4.00E-04 H		5.70E-05 I			1.5E+01 N	2.1E-01 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
ARSENIC	7440382	3.00E-04 I	1.50E+00 I		1.51E+01 I		4.5E-02 C	4.1E-04 C	2.1E-03 C	3.8E+00 C	4.3E-01 C
ARSINE	7784421			1.40E-05 I		y	1.0E-01 N	5.1E-02 N			
ASSURE	76578148	9.00E-03 I					3.3E+02 N	3.3E+01 N	1.2E+01 N	1.8E+04 N	7.0E+02 N
ATRAZINE	1912249	3.50E-02 I	2.20E-01 H				3.0E-01 C	2.8E-02 C	1.4E-02 C	2.6E+01 C	2.9E+00 C
AZOBENZENE	103333		1.10E-01 I		1.10E-01 I		6.1E-01 C	5.7E-02 C	2.9E-02 C	5.2E+01 C	5.8E+00 C
BARIUM	7440393	7.00E-02 I		1.40E-04 A			2.6E+03 N	5.1E-01 N	9.5E+01 N	1.4E+05 N	5.5E+03 N
BAYGON	114261	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
BAYTHROID	68359375	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
BENTAZON	25057890	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
BENZALDEHYDE	100527	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
BENZENE	71432	3.00E-03 E	2.90E-02 I	1.70E-03 E	2.90E-02 I	y	3.6E-01 C	2.2E-01 C	1.1E-01 C	2.0E+02 C	2.2E+01 C
BENZENETHIOL	108985	1.00E-05 H				y	6.1E-02 N	3.7E-02 N	1.4E-02 N	2.0E+01 N	7.8E-01 N
BENZIDINE	92875	3.00E-03 I	2.30E+02 I		2.30E+02 I		2.9E-04 C	2.7E-05 C	1.4E-05 C	2.5E-02 C	2.8E-03 C
BENZOIC ACID	65850	4.00E+00 I					1.5E+05 N	1.5E+04 N	5.4E+03 N	8.2E+06 N	3.1E+05 N
BENZYL ALCOHOL	100516	3.00E-01 H					1.1E+04 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
BENZYL CHLORIDE	100447		0.17 I			y	6.2E-02 C	3.7E-02 C	1.9E-02 C	3.4E+01 C	3.8E+00 C
BERYLLIUM	7440417	2.00E-03 I		5.7E-06 I	8.40E+00 I		7.3E+01 N	7.5E-04 C	2.7E+00 N	4.1E+03 N	1.6E+02 N
BIPHENYL	92524	5.00E-02 I				y	3.0E+02 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
**BIS(2-CHLOROETHYL)ETHER	111444		1.10E+00 I		1.10E+00 I	y	9.6E-03 C	5.7E-03 C	2.9E-03 C	5.2E+00 C	5.8E-01 C
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-02 I	7.00E-02 H		3.50E-02 H	y	2.6E-01 C	1.8E-01 C	4.5E-02 C	8.2E+01 C	9.1E+00 C
BIS(CHLOROMETHYL)ETHER	542881		2.20E+02 I		2.20E+02 I	y	4.8E-05 C	2.8E-05 C	1.4E-05 C	2.6E-02 C	2.9E-03 C
BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-02 I	1.40E-02 I		1.40E-02 E		4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C
BORON	7440428	9.00E-02 I		5.70E-03 H			3.3E+03 N	2.1E+01 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
BROMODICHLOROMETHANE	75274	2.00E-02 I	6.20E-02 I			y	1.7E-01 C	1.0E-01 C	5.1E-02 C	9.2E+01 C	1.0E+01 C
BROMOETHENE	593602			8.6E-04 I	1.10E-01 H	y	1.1E-01 C	5.7E-02 C			
**BROMOFORM	75252	2.00E-02 I	7.90E-03 I		3.90E-03 I		8.5E+00 C	1.6E+00 C	4.0E-01 C	7.2E+02 C	8.1E+01 C
BROMOMETHANE	74839	1.40E-03 I		1.40E-03 I		y	8.5E+00 N	5.1E+00 N	1.9E+00 N	2.9E+03 N	1.1E+02 N
**BROMOPHOS	2104963	5.00E-03 H					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
1,3-BUTADIENE	106990				1.80E+00 H	y	7.0E-03 C	3.5E-03 C			
1-BUTANOL	71363	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
BUTYLBENZYLPHTHALATE	85687	2.00E-01 I					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
BUTYLATE	2008415	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
N-BUTYLBENZENE	104518	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
SEC-BUTYLBENZENE	135988	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg
TERT-BUTYLBENZENE	98066	1.00E-02 E				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
CADMIUM-WATER	7440439	5.00E-04 I			6.30E+00 I		1.8E+01 N	9.9E-04 C	6.8E-01 N	1.0E+03 N	3.9E+01 N
CADMIUM-FOOD	7440439	1.00E-03 I			6.30E+00 I		3.7E+01 N	9.9E-04 C	1.4E+00 N	2.0E+03 N	7.8E+01 N
CAPROLACTAM	105602	5.00E-01 I					1.8E+04 N	1.8E+03 N	6.8E+02 N	1.0E+06 N	3.9E+04 N
CARBARYL	63252	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CARBON DISULFIDE	75150	1.00E-01 I		2.00E-01 I		y	1.0E+03 N	7.3E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CARBON TETRACHLORIDE	56235	7.00E-04 I	1.30E-01 I	5.71E-04 E	5.30E-02 I	y	1.6E-01 C	1.2E-01 C	2.4E-02 C	4.4E+01 C	4.9E+00 C
CARBOSULFAN	55285148	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
**CHLORAL	75876	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
CHLORANIL	118752		4.00E-01 H				1.7E-01 C	1.6E-02 C	7.9E-03 C	1.4E+01 C	1.6E+00 C
CHLORDANE	57749	5.00E-04 I	3.5E-01 I	2.00E-04 I	3.5E-01 I		1.9E-01 C	1.8E-02 C	9.0E-03 C	1.6E+01 C	1.8E+00 C
CHLORINE	7782505	1.00E-01 I				y	6.1E+02 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CHLORINE DIOXIDE	10049044			5.70E-05 I		y	4.2E-01 N	2.1E-01 N			
CHLOROACETIC ACID	79118	2.00E-03 H					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
4-CHLOROANILINE	106478	4.00E-03 I					1.5E+02 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
**CHLOROBENZENE	108907	2.00E-02 I		1.7E-02 E		y	1.1E+02 N	6.2E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CHLOROBENZILATE	510156	2.00E-02 I	2.70E-01 H		2.70E-01 H		2.5E-01 C	2.3E-02 C	1.2E-02 C	2.1E+01 C	2.4E+00 C
P-CHLOROBENZOIC ACID	74113	2.00E-01 H					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
2-CHLORO-1,3-BUTADIENE	126998	2.00E-02 A		2.00E-03 H		y	1.4E+01 N	7.3E+00 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
1-CHLOROBUTANE	109693	4.00E-01 H				y	2.4E+03 N	1.5E+03 N	5.4E+02 N	8.2E+05 N	3.1E+04 N
1-CHLORO-1,1-DIFLUOROETHANE	75683			1.40E+01 I		y	1.0E+05 N	5.1E+04 N			
CHLORODIFLUOROMETHANE	75456			1.40E+01 I		y	1.0E+05 N	5.1E+04 N			
CHLOROETHANE	75003	4.00E-01 E	2.90E-03 E	2.90E+00 I		y	3.6E+00 C	2.2E+00 C	1.1E+00 C	2.0E+03 C	2.2E+02 C
CHLOROFORM	67663	1.00E-02 I	6.10E-03 I	8.6E-05 E	8.10E-02 I	y	1.5E-01 C !	7.7E-02 C !	5.2E-01 C	9.4E+02 C	1.0E+02 C !
**CHLOROMETHANE	74873		1.30E-02 H	8.6E-02 E	3.5E-03 E	y	2.1E+00 C	1.8E+00 C	2.4E-01 C	4.4E+02 C	4.9E+01 C
4-CHLORO-2-METHYLANILINE	95692		5.80E-01 H				1.2E-01 C	1.1E-02 C	5.4E-03 C	9.9E+00 C	1.1E+00 C
BETA-CHLORONAPHTHALENE	91587	8.00E-02 I				y	4.9E+02 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
O-CHLORONITROBENZENE	88733		2.50E-02 H			y	4.2E-01 C	2.5E-01 C	1.3E-01 C	2.3E+02 C	2.6E+01 C
P-CHLORONITROBENZENE	100005		1.80E-02 H			y	5.9E-01 C	3.5E-01 C	1.8E-01 C	3.2E+02 C	3.5E+01 C
**2-CHLOROPHENOL	95578	5.00E-03 I				y	3.0E+01 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
2-CHLOROPROPANE	75296			2.90E-02 H		y	2.1E+02 N	1.1E+02 N			
O-CHLOROTOLUENE	95498	2.00E-02 I				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CHLORPYRIFOS	2921882	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
CHLORPYRIFOS-METHYL	5598130	1.00E-02 H					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
CHROMIUM III	16065831	1.50E+00 I					5.5E+04 N	5.5E+03 N	2.0E+03 N	3.1E+06 N	1.2E+05 N
CHROMIUM VI	18540299	3.00E-03 I		3.00E-05 I	4.10E+01 H		1.1E+02 N	1.5E-04 C	4.1E+00 N	6.1E+03 N	2.3E+02 N
COBALT	7440484	6.00E-02 E					2.2E+03 N	2.2E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
**COKE OVEN EMISSIONS (COAL TAR)	8007452				2.2 I			2.8E-03 C			
COPPER	7440508	4.00E-02 H					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
**CROTONALDEHYDE	123739		1.90E+00 H			y	5.6E-03 C	3.3E-03 C	1.7E-03 C	3.0E+00 C	3.4E-01 C
CUMENE	98828	1.00E-01 I		1.10E-01 I		y	6.6E+02 N	4.0E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
CYANIDE (FREE)	57125	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
CALCIUM CYANIDE	592018	4E-02 I					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
COPPER CYANIDE	544923	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
CYANAZINE	21725462	2.00E-03 H	8.40E-01 H				8.0E-02 C	7.5E-03 C	3.8E-03 C	6.8E+00 C	7.6E-01 C
CYANOGEN	460195	4.00E-02 I				y	2.4E+02 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
CYANOGEN BROMIDE	506683	9.00E-02 I					3.3E+03 N	3.3E+02 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
CYANOGEN CHLORIDE	506774	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
HYDROGEN CYANIDE	74908	2.00E-02 I		8.60E-04 I		y	6.2E+00 N	3.1E+00 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
POTASSIUM CYANIDE	151508	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
POTASSIUM SILVER CYANIDE	506616	2.00E-01 I					7.3E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
SILVER CYANIDE	506649	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
SODIUM CYANIDE	143339	4.00E-02 I					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
THIOCYANATE		1.00E-01 E					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
ZINC CYANIDE	557211	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
CYCLOHEXAN	108941	5.00E+00 I					1.8E+05 N	1.8E+04 N	6.8E+03 N	1.0E+07 N	3.9E+05 N

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
CYHALOTHRIN/KARATE	68085858	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
CYPERMETHRIN	52315078	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DACTHAL	1861321	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DALAPON	75990	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
DDD	72548		2.40E-01 I				2.8E-01 C	2.6E-02 C	1.3E-02 C	2.4E+01 C	2.7E+00 C
DDE	72559		3.40E-01 I				2.0E-01 C	1.8E-02 C	9.3E-03 C	1.7E+01 C	1.9E+00 C
DDT	50293	5.00E-04 I	3.40E-01 I		3.40E-01 I		2.0E-01 C	1.8E-02 C	9.3E-03 C	1.7E+01 C	1.9E+00 C
DIAZINON	333415	9.00E-04 H					3.3E+01 N	3.3E+00 N	1.2E+00 N	1.8E+03 N	7.0E+01 N
DIBENZOFURAN	132649	4.00E-03 E				y	2.4E+01 N	1.5E+01 N	5.4E+00 N	8.2E+03 N	3.1E+02 N
**1,4-DIBROMOBENZENE	106376	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DIBROMOCHLOROMETHANE	124481	2.00E-02 I	8.40E-02 I			y	1.3E-01 C	7.5E-02 C	3.8E-02 C	6.8E+01 C	7.6E+00 C
1,2-DIBROMO-3-CHLOROPROPANE	96128		1.40E+00 H	5.70E-05 I	2.40E-03 H	y	4.7E-02 C !	2.1E-01 N	2.3E-03 C	4.1E+00 C	4.6E-01 C
1,2-DIBROMOETHANE	106934		8.50E+01 I	5.70E-05 H	7.60E-01 I	y	7.5E-04 C	8.2E-03 C	3.7E-05 C	6.7E-02 C	7.5E-03 C
DIBUTYLPHTHALATE	84742	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
DICAMBA	1918009	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
1,2-DICHLOROBENZENE	95501	9.00E-02 I		9.00E-03 E		y	6.4E+01 N	3.3E+01 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
**1,3-DICHLOROBENZENE	541731	9.00E-04 E				y	5.5E+00 N	3.3E+00 N	1.2E+00 N	1.8E+03 N	7.0E+01 N
1,4-DICHLOROBENZENE	106467	3.00E-02 E	2.40E-02 H	2.29E-01 I	2.2E-02 E	y	4.7E-01 C	2.8E-01 C	1.3E-01 C	2.4E+02 C	2.7E+01 C
3,3'-DICHLOROBENZIDINE	91941		4.50E-01 I				1.5E-01 C	1.4E-02 C	7.0E-03 C	1.3E+01 C	1.4E+00 C
1,4-DICHLORO-2-BUTENE	764410				9.30E+00 H	y	1.3E-03 C	6.7E-04 C			
DICHLORODIFLUOROMETHANE	75718	2.00E-01 I		5.00E-02 A		y	3.5E+02 N	1.8E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
1,1-DICHLOROETHANE	75343	1.00E-01 H		1.40E-01 A		y	8.0E+02 N	5.1E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
1,2-DICHLOROETHANE	107062	3.00E-02 E	9.10E-02 I	1.40E-03 E	9.10E-02 I	y	1.2E-01 C	6.9E-02 C	3.5E-02 C	6.3E+01 C	7.0E+00 C
1,1-DICHLOROETHENE	75354	9.00E-03 I	6.00E-01 I		1.75E-01 I	y	4.4E-02 C	3.6E-02 C	5.3E-03 C	9.5E+00 C	1.1E+00 C
CIS-1,2-DICHLOROETHENE	156592	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
TRANS-1,2-DICHLOROETHENE	156605	2.00E-02 I				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
TOTAL 1,2-DICHLOROETHENE	540590	9.00E-03 H				y	5.5E+01 N	3.3E+01 N	1.2E+01 N	1.8E+04 N	7.0E+02 N
2,4-DICHLOROPHENOL	120832	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
**2,4-D	94757	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826	8E-03 I					2.9E+02 N	2.9E+01 N	1.1E+01 N	1.6E+04 N	6.3E+02 N
1,2-DICHLOROPROPANE	78875		6.80E-02 H	1.14E-03 I		y	1.6E-01 C	9.2E-02 C	4.6E-02 C	8.4E+01 C	9.4E+00 C
2,3-DICHLOROPROPANOL	616239	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
1,3-DICHLOROPROPENE	542756	3.00E-04 I	1.80E-01 H	5.71E-03 I	1.30E-01 H	y	7.7E-02 C	4.8E-02 C	1.8E-02 C	3.2E+01 C	3.5E+00 C !
DICHLORVOS	62737	5E-04 I	0.29 I	1.43E-04 I			2.3E-01 C	2.2E-02 C	1.1E-02 C	2.0E+01 C	2.2E+00 C
DICOFOL	115322		4.4E-01 W				1.5E-01 C	1.4E-02 C	7.2E-03 C	1.3E+01 C	1.5E+00 C
DICYCLOPENTADIENE	77736	3E-02 H		6.00E-05 A		y	4.4E-01 N	2.2E-01 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
DIELDRIN	60571	5.00E-05 I	1.60E+01 I		1.60E+01 I		4.2E-03 C	3.9E-04 C	2.0E-04 C	3.6E-01 C	4.0E-02 C
DIESEL EMISSIONS				1.40E-03 I				5.1E+00 N			
DIETHYLPHTHALATE	84662	8.00E-01 I					2.9E+04 N	2.9E+03 N	1.1E+03 N	1.6E+06 N	6.3E+04 N
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			5.70E-03 H				2.1E+01 N			
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900	2.00E+00 H					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
DI(2-ETHYLHEXYL)ADIPATE	103231	6.00E-01 I	1.20E-03 I				5.6E+01 C	5.2E+00 C	2.6E+00 C	4.8E+03 C	5.3E+02 C
DIETHYLSTILBESTROL	56531		4.70E+03 H				1.4E-05 C	1.3E-06 C	6.7E-07 C	1.2E-03 C	1.4E-04 C
DIFENZOQUAT (AVENGE)	43222486	8.00E-02 I					2.9E+03 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
1,1-DIFLUOROETHANE	75376			1.10E+01 I		y	8.0E+04 N	4.0E+04 N			
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756	8.00E-02 I					2.9E+03 N	2.9E+02 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
3,3'-DIMETHOXYBENZIDINE	119904		1.40E-02 H				4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C
**DIMETHYLAMINE	124403			5.70E-06 W		y	4.2E-02 N	2.1E-02 N			
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964		5.80E-01 H				1.2E-01 C	1.1E-02 C	5.4E-03 C	9.9E+00 C	1.1E+00 C
2,4-DIMETHYLANILINE	95681		7.50E-01 H				8.9E-02 C	8.3E-03 C	4.2E-03 C	7.6E+00 C	8.5E-01 C
N,N-DIMETHYLANILINE	121697	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
3,3'-DIMETHYLBENZIDINE	119937		9.20E+00 H				7.3E-03 C	6.8E-04 C	3.4E-04 C	6.2E-01 C	6.9E-02 C
1,1-DIMETHYLHYDRAZINE	57147		2.60E+00 W		3.50E+00 W		2.6E-02 C	1.8E-03 C	1.2E-03 C	2.2E+00 C	2.5E-01 C
1,2-DIMETHYLHYDRAZINE	540738		3.70E+01 W		3.70E+01 W		1.8E-03 C	1.7E-04 C	8.5E-05 C	1.5E-01 C	1.7E-02 C
2,4-DIMETHYLPHENOL	105679	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
2,6-DIMETHYLPHENOL	576261	6.00E-04 I					2.2E+01 N	2.2E+00 N	8.1E-01 N	1.2E+03 N	4.7E+01 N

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Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg
3,4-DIMETHYLPHENOL	95658	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
DIMETHYLPHTHALATE	131113	1.00E+01 W					3.7E+05 N	3.7E+04 N	1.4E+04 N	2.0E+07 N	7.8E+05 N
1,2-DINITROBENZENE	528290	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
1,3-DINITROBENZENE	99650	1.00E-04 I					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
1,4-DINITROBENZENE	100254	4.00E-04 H					1.5E+01 N	1.5E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
4,6-DINITRO-2-METHYLPHENOL	534521	1.00E-04 E					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
2,4-DINITROPHENOL	51285	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
DINITROTOLUENE MIX			6.80E-01 I				9.8E-02 C	9.2E-03 C	4.6E-03 C	8.4E+00 C	9.4E-01 C
2,4-DINITROTOLUENE	121142	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
2,6-DINITROTOLUENE	606202	1.00E-03 H					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
**DINOSEB	88857	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
DIOCTYLPHTHALATE	117840	2.00E-02 H					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
1,4-DIOXANE	123911		1.10E-02 I				6.1E+00 C	5.7E-01 C	2.9E-01 C	5.2E+02 C	5.8E+01 C
DIPHENYLAMINE	122394	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
1,2-DIPHENYLHYDRAZINE	122667		8.00E-01 I		8.00E-01 I		8.4E-02 C	7.8E-03 C	3.9E-03 C	7.2E+00 C	8.0E-01 C
DIQUAT	85007	2.20E-03 I					8.0E+01 N	8.0E+00 N	3.0E+00 N	4.5E+03 N	1.7E+02 N
**DISULFOTON	298044	4.00E-05 I					1.5E+00 N	1.5E-01 N	5.4E-02 N	8.2E+01 N	3.1E+00 N
1,4-DITHIANE	505293	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
DIURON	330541	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
ENDOSULFAN	115297	6.00E-03 I					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
ENDRIN	72208	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
**EPICHLOROHYDRIN	106898	2.00E-03 H	9.90E-03 I	2.86E-04 I	4.20E-03 I	y	2.0E+00 N	1.0E+00 N	3.2E-01 C !	5.8E+02 C !	6.5E+01 C !
ETHION	563122	5.00E-04 I					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
2-ETHOXYETHANOL	110805	4.00E-01 H		5.70E-02 I			1.5E+04 N	2.1E+02 N	5.4E+02 N	8.2E+05 N	3.1E+04 N
ETHYL ACETATE	141786	9.00E-01 I				y	5.5E+03 N	3.3E+03 N	1.2E+03 N	1.8E+06 N	7.0E+04 N
ETHYLBENZENE	100414	1.00E-01 I		2.90E-01 I		y	1.3E+03 N	1.1E+03 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
ETHYLENE DIAMINE	107153	2.00E-02 H					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
ETHYLENE GLYCOL	107211	2.00E+00 I					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762			5.70E-03 H				2.1E+01 N			
**ETHYLENE OXIDE	75218		1.00E+00 H		3.50E-01 H	y	2.3E-02 C	1.8E-02 C	3.2E-03 C	5.7E+00 C	6.4E-01 C
ETHYLENE THIOUREA	96457	8.00E-05 I	1.1E-01 H				6.1E-01 C !	5.7E-02 C !	2.9E-02 C !	5.2E+01 C !	5.8E+00 C !
ETHYL ETHER	60297	2.00E-01 I				y	1.2E+03 N	7.3E+02 N	2.7E+02 N	4.1E+05 N	1.6E+04 N
ETHYL METHACRYLATE	97632	9.00E-02 H				y	5.5E+02 N	3.3E+02 N	1.2E+02 N	1.8E+05 N	7.0E+03 N
FENAMIPHOS	22224926	2.50E-04 I					9.1E+00 N	9.1E-01 N	3.4E-01 N	5.1E+02 N	2.0E+01 N
FLUOMETURON	2164172	1.30E-02 I					4.7E+02 N	4.7E+01 N	1.8E+01 N	2.7E+04 N	1.0E+03 N
FLUORINE	7782414	6.00E-02 I					2.2E+03 N	2.2E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
FOMESAFEN	72178020		1.90E-01 I				3.5E-01 C	3.3E-02 C	1.7E-02 C	3.0E+01 C	3.4E+00 C
FONOFOS	944229	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
FORMALDEHYDE	50000	2.00E-01 I			4.50E-02 I		7.3E+03 N	1.4E-01 C	2.7E+02 N	4.1E+05 N	1.6E+04 N
FORMIC ACID	64186	2.00E+00 H					7.3E+04 N	7.3E+03 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
FURAN	110009	1.00E-03 I				y	6.1E+00 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
FURAZOLIDONE	67458		3.80E+00 H				1.8E-02 C	1.6E-03 C	8.3E-04 C	1.5E+00 C	1.7E-01 C
FURFURAL	98011	3.00E-03 I		1.00E-02 A			1.1E+02 N	3.7E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
GLYCIDALDEHYDE	765344	4.00E-04 I		2.90E-04 H			1.5E+01 N	1.1E+00 N	5.4E-01 N	8.2E+02 N	3.1E+01 N
GLYPHOSATE	1071836	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
**HEPTACHLOR	76448	5.00E-04 I	4.50E+00 I		4.50E+00 I		1.5E-02 C	1.4E-03 C	7.0E-04 C	1.3E+00 C	1.4E-01 C
**HEPTACHLOR EPOXIDE	1024573	1.30E-05 I	9.10E+00 I		9.10E+00 I		7.4E-03 C	6.9E-04 C	3.5E-04 C	6.3E-01 C	7.0E-02 C
HEXABROMOBENZENE	87821	2.00E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
**HEXACHLOROBENZENE	118741	8.00E-04 I	1.60E+00 I		1.60E+00 I		4.2E-02 C	3.9E-03 C	2.0E-03 C	3.6E+00 C	4.0E-01 C
**HEXACHLOROBUTADIENE	87683	2.00E-04 H	7.80E-02 I		7.80E-02 I		8.6E-01 C !	8.0E-02 C !	4.0E-02 C !	7.3E+01 C !	8.2E+00 C !
ALPHA-HCH	319846		6.30E+00 I		6.30E+00 I		1.1E-02 C	9.9E-04 C	5.0E-04 C	9.1E-01 C	1.0E-01 C
BETA-HCH	319857		1.80E+00 I		1.80E+00 I		3.7E-02 C	3.5E-03 C	1.8E-03 C	3.2E+00 C	3.5E-01 C
GAMMA-HCH (LINDANE)	58899	3.00E-04 I	1.30E+00 H				5.2E-02 C	4.8E-03 C	2.4E-03 C	4.4E+00 C	4.9E-01 C
TECHNICAL HCH	608731		1.80E+00 I		1.80E+00 I		3.7E-02 C	3.5E-03 C	1.8E-03 C	3.2E+00 C	3.5E-01 C
**HEXACHLOROPENTADIENE	77474	7.00E-03 I		2.00E-05 H			2.6E+02 N	7.3E-02 N	9.5E+00 N	1.4E+04 N	5.5E+02 N

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Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
HEXACHLORODIBENZODIOXIN MIX	19408743		6.20E+03 I		4.55E+03 I		1.1E-05 C	1.4E-06 C	5.1E-07 C	9.2E-04 C	1.0E-04 C
**HEXACHLOROETHANE	67721	1.00E-03 I	1.40E-02 I		1.40E-02 I		4.8E+00 C !	4.5E-01 C !	2.3E-01 C !	4.1E+02 C !	4.6E+01 C !
HEXACHLOROPHENE	70304	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			2.90E-06 I				1.1E-02 N			
HEXANE	110543	6.00E-02 H		5.71E-02 I		y	3.5E+02 N	2.1E+02 N	8.1E+01 N	1.2E+05 N	4.7E+03 N
2-HEXANONE	591786	4.00E-02 E		1.4E-03 E			1.5E+03 N	5.1E+00 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
HEXAZINONE	51235042	3.30E-02 I					1.2E+03 N	1.2E+02 N	4.5E+01 N	6.7E+04 N	2.6E+03 N
HMX	2691410	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
HYDRAZINE	302012		3.00E+00 I		1.70E+01 I		2.2E-02 C	3.7E-04 C	1.1E-03 C	1.9E+00 C	2.1E-01 C
HYDROGEN CHLORIDE	7647010			5.70E-03 I				2.1E+01 N			
HYDROGEN SULFIDE	7783064	3.00E-03 I		2.85E-04 I			1.1E+02 N	1.0E+00 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
HYDROQUINONE	123319	4.00E-02 H					1.5E+03 N	1.5E+02 N	5.4E+01 N	8.2E+04 N	3.1E+03 N
IRON	7439896	3.00E-01 E					1.1E+04 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
ISOBUTANOL	78831	3.00E-01 I				y	1.8E+03 N	1.1E+03 N	4.1E+02 N	6.1E+05 N	2.3E+04 N
ISOPHORONE	78591	2.00E-01 I	9.50E-04 I				7.0E+01 C	6.6E+00 C	3.3E+00 C	6.0E+03 C	6.7E+02 C
ISOPROPALIN	33820530	1.50E-02 I					5.5E+02 N	5.5E+01 N	2.0E+01 N	3.1E+04 N	1.2E+03 N
ISOPROPYL METHYL PHOSPHONIC ACID	1832548	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
**TETRAETHYLLEAD	78002	1.00E-07 I					3.7E-03 N	3.7E-04 N	1.4E-04 N	2.0E-01 N	7.8E-03 N
LITHIUM	7439932	2.00E-02 E					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MALATHION	121755	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MALEIC ANHYDRIDE	108316	1.00E-01 I					3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
MANGANESE-NONFOOD	7439965	2.00E-02 I		1.43E-05 I			7.3E+02 N	5.2E-02 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
MANGANESE-FOOD	7439965	1.40E-01 I		1.43E-05 I			5.1E+03 N	5.2E-02 N	1.9E+02 N	2.9E+05 N	1.1E+04 N
MEPHOSFOLAN	950107	9.00E-05 H					3.3E+00 N	3.3E-01 N	1.2E-01 N	1.8E+02 N	7.0E+00 N
MEPIQUAT CHLORIDE	24307264	3.00E-02 I					1.1E+03 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
MERCURIC CHLORIDE	7487947	3.00E-04 I					1.1E+01 N	1.1E+00 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
MERCURY (INORGANIC)	7439976			8.60E-05 I				3.1E-01 N			
METHYLMERCURY	22967926	1.00E-04 I					3.7E+00 N	3.7E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
METHACRYLONITRILE	126987	1.00E-04 I		2.00E-04 A		y	1.0E+00 N	7.3E-01 N	1.4E-01 N	2.0E+02 N	7.8E+00 N
METHANOL	67561	5.00E-01 I					1.8E+04 N	1.8E+03 N	6.8E+02 N	1.0E+06 N	3.9E+04 N
METHIDATHION	950378	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
METHOXYCHLOR	72435	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
METHYL ACETATE	79209	1.00E+00 H				y	6.1E+03 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
METHYL ACRYLATE	96333	3.00E-02 A				y	1.8E+02 N	1.1E+02 N	4.1E+01 N	6.1E+04 N	2.3E+03 N
2-METHYLANILINE	95534		2.40E-01 H				2.8E-01 C	2.6E-02 C	1.3E-02 C	2.4E+01 C	2.7E+00 C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815	1.00E-02 I					3.7E+02 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746	5.00E-04 I					1.8E+01 N	1.8E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (M	93652	1.00E-03 I					3.7E+01 N	3.7E+00 N	1.4E+00 N	2.0E+03 N	7.8E+01 N
METHYLCYCLOHEXANE	108872			8.60E-01 H		y	6.3E+03 N	3.1E+03 N			
METHYLENE BROMIDE	74953	1.00E-02 A				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
METHYLENE CHLORIDE	75092	6.00E-02 I	7.50E-03 I	8.60E-01 H	1.65E-03 I	y	4.1E+00 C	3.8E+00 C	4.2E-01 C	7.6E+02 C	8.5E+01 C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144	7.00E-04 H	1.30E-01 H		1.30E-01 H		5.2E-01 C	4.8E-02 C	2.4E-02 C	4.4E+01 C	4.9E+00 C
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611		4.60E-02 I				1.5E+00 C	1.4E-01 C	6.9E-02 C	1.2E+02 C	1.4E+01 C
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			1.7E-04 I				6.2E-01 N			
METHYL ETHYL KETONE (2-BUTANONE)	78933	6.00E-01 I		2.86E-01 I		y	1.9E+03 N	1.0E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
METHYL HYDRAZINE	60344		1.10E+00 W				6.1E-02 C	5.7E-03 C	2.9E-03 C	5.2E+00 C	5.8E-01 C
**METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANON	108101	8.00E-02 H		2.00E-02 A		y	1.4E+02 N	7.3E+01 N	1.1E+02 N	1.6E+05 N	6.3E+03 N
METHYL METHACRYLATE	80626	1.40E+00 I		2.00E-01 I		y	1.4E+03 N	7.3E+02 N	1.9E+03 N	2.9E+06 N	1.1E+05 N
2-METHYL-5-NITROANILINE	99558		3.30E-02 H				2.0E+00 C	1.9E-01 C	9.6E-02 C	1.7E+02 C	1.9E+01 C
METHYL PARATHION	298000	2.50E-04 I					9.1E+00 N	9.1E-01 N	3.4E-01 N	5.1E+02 N	2.0E+01 N
2-METHYLPHENOL	95487	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
3-METHYLPHENOL	108394	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
4-METHYLPHENOL	106445	5.00E-03 H					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
METHYLSTYRENE MIX	25013154	6.00E-03 A		1.00E-02 A		y	5.5E+01 N	3.7E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
ALPHA-METHYLSTYRENE	98839	7.00E-02 A				y	4.3E+02 N	2.6E+02 N	9.5E+01 N	1.4E+05 N	5.5E+03 N
METHYL TERT-BUTYL ETHER	1634044			8.57E-01 I		y	6.3E+03 N	3.1E+03 N			

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects ! = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
METOLACHLOR (DUAL)	51218452	1.50E-01 I					5.5E+03 N	5.5E+02 N	2.0E+02 N	3.1E+05 N	1.2E+04 N
**MIREX	2385855	2.00E-04 I					7.3E+00 N	7.3E-01 N	2.7E-01 N	4.1E+02 N	1.6E+01 N
MOLYBDENUM	7439987	5E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
**MONOCHLORAMINE	10599903	1E-01 I		1.00E-01 H			3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
NALED	300765	2E-03 I					7.3E+01 N	7.3E+00 N	2.7E+00 N	4.1E+03 N	1.6E+02 N
NICKEL REFINERY DUST					8.4E-01 I			7.5E-03 C			
NICKEL	7440020	2.00E-02 I					7.3E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
NITRATE	14797558	1.60E+00 I					5.8E+04 N	5.8E+03 N	2.2E+03 N	3.3E+06 N	1.3E+05 N
NITRIC OXIDE	10102439	1.00E-01 W					6.1E+02 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
NITRITE	14797650	1.00E-01 I				y	3.7E+03 N	3.7E+02 N	1.4E+02 N	2.0E+05 N	7.8E+03 N
2-NITROANILINE	88744			5.70E-05 H				2.1E-01 N			
NITROBENZENE	98953	5.00E-04 I		6.00E-04 A		y	3.5E+00 N	2.2E+00 N	6.8E-01 N	1.0E+03 N	3.9E+01 N
NITROFURANTOIN	67209	7.00E-02 H					2.6E+03 N	2.6E+02 N	9.5E+01 N	1.4E+05 N	5.5E+03 N
NITROFURAZONE	59870		1.50E+00 H				4.5E-02 C	4.2E-03 C	2.1E-03 C	3.8E+00 C	4.3E-01 C
NITROGEN DIOXIDE	10102440	1.00E+00 W				y	6.1E+03 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
NITROGLYCERIN	55630		1.4E-02 E				4.8E+00 C	4.5E-01 C	2.3E-01 C	4.1E+02 C	4.6E+01 C
4-NITROPHENOL	100027	8.00E-03 E					2.9E+02 N	2.9E+01 N	1.1E+01 N	1.6E+04 N	6.3E+02 N
2-NITROPROPANE	79469			5.70E-03 I	9.40E+00 H	y	1.3E-03 C	6.7E-04 C			
**N-NITROSO-DI-N-BUTYLAMINE	924163		5.40E+00 I		5.60E+00 I	y	1.9E-03 C	1.1E-03 C	5.8E-04 C	1.1E+00 C	1.2E-01 C
N-NITROSODIETHANOLAMINE	1116547		2.80E+00 I				2.4E-02 C	2.2E-03 C	1.1E-03 C	2.0E+00 C	2.3E-01 C
N-NITROSODIETHYLAMINE	55185		1.50E+02 I		1.50E+02 I		4.5E-04 C	4.2E-05 C	2.1E-05 C	3.8E-02 C	4.3E-03 C
N-NITROSODIMETHYLAMINE	62759		5.10E+01 I		5.10E+01 I		1.3E-03 C	1.2E-04 C	6.2E-05 C	1.1E-01 C	1.3E-02 C
N-NITROSODIPHENYLAMINE	86306		4.90E-03 I				1.4E+01 C	1.3E+00 C	6.4E-01 C	1.2E+03 C	1.3E+02 C
N-NITROSODIPROPYLAMINE	621647		7.00E+00 I				9.6E-03 C	8.9E-04 C	4.5E-04 C	8.2E-01 C	9.1E-02 C
N-NITROSO-N-ETHYLUREA	759739		1.40E+02 H				4.8E-04 C	4.5E-05 C	2.3E-05 C	4.1E-02 C	4.6E-03 C
N-NITROSO-N-METHYLETHYLAMINE	10595956		2.20E+01 I				3.0E-03 C	2.8E-04 C	1.4E-04 C	2.6E-01 C	2.9E-02 C
N-NITROSOPYRROLIDINE	930552		2.10E+00 I		2.10E+00 I		3.2E-02 C	3.0E-03 C	1.5E-03 C	2.7E+00 C	3.0E-01 C
M-NITROTOLUENE	99081	2.00E-02 E				y	1.2E+02 N	7.3E+01 N	2.7E+01 N	4.1E+04 N	1.6E+03 N
O-NITROTOLUENE	88722	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
P-NITROTOLUENE	99990	1.00E-02 H				y	6.1E+01 N	3.7E+01 N	1.4E+01 N	2.0E+04 N	7.8E+02 N
NUSTAR	85509199	7.00E-04 I					2.6E+01 N	2.6E+00 N	9.5E-01 N	1.4E+03 N	5.5E+01 N
ORYZALIN	19044883	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
OXADIAZON	19666309	5.00E-03 I					1.8E+02 N	1.8E+01 N	6.8E+00 N	1.0E+04 N	3.9E+02 N
OXAMYL	23135220	2.50E-02 I					9.1E+02 N	9.1E+01 N	3.4E+01 N	5.1E+04 N	2.0E+03 N
OXYFLUORFEN	42874033	3.00E-03 I					1.1E+02 N	1.1E+01 N	4.1E+00 N	6.1E+03 N	2.3E+02 N
PARAQUAT DICHLORIDE	1910425	4.50E-03 I					1.6E+02 N	1.6E+01 N	6.1E+00 N	9.2E+03 N	3.5E+02 N
PARATHION	56382	6.00E-03 H					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
**PENTACHLOROBENZENE	608935	8.00E-04 I					2.9E+01 N	2.9E+00 N	1.1E+00 N	1.6E+03 N	6.3E+01 N
**PENTACHLORONITROBENZENE	82688	3.00E-03 I	2.60E-01 H				2.6E-01 C	2.4E-02 C	1.2E-02 C	2.2E+01 C	2.5E+00 C
PENTACHLOROPHENOL	87865	3.00E-02 I	1.20E-01 I				5.6E-01 C	5.2E-02 C	2.6E-02 C	4.8E+01 C	5.3E+00 C
PERMETHRIN	52645531	5.00E-02 I					1.8E+03 N	1.8E+02 N	6.8E+01 N	1.0E+05 N	3.9E+03 N
PHENOL	108952	6.00E-01 I					2.2E+04 N	2.2E+03 N	8.1E+02 N	1.2E+06 N	4.7E+04 N
M-PHENYLENEDIAMINE	108452	6.00E-03 I					2.2E+02 N	2.2E+01 N	8.1E+00 N	1.2E+04 N	4.7E+02 N
O-PHENYLENEDIAMINE	95545		4.70E-02 H				1.4E+00 C	1.3E-01 C	6.7E-02 C	1.2E+02 C	1.4E+01 C
P-PHENYLENEDIAMINE	106503	1.90E-01 H					6.9E+03 N	6.9E+02 N	2.6E+02 N	3.9E+05 N	1.5E+04 N
2-PHENYLPHENOL	90437		1.90E-03 H				3.5E+01 C	3.3E+00 C	1.7E+00 C	3.0E+03 C	3.4E+02 C
PHOSPHINE	7803512	3.00E-04 I		8.60E-05 I			1.1E+01 N	3.1E-01 N	4.1E-01 N	6.1E+02 N	2.3E+01 N
PHOSPHORIC ACID	7664382			2.90E-03 I				1.1E+01 N			
PHOSPHORUS (WHITE)	7723140	2.00E-05 I					7.3E-01 N	7.3E-02 N	2.7E-02 N	4.1E+01 N	1.6E+00 N
P-PHTHALIC ACID	100210	1.00E+00 H					3.7E+04 N	3.7E+03 N	1.4E+03 N	2.0E+06 N	7.8E+04 N
PHTHALIC ANHYDRIDE	85449	2.00E+00 I		3.43E-02 H			7.3E+04 N	1.3E+02 N	2.7E+03 N	4.1E+06 N	1.6E+05 N
POLYBROMINATED BIPHENYLS		7.00E-06 H	8.90E+00 H				7.5E-03 C	7.0E-04 C	3.5E-04 C	6.4E-01 C	7.2E-02 C !
POLYCHLORINATED BIPHENYLS	1336363		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1016	12674112	7.00E-05 I	7.00E-02 I		7.00E-02 I		9.6E-01 C !	8.9E-02 C !	4.5E-02 C !	8.2E+01 C !	5.5E+00 N
AROCLOR-1221	11104282		2.00E+00 I		2.00E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C
AROCLOR-1232	11141165		2.00E+00 I		[illegible]0E+00 I		3.3E-02 C	3.1E-03 C	1.6E-03 C	2.9E+00 C	3.2E-01 C

APPENDIX C

GENERAL RESPONSE ACTION DESCRIPTION

GENERAL RESPONSE ACTIONS

General response actions describe those actions that will satisfy the remedial action objectives. General response actions may include treatment, containment, excavation, extraction, disposal, institutional actions, or a combination of these. Like remedial action objectives, general response actions are medium-specific. General response actions that might be used at a site are initially defined during scoping and are refined throughout the RI/FS as a better understanding of site conditions is gained and action-specific ARARs are identified.

No Action

The No Action general response action consists of no additional action. No Action is typically considered in an FS to serve as a baseline consideration or to address sites that do not require any active remediation. The No Action baseline condition for NAS Whiting Field consists of access restrictions. Access to the base is controlled in accordance with existing Navy regulations including controlled entrances on the base and security fencing. The regulations minimize the potential for accidental contact with any portion of the site and are assumed to remain in effect during remediation.

Limited Action

The Limited Action would consist of Land Use Controls (LUCs) and fencing. LUCs are any restriction or control arising from the need to protect human health and the environment or to limit the use of and/or exposure to environmentally contaminated media (e.g., soils, surface water, groundwater) at any site on NAS Whiting Field. LUCs include controls on access (e.g., engineered and nonengineered mechanisms such as fences, caps, and security guards). Additionally, LUCs encompasses both affirmative measures to achieve the desired control (e.g., night lighting of an area) and prohibitive directives (e.g., no drilling of drinking water wells). LUCs include “institutional controls,” which are nonengineered mechanisms for ensuring compliance with necessary land use limitations (e.g., public advisories, Base Master Plan notations, and applicable legal restrictions on land or water usage). Monitoring of soil contamination would not be conducted.

Containment

Containment would be used to control access to contaminants in soils. Containment using horizontal barriers, such as soil caps, can be used to minimize dermal contact risks.

In Situ Treatment

In situ treatment is the treatment of organic-contaminated soil "in place." In situ treatment allows the soils to be treated in place with minimal disturbance and typically includes soil venting when remediating organics.

Removal and Disposal

Removal and disposal would consist of excavating the contaminated soils and disposing of them without treatment in a disposal site. Additional excavation would be required to provide access to buried contaminated areas.

APPENDIX D

CERCLA EVALUATION CRITERIA SUMMARY

CERCLA EVALUATION CRITERIA

The objective of the individual detailed analyses is to provide adequate information for each alternative to facilitate the selection of soil remedial actions at NAS Whiting Field. During detailed analysis of alternatives, soil remedial alternatives are assessed against the nine evaluation criteria outlined in USEPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988). The evaluation criteria, widely used in CERCLA investigations, are beneficial in selecting and reducing the number of remedial alternatives. Uncertainties associated with specific alternatives are included in the evaluation when changes in assumptions or unknown conditions could affect the analyses.

A three-phase approach is used in the detailed analyses with the evaluation criteria. Table 1-1 presents a summary of the criteria for detailed analyses of alternatives. The "threshold" criteria represent the initial evaluation step for an alternative. For an alternative to advance to the next set of criteria, it must (1) be protective of human health and the environment and (2) comply with ARARs. The "balancing" criteria constitute the second step in the evaluation stage in which an alternative is assessed as to (1) long-term effectiveness and permanence; (2) reduction of mobility, toxicity, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. The third and final stage relates to the "modifying" criteria in which (1) state acceptance and (2) community acceptance are evaluated. Descriptions of the nine CERCLA evaluation criteria based on USEPA guidance (USEPA, 1988) are provided below.

Threshold Criteria

Overall Protection of Human Health and the Environment

Evaluation of the overall protectiveness of an alternative focuses on whether a specific alternative provides adequate protection and describes how risks associated with the potential site-specific exposure pathways are eliminated, reduced, or controlled through treatment, engineering, and/or LUCs. This criterion also allows for consideration of whether an alternative poses any unacceptable short-term (during remedial activities) or cross-media impacts. The overall evaluation of protection draws on the assessments conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. Overall protection from impacted soil is based largely on the certainty that the remedy can achieve and maintain cleanup levels or minimize potential exposure pathways. This criterion must be satisfied for an alternative to be considered in the selection process.

Compliance with ARARs

This evaluation criterion is used to determine whether an alternative specific to the site will satisfy all the Federal and state ARARs including compliance with chemical-, action-, and location-specific ARARs. Applicable requirements are those cleanup standards, standards of control (technology- or activity-based), and substantive environmental protection requirements promulgated under Federal or state law that specifically address a situation encountered at NAS Whiting Field. Relevant and appropriate requirements are those Federal and state regulatory requirements that, while not "applicable," address problems or situations sufficiently similar to those encountered in NAS Whiting Field and are appropriate to the circumstances of release or threatened release. Chemical-specific ARARs are numerically represented by the PRGs. Action-specific ARARs are represented by such regulations as RCRA. Location-specific ARARs are represented by regulations regarding actions such as floodplain management. The Navy in consultation with the State of Florida and USEPA makes the final determination of which requirements are relevant and appropriate. This criterion must be satisfied for an alternative to be considered in the selection process.

Balancing Criteria

Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the results of a remedial action in terms of the exposure to risk remaining at the site after RAOs have been satisfied. This evaluation focuses on the extent and effectiveness of controls that may be required to manage risks posed by treatment residuals and/or untreated constituents. The following components of the criterion (USEPA, 1988) described below are addressed for each alternative.

- Magnitude of residual risk. This component provides an assessment of the residual risk (on a pathway basis) remaining from treatment residuals and/or untreated constituents at the conclusion of remedial activities. Issues for evaluation of the residual risk include identifying the remaining sources of risk and the requirement of a 5-year review.

- Adequacy and reliability. This component provides an assessment of the adequacy and reliability of remedial controls, if any, used to manage treatment residuals or untreated constituents remaining at the site. Issues for evaluation are type and degree of long-term management, long-term monitoring, operations and maintenance (O&M) functions, and degree of confidence.

Qualitative terms such as “high,” “medium,” “low,” “certain,” and “uncertain” are used to define how well an alternative satisfies the requirements of the evaluation criterion in achieving RAOs. Alternatives must be widely used and proven effective to be considered reliable. An evaluation of the reliability of an alternative is required by CERCLA.

Reduction in Mobility, Toxicity, or Volume through Treatment

This evaluation criterion addresses the preference for selecting remedial actions that employ, as their principal element, treatment technologies that permanently and significantly reduce mobility, toxicity, and/or volume of the constituents in the soil. This preference is satisfied when treatment is used to reduce the principal threats at an area through the destruction of toxic constituents, irreversible reduction in constituent mobility, and/or reduction of the total volume of impacted media.

This evaluation focuses on the following specific factors for each alternative as summarized from CERCLA guidance (USEPA, 1988):

- The treatment process employed.
- The amount of hazardous materials destroyed or treated.
- The degree of expected reduction in mobility, toxicity, or volume.
- The degree to which the treatment is irreversible.
- The type and quantity of treatment residuals that will remain following treatment.
- The degree to which the alternative satisfies the statutory preference for a principal treatment element.

Qualitative terms such as “high,” “medium,” “low,” “certain,” and “uncertain” are used to define how an alternative satisfies the requirements of the evaluation criterion in achieving the RAOs.

Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction, implementation, and operational phases of remedial action until remedial objectives (e.g., cleanup levels) are achieved. Under this criterion the alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The factors below are summarized from CERCLA guidance (USEPA, 1988) and are addressed as appropriate for each of the remedial action alternatives.

- Protection of the community and workers during construction phases. This aspect of short-term effectiveness addresses risk and inconvenience (such as odor) that may result from implementation of the proposed soil remedial action. These considerations include worker and community threats during remedial action and the effectiveness and reliability of available worker-protective measures.

- Environmental impacts. This factor addresses the potential adverse environmental impacts that may result from the construction and implementation of an alternative and evaluates the reliability of available mitigation measures to prevent or reduce potential impacts.

- Time. This factor addresses the time required to complete construction, implementation, and O&M activities, as well as to achieve remedial objectives. Estimated remedial times are based on the time required to remediate sites with similar conditions, computer modeling, pilot test data, and professional judgment.

Qualitative terms such as “high,” “medium,” “low,” “certain,” and “uncertain” are used to define how an alternative satisfies the requirements of the evaluation criterion in achieving the RAOs.

Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative as well as the availability of services and materials required during implementation. This criterion involves analysis of the factors below as summarized from CERCLA guidance (USEPA, 1988).

- Technical feasibility
  - Ability to construct and operate the technology includes an evaluation of difficulties and uncertainties associated with the alternative.
  - Reliability of the technology focuses on the likelihood that technical problems associated with implementation could lead to schedule delays.
  - Ease of undertaking additional remedial action includes a discussion of any future remedial actions that may be required and the difficulty of implementing such additional actions. This criterion addresses the ability of the remedy to accommodate future technologies, capacities, or changing soil-constituent concentrations.
  - Monitoring considerations concern the ability to monitor the effectiveness of the remedy and include the effects of exposure if monitoring is insufficient to detect a system failure.

- Administrative Feasibility
  - Ability to coordinate with other offices and agencies for such requirements as construction permits and necessary access to treatment facilities is assessed.

- Availability of Services and Treatment
  - Availability of TSDF that have the required capacity is evaluated.
  - Availability of equipment, specialists, and provisions required to perform the remediation is evaluated.
  - Availability of sources for competitive services and materials is determined.

Qualitative terms such as “high,” “medium,” “low,” “certain,” and “uncertain” are used to define how well an alternative satisfies the requirements of the evaluation criterion in achieving the RAOs.

Cost

The cost criterion addresses the capital costs and annual O&M costs. Costs are estimates for the scope of the remedial action described. A present worth analysis is used to evaluate remedial alternatives occurring over several years. The estimated present worth of each remedial alternative was determined based on a combined interest and inflation rate of 10 percent and a base long-term maintenance/monitoring of not greater than 30 years in accordance with current USEPA guidance (USEPA, 1991). Long-term maintenance/monitoring of alternatives begins upon completion of remedial actions and achievement of PRGs. Costs are presented for comparison and evaluation purposes only.

The cost estimates are prepared based on information from such sources as the *Means Environmental Remediation Cost Data – Assemblies* (Means, 1999a), the *Means Environmental Remediation Cost Data – Unit Price* (Means, 1999b), estimates for similar Tetra Tech NUS projects, telephone quotes provided by vendors, and details provided by treatment facilities personnel. The O&M costs developed are incremental increases over any current system costs. The procedure for preparing the cost estimate was taken from the *Remedial Action Costing Procedures Manual* (USEPA, 1987). A discussion of each component of the cost criterion is given below.

Capital Costs

Total capital costs are defined as those expenditures required to initiate and implement a remedial action. These are short-term costs and are exclusive of costs required to maintain the action throughout the project’s lifetime. These direct costs include construction costs or expenditures for equipment, labor, disposal, permits, startup, and materials required during the remedial action installation. A single contingency (10 to 30 percent of present worth project total) is included for each alternative for any bid and scope changes. The bid contingency covers changes during final design and implementation and accounts for factors such as economic/bidding climate, contractor's uncertainty regarding liability and

insurance on hazardous waste sites, adverse weather, strikes by material suppliers, and geotechnical unknowns tending to increase costs associated with constructing a project. Scope contingencies include provisions for inherent uncertainties such as expanding the extent of excavation needed and regulatory or policy changes that may affect the initial assumptions.

The cost for engineering design (between 5-20 percent of the capital cost) is included in the capital cost. Allowances for price inflation and abnormal technical difficulties are not accounted for in the contingencies.

Operations and Maintenance Costs

Short-term costs occur after construction and installation are complete, but before the remedial action is complete. Such costs include labor, monitoring, materials, utilities, energy, disposal, administrative support, services, rehabilitation, and progress reviews required to operate and maintain remedial action activities. Long-term annual O&M costs are costs incurred after remediation is complete and may also include labor, monitoring, materials, administrative support, and site reviews. The O&M costs presented herein are incremental increases from current system costs for each alternative.

Modifying Criteria

Regulatory Agency Acceptance

This assessment evaluates the technical and administrative issues and concerns that regulators may have regarding each alternative. When regulatory review of the FS report has been completed, the response summary to the Proposed Plan and ROD will address this criterion.

Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each of the alternatives. As with regulatory agency acceptance, this criterion will be addressed in the response summary to the Proposed Plan and the ROD when public comments have been received.

APPENDIX E

REMEDIAL ALTERNATIVE COST ESTIMATES

Basis of Estimate

The cost estimates for Sites 3, 4, 6, 30, 32, and 33 were developed by estimating the quantities of labor, material, equipment, and subcontract costs for each remedial alternatives. The cost for each activity was estimated using either environmental remediation cost data manuals, engineering judgment based on past experience in performing the task, or historic cost data for similar tasks.

Labor hours for activities performed by professional and technical staff were estimated using engineering judgment based on past experience in performing the task. For example, labor hours to produce remedial action plans were based on substantial experience in writing similar submittals for other remedial action projects.

Costs for on-site construction tasks were estimated using the 1999 ECHOS Environmental Remediation Cost Data Manual (R. S. Means) or were based on historic cost data from previous construction experience performing similar activities. Each activity was evaluated to determine the labor, equipment, and materials required to perform the task.

Quantities of work for each activity were either calculated based on design information developed during preparation of the FS or were based on best engineering practice, judgment, and experience. General assumptions used to calculate excavation and disposal quantities include:

- Excavation volume includes contaminated soil, uncontaminated overburden, 1.5 to 1 side slopes for slope stability, and 20% expansion factor.
- Disposal quantities are based on a soil weight of 1.5 tons per cubic yard.
- An average soil disposal rate of 200 tons per day was assumed.

Estimating Markups

The markups utilized in the cost estimates are based on standardized cost data manual estimates (ECHOS) and on experience performing similar projects. The markups are described below:

- Overhead on Labor (30% for construction tasks and 100% for professional service task): Includes FIAC, Workman's Compensation, Unemployment Insurance, Builders Risk Insurance.

- G & A on Labor, Materials, and Subcontracts (10%): Includes Administrative and Handling.

- Indirects on Labor (75%): Includes Supervision, Travel, Medical, Supplies, Data Process, Bond

Premium Insurance, Security, Testing & Analysis, Maintenance, Timekeeper, Photos, Pre and Post Documents (as-builts, reports), Pollution Insurance, Normal Trash Disposal, and Site Clean up. (30% to 150%)

- Health & Safety Monitoring (3%): Includes labor and equipment for oversite on a hazardous site. (Does not include personnel air monitoring or laboratory testing). (3% to 10%)

- Contingency (10%): Includes unknowns site conditions noted during final design or construction. (5% to 25%)

- Engineering (5%): Includes cost to design project. (5% to 20%)

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.4 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	5	drum	$125.00				$625	$0	$0	$0	$625
3.3 Decon Water Storage Drums	5	ea		$45.00			$0	$225	$0	$0	$225
3.4 PPE (2 p * 5 days * 2 Weeks)	20	m-day		$30.00			$0	$600	$0	$0	$600
3.5 Decontaminate Equipment (Pressure Washer)	2	ea			$134.45	$50.00	$0	$0	$269	$100	$369
4 SITE PREPARATION											
4.1 Erosion Control Fencing	264	lf		$0.23	$1.17		$0	$61	$309	$0	$370
4.2 Collect/Analyze Delineation Samples (inorganics	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	174	cy			$1.27	$2.23	$0	$0	$221	$388	$609
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavato	24	hrs				$20.50	$0	$0	$0	$492	$492
5.3 Health & Safety Monitoring with OVA during Excavatior	5	day			$188.16	$100.00	$0	$0	$941	$500	$1,441
5.4 Collect/Analyze Confirmatory Samples	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
5.5 Import (Offsite) Place, Compact Clean Fill Materia	131	cy		$7.82	$0.85	$1.81	$0	$1,024	$111	$237	$1,373
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	261	ton	$45.00				$11,745	$0	$0	$0	$11,745
6.3 Prepare Shipment Manifests	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	43	cy		$15.00			$0	$645	$0	$0	$645
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.091	acre	$20,859.00				$1,898	$0	$0	$0	$1,898
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$3,955	$20,267	$2,807	$27,029
Local Area Adjustment								84%	84%	84%	
								$3,322	$17,024	$2,358	$22,705
Overhead on Labor Cost @ 30%									$5,107		$5,107
G & A on Labor Cost @ 10%									$1,702		$1,702
G & A on Material Cost @ 10%								$332			$332
Total Direct Capital Cost								$3,655	$23,834	$2,358	$29,847

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$17,876		$17,876
Profit on Total Direct Cost @ 10%											$2,985
Subtotal											$50,707
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$2,241
Total Field Cost											**$52,948**
Subtotal Subcontractor Cost							$23,986				$23,986
G & A on Subcontract Cost @ 10%							$2,399				$2,399
Profit on Subcontractor Cost @ 5%											$1,199
Subcontractor Cost											**$27,584**
Contingency on Total Field and Subcontractor Costs @ 10%											**$8,053**
Engineering on Total Field and Subcontractor Costs @ 5%											**$4,027**
TOTAL Capital COST											**$92,611**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$92,611			$92,611	1.000	$92,611
1		$0	$3,092	$3,092	0.943	$2,917
2		$0	$3,092	$3,092	0.890	$2,752
3		$0	$3,092	$3,092	0.840	$2,596
4		$0	$3,092	$3,092	0.792	$2,449
5		$0	$10,467	$10,467	0.747	$7,822
6		$0	$3,092	$3,092	0.705	$2,180
7		$0	$3,092	$3,092	0.665	$2,057
8		$0	$3,092	$3,092	0.627	$1,940
9		$0	$3,092	$3,092	0.592	$1,830
10		$0	$10,467	$10,467	0.558	$5,845
11		$0	$3,092	$3,092	0.527	$1,629
12		$0	$3,092	$3,092	0.497	$1,537
13		$0	$3,092	$3,092	0.469	$1,450
14		$0	$3,092	$3,092	0.442	$1,368
15		$0	$10,467	$10,467	0.417	$4,368
16		$0	$3,092	$3,092	0.394	$1,217
17		$0	$3,092	$3,092	0.371	$1,148
18		$0	$3,092	$3,092	0.350	$1,083
19		$0	$3,092	$3,092	0.331	$1,022
20		$0	$10,467	$10,467	0.312	$3,264
21		$0	$3,092	$3,092	0.294	$910
22		$0	$3,092	$3,092	0.278	$858
23		$0	$3,092	$3,092	0.262	$810
24		$0	$3,092	$3,092	0.247	$764
25		$0	$10,467	$10,467	0.233	$2,439
26		$0	$3,092	$3,092	0.220	$680
27		$0	$3,092	$3,092	0.207	$641
28		$0	$3,092	$3,092	0.196	$605
29		$0	$3,092	$3,092	0.185	$571
30		$0	$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	$153,183

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-3: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	3	mo	$74.18				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	$98.33				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	$221.49				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	10	drum	$125.00				$1,250	$0	$0	$0	$1,250
3.3 Decon Water Storage Drums	10	ea		$45.00			$0	$450	$0	$0	$450
3.4 PPE (3 p * 5 days * 6 Weeks)	90	m-day		$30.00			$0	$2,700	$0	$0	$2,700
3.5 Decontaminate Equipment (Pressure Washer)	3	ea			$134.45	$50.00	$0	$0	$403	$150	$553
4 SITE PREPARATION											
4.1 Erosion Control Fencing	762	lf		$0.23	$1.17		$0	$175	$892	$0	$1,067
4.2 Collect/Analyze Delineation Samples (inorganics	25	ea	$305.00	$10.00	$23.52		$7,625	$250	$588	$0	$8,463
4.3 Construction Surveys (2-man crew)	5	day	$648.36				$3,242	$0	$0	$0	$3,242
4.4 Utility Location and Site Delineation/Layou	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
4.5 Concrete Demolition/Removal (6" reinforced)	148	cy	$45.58				$6,746	$0	$0	$0	$6,746
4.6 Concrete Debris Disposal	148	cy	$20.70				$3,064	$0	$0	$0	$3,064
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	7521	cy			$0.68	$1.71	$0	$0	$5,114	$12,861	$17,975
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavato	90	hrs				$37.54	$0	$0	$0	$3,379	$3,379
5.3 Wheel Loader, 3 cy	240	hrs			$27.20	$56.31	$0	$0	$6,528	$13,514	$20,042
5.4 Standby, Wheel Loader, 3 cy	40	hrs				$14.07	$0	$0	$0	$563	$563
5.5 Health & Safety Monitoring with OVA during Excavatior	45	day			$188.16	$100.00	$0	$0	$8,467	$4,500	$12,967
5.6 Collect/Analyze Confirmatory Samples	15	ea	$305.00	$10.00	$23.52		$4,575	$150	$353	$0	$5,078
5.7 Import (Offsite) Place, Compact Clean Fill Materia	4011	cy		$7.82	$0.85	$1.81	$0	$31,366	$3,409	$7,260	$42,035
5.8 Backfill with Clean Excavated Materia	3259	cy		$0.28	$2.02	$0.76	$0	$913	$6,583	$2,477	$9,973
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	4	ls	$750.00				$3,000	$0	$0	$0	$3,000
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	6395	ton	$45.00				$287,775	$0	$0	$0	$287,775
6.3 Prepare Shipment Manifests	300	hrs			$33.23		$0	$0	$9,969	$0	$9,969
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	252	cy		$15.00			$0	$3,780	$0	$0	$3,780
7.2 Place/Grade Topsoil (6")	2	day			$227.20	$435.00	$0	$0	$454	$870	$1,324
7.3 Sod Disturbed Area	0.359	acre	$20,859.00				$7,488	$0	$0	$0	$7,488
7.4 Concrete Slab (Reinforced) on Grade (6")	7980	sf	$4.03				$32,159	$0	$0	$0	$32,159
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	3	days	$648.36				$1,945	$0	$0	$0	$1,945
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$41,359	$66,242	$46,478	$154,079

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-3: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$34,741	$55,643	$39,042	$129,426
Overhead on Labor Cost @ 30%									$16,693		$16,693
G & A on Labor Cost @ 10%									$5,564		$5,564
G & A on Material Cost @ 10%								$3,474			$3,474
Total Direct Capital Cost								$38,216	$77,900	$39,042	$155,158
Indirects on Total Direct Labor Cost @ 75%									$58,425		$58,425
Profit on Total Direct Cost @ 10%											$15,516
Subtotal											$229,099
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$17,765
Total Field Cost											**$246,864**
Subtotal Subcontractor Cost							$363,051				$363,051
G & A on Subcontract Cost @ 10%							$36,305				$36,305
Profit on Subcontractor Cost @ 5%											$18,153
Subcontractor Cost											**$417,509**
Contingency on Total Field and Subcontractor Costs @ 10%											**$66,437**
Engineering on Total Field and Subcontractor Costs @ 5%											**$33,219**
TOTAL Capital COST											**$764,028**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-3: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$300.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-3: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 3
SOIL ALTERNATIVE S3-3: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$764,028			$764,028	1.000	$764,028
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$821,118**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier)		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.4 Storage Trailer (28' x 10'	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	5	drum	$125.00				$625	$0	$0	$0	$625
3.3 Decon Water Storage Drums	5	ea		$45.00			$0	$225	$0	$0	$225
3.4 PPE (2 p * 6 days * 2 Weeks)	22	m-day		$30.00			$0	$660	$0	$0	$660
3.5 Decontaminate Equipment (Pressure Washer)	2	ea			$134.45	$50.00	$0	$0	$269	$100	$369
4 SITE PREPARATION											
4.1 Erosion Control Fencing	300	lf		$0.23	$1.17		$0	$69	$351	$0	$420
4.2 Collect/Analyze Delineation Samples (inorganics	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
4.3 Construction Surveys (2-man crew)	1.5	day	$648.36				$973	$0	$0	$0	$973
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	223	cy			$1.27	$2.23	$0	$0	$283	$497	$781
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	36	hrs				$20.50	$0	$0	$0	$738	$738
5.3 Health & Safety Monitoring with OVA during Excavatior	6	day			$188.16	$100.00	$0	$0	$1,129	$600	$1,729
5.4 Collect/Analyze Confirmatory Samples	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
5.5 Import (Offsite) Place, Compact Clean Fill Materia	168	cy		$7.82	$0.85	$1.81	$0	$1,314	$143	$304	$1,761
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	335	ton	$45.00				$15,075	$0	$0	$0	$15,075
6.3 Prepare Shipment Manifests	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil	56	cy		$15.00			$0	$840	$0	$0	$840
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.104	acre	$20,859.00				$2,169	$0	$0	$0	$2,169
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$4,508	$20,591	$3,329	$28,428
Local Area Adjustment								84%	84%	84%	
								$3,787	$17,296	$2,797	$23,880
Overhead on Labor Cost @ 30%									$5,189		$5,189
G & A on Labor Cost @ 10%									$1,730		$1,730
G & A on Material Cost @ 10%								$379			$379
Total Direct Capital Cost								$4,165	$24,215	$2,797	$31,177

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$18,161		$18,161
Profit on Total Direct Cost @ 10%											$3,118
Subtotal											$52,456
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$2,411
Total Field Cost											**$54,867**
Subtotal Subcontractor Cost							$27,911				$27,911
G & A on Subcontract Cost @ 10%							$2,791				$2,791
Profit on Subcontractor Cost @ 5%											$1,396
Subcontractor Cost											**$32,098**
Contingency on Total Field and Subcontractor Costs @ 10%											**$8,696**
Engineering on Total Field and Subcontractor Costs @ 5%											**$4,348**
TOTAL Capital COST											**$100,009**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$100,009			$100,009	1.000	$100,009
1		$0	$3,092	$3,092	0.943	$2,917
2		$0	$3,092	$3,092	0.890	$2,752
3		$0	$3,092	$3,092	0.840	$2,596
4		$0	$3,092	$3,092	0.792	$2,449
5		$0	$10,467	$10,467	0.747	$7,822
6		$0	$3,092	$3,092	0.705	$2,180
7		$0	$3,092	$3,092	0.665	$2,057
8		$0	$3,092	$3,092	0.627	$1,940
9		$0	$3,092	$3,092	0.592	$1,830
10		$0	$10,467	$10,467	0.558	$5,845
11		$0	$3,092	$3,092	0.527	$1,629
12		$0	$3,092	$3,092	0.497	$1,537
13		$0	$3,092	$3,092	0.469	$1,450
14		$0	$3,092	$3,092	0.442	$1,368
15		$0	$10,467	$10,467	0.417	$4,368
16		$0	$3,092	$3,092	0.394	$1,217
17		$0	$3,092	$3,092	0.371	$1,148
18		$0	$3,092	$3,092	0.350	$1,083
19		$0	$3,092	$3,092	0.331	$1,022
20		$0	$10,467	$10,467	0.312	$3,264
21		$0	$3,092	$3,092	0.294	$910
22		$0	$3,092	$3,092	0.278	$858
23		$0	$3,092	$3,092	0.262	$810
24		$0	$3,092	$3,092	0.247	$764
25		$0	$10,467	$10,467	0.233	$2,439
26		$0	$3,092	$3,092	0.220	$680
27		$0	$3,092	$3,092	0.207	$641
28		$0	$3,092	$3,092	0.196	$605
29		$0	$3,092	$3,092	0.185	$571
30		$0	$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	**$160,582**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Extended Cost Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.4 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	10	drum	$125.00				$1,250	$0	$0	$0	$1,250
3.3 Decon Water Storage Drums	10	ea		$45.00			$0	$450	$0	$0	$450
3.4 PPE (2 p * 6 days * 2 Weeks)	22	m-day		$30.00			$0	$660	$0	$0	$660
3.5 Decontaminate Equipment (Pressure Washer)	10	ea			$134.45	$50.00	$0	$0	$1,345	$500	$1,845
4 SITE PREPARATION											
4.1 Erosion Control Fencing	300	lf		$0.23	$1.17		$0	$69	$351	$0	$420
4.2 Collect/Analyze Delineation Samples (inorganics	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
4.3 Construction Surveys (2-man crew)	1.5	day	$648.36				$973	$0	$0	$0	$973
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	223	cy			$1.27	$2.23	$0	$0	$283	$497	$781
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavato	36	hrs				$20.50	$0	$0	$0	$738	$738
5.3 Health & Safety Monitoring with OVA during Excavatior	6	day			$188.16	$100.00	$0	$0	$1,129	$600	$1,729
5.4 Collect/Analyze Confirmatory Samples	10	ea	$305.00	$10.00	$23.52		$3,050	$100	$235	$0	$3,385
5.5 Import (Offsite) Place, Compact Clean Fill Materia	168	cy		$7.82	$0.85	$1.81	$0	$1,314	$143	$304	$1,761
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	335	ton	$45.00				$15,075	$0	$0	$0	$15,075
6.3 Prepare Shipment Manifests	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	56	cy		$15.00			$0	$840	$0	$0	$840
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.104	acre	$20,859.00				$2,169	$0	$0	$0	$2,169
8 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)											
8.1 Soil Vapor Extraction (SVE) System Layout (30' radius	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
8.2 Mobilize/Demobilize Drill Rig and Trenching Equipmer	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
8.3 SVE Well Install, 11" H. S. Auger (12 wells x 35' depth	420	lf	$27.01				$11,344	$0	$0	$0	$11,344
8.4 PVC Well Screen, 4" dia	210	lf	$17.84				$3,746	$0	$0	$0	$3,746
8.5 PVC Well Riser, 4" dia.	210	lf	$13.39				$2,812	$0	$0	$0	$2,812
8.6 Well Box and Surface Completion	12	well	$250.00				$3,000	$0	$0	$0	$3,000
8.7 PVC Piping, Schedule 40, 4'	650	lf		$1.62	$4.60		$0	$1,053	$2,990	$0	$4,043
8.8 Install SVE Piping and System Equipmen	1	ls	$8,000.00				$8,000	$0	$0	$0	$8,000
8.9 Piping Values, fittings, etc	1	ls	$1,200.00				$1,200	$0	$0	$0	$1,200
8.10 Backfill with Excavated Material	110	cy		$0.28	$2.02	$0.76	$0	$31	$222	$84	$337
8.11 QA/QC Inspection of System Installation	120	hrs			$31.08		$0	$0	$3,730	$0	$3,730
8.12 Vapor Recovery System, 280 SCFM, 5 Hp	1	ea	$6,828.00				$6,828	$0	$0	$0	$6,828
8.13 Trailer for SVE System (8' x 20')	1	ea	$5,240.00				$5,240	$0	$0	$0	$5,240
8.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM	2	ea	$2,520.00				$5,040	$0	$0	$0	$5,040
8.15 Electrical System Installatior	1	ls	$4,000.00				$4,000	$0	$0	$0	$4,000
9 LAND USE CONTROLS											
9.1 Site Survey (2-man crew)	3	days	$648.36				$1,945	$0	$0	$0	$1,945
9.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
9.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$5,817	$34,668	$3,813	$44,298

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$4,886	$29,121	$3,203	$37,210
Overhead on Labor Cost @ 30%									$8,736		$8,736
G & A on Labor Cost @ 10%									$2,912		$2,912
G & A on Material Cost @ 10%								$489			$489
Total Direct Capital Cost								$5,375	$40,770	$3,203	$49,347
Indirects on Total Direct Labor Cost @ 75%									$30,577		$30,577
Profit on Total Direct Cost @ 10%											$4,935
Subtotal											$84,859
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$5,048
Total Field Cost											**$89,907**
Subtotal Subcontractor Cost							$83,395				$83,395
G & A on Subcontract Cost @ 10%							$8,339				$8,339
Profit on Subcontractor Cost @ 5%											$4,170
Subcontractor Cost											**$95,904**
Contingency on Total Field and Subcontractor Costs @ 10%											**$18,581**
Engineering on Total Field and Subcontractor Costs @ 5%											**$9,291**
TOTAL Capital COST											**$213,683**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC:
ANNUAL OPERATION AND MAINTENANCE COSTS

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Soil Venting System	39,210	kWh	$0.06	$2,353	Electrical Load is approx. 6 Hp.
2	Maintenance	1	ls	$1,950.00	$1,950	3% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon	800	pound	$3.00	$2,400	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies	12	mo	$1,000.00	$12,000	Monthly O&M Site Visit (1 person , 2 days)
6	Analysis of Off-gas samples	12	ea	$300.00	$3,600	1 per month, VOCs
7	Geoprobe Mob/Demob. & 1 day Operation	1	ea	$650.00	$650	
8	Soil Samples (TPH & PAHs)	8	ea	$178.33	$1,427	
9	Quarterly Reports	4	ea	$4,000.00	$16,000	
	Total Cost for One Year Operation				**$40,379**	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$213,683			$213,683	1.000	$213,683
1		$40,379	$3,092	$43,472	0.943	$41,011
2		$40,379	$3,092	$43,472	0.890	$38,689
3		$40,379	$3,092	$43,472	0.840	$36,500
4			$3,092	$3,092	0.792	$2,449
5			$10,467	$10,467	0.747	$7,822
6			$3,092	$3,092	0.705	$2,180
7			$3,092	$3,092	0.665	$2,057
8			$3,092	$3,092	0.627	$1,940
9			$3,092	$3,092	0.592	$1,830
10			$10,467	$10,467	0.558	$5,845
11			$3,092	$3,092	0.527	$1,629
12			$3,092	$3,092	0.497	$1,537
13			$3,092	$3,092	0.469	$1,450
14			$3,092	$3,092	0.442	$1,368
15			$10,467	$10,467	0.417	$4,368
16			$3,092	$3,092	0.394	$1,217
17			$3,092	$3,092	0.371	$1,148
18			$3,092	$3,092	0.350	$1,083
19			$3,092	$3,092	0.331	$1,022
20			$10,467	$10,467	0.312	$3,264
21			$3,092	$3,092	0.294	$910
22			$3,092	$3,092	0.278	$858
23			$3,092	$3,092	0.262	$810
24			$3,092	$3,092	0.247	$764
25			$10,467	$10,467	0.233	$2,439
26			$3,092	$3,092	0.220	$680
27			$3,092	$3,092	0.207	$641
28			$3,092	$3,092	0.196	$605
29			$3,092	$3,092	0.185	$571
30			$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	**$382,190**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-4: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	8	mo	$74.18				$593	$0	$0	$0	$593
2.4 Storage Trailer (28' x 10')	8	mo	$98.33				$787	$0	$0	$0	$787
2.5 Office Trailer (32' x 8')	8	mo	$221.49				$1,772	$0	$0	$0	$1,772
2.6 Site Utilities	8	mo	$1,000.00				$8,000	$0	$0	$0	$8,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	50	drum	$125.00				$6,250	$0	$0	$0	$6,250
3.3 Decon Water Storage Drums	50	ea		$45.00			$0	$2,250	$0	$0	$2,250
3.4 PPE (3 p * 5 days * 22 Weeks)	330	m-day		$30.00			$0	$9,900	$0	$0	$9,900
3.5 Decontaminate Equipment (Pressure Washer)	6	ea			$134.45	$50.00	$0	$0	$807	$300	$1,107
4 SITE PREPARATION											
4.1 Erosion Control Fencing	1225	lf		$0.23	$1.17		$0	$282	$1,433	$0	$1,715
4.2 Collect/Analyze Delineation Samples (inorganics & PAHs	20	ea	$410.00	$10.00	$23.52		$8,200	$200	$470	$0	$8,870
4.3 Construction Surveys (2-man crew)	5	day	$648.36				$3,242	$0	$0	$0	$3,242
4.4 Utility Location and Site Delineation/Layou	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	50697	cy			$0.68	$1.71	$0	$0	$34,474	$86,692	$121,166
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavator	160	hrs				$37.54	$0	$0	$0	$6,006	$6,006
5.3 Wheel Loader, 3 cy	1000	hrs			$27.20	$56.31	$0	$0	$27,200	$56,310	$83,510
5.4 Standby, Wheel Loader, 3 cy	160	hrs				$14.07	$0	$0	$0	$2,251	$2,251
5.5 Health & Safety Monitoring with OVA during Excavatior	200	day			$188.16	$100.00	$0	$0	$37,632	$20,000	$57,632
5.6 Collect/Analyze Confirmatory Samples	20	ea	$410.00	$10.00	$23.52		$8,200	$200	$470	$0	$8,870
5.7 Import (Offsite) Place, Compact Clean Fill Materia	21472	cy		$7.82	$0.85	$1.81	$0	$167,911	$18,251	$38,864	$225,027
5.8 Backfill with Clean Excavated Materia	28828	cy		$0.28	$2.02	$0.76	$0	$8,072	$58,233	$21,909	$88,214
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	4	ls	$750.00				$3,000	$0	$0	$0	$3,000
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	32800	ton	$45.00				$1,476,000	$0	$0	$0	$1,476,000
6.3 Prepare Shipment Manifests	1000	hrs			$33.23		$0	$0	$33,230	$0	$33,230
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	397	cy		$15.00			$0	$5,955	$0	$0	$5,955
7.2 Place/Grade Topsoil (6")	3	day			$227.20	$435.00	$0	$0	$682	$1,305	$1,987
7.3 Sod Disturbed Area	0.538	acre	$20,859.00				$11,222	$0	$0	$0	$11,222
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	3	days	$648.36				$1,945	$0	$0	$0	$1,945
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$196,345	$236,363	$234,543	$667,251

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-4: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$164,929	$198,545	$197,016	$560,490
Overhead on Labor Cost @ 30%									$59,563		$59,563
G & A on Labor Cost @ 10%									$19,854		$19,854
G & A on Material Cost @ 10%								$16,493			$16,493
Total Direct Capital Cost								$181,422	$277,963	$197,016	$656,401
Indirects on Total Direct Labor Cost @ 75%									$208,472		$208,472
Profit on Total Direct Cost @ 10%											$65,640
Subtotal											$930,514
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$73,792
Total Field Cost											**$1,004,305**
Subtotal Subcontractor Cost							$1,529,211				$1,529,211
G & A on Subcontract Cost @ 10%							$152,921				$152,921
Profit on Subcontractor Cost @ 5%											$76,461
Subcontractor Cost											**$1,758,593**
Contingency on Total Field and Subcontractor Costs @ 10%											**$276,290**
Engineering on Total Field and Subcontractor Costs @ 5%											**$138,145**
TOTAL Capital COST											**$3,177,333**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-4: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-4: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 4
SOIL ALTERNATIVE S4-4: EXCAVATION OF SURFACE &SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$3,177,333			$3,177,333	1.000	$3,177,333
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$3,234,423**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	2	mo	$74.18				$148	$0	$0	$0	$148
2.4 Storage Trailer (28' x 10')	2	mo	$98.33				$197	$0	$0	$0	$197
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	5	drum	$125.00				$625	$0	$0	$0	$625
3.3 Decon Water Storage Drums	5	ea		$45.00			$0	$225	$0	$0	$225
3.4 PPE (2 p * 5 days * 3 Weeks)	30	m-day		$30.00			$0	$900	$0	$0	$900
3.5 Decontaminate Equipment (Pressure Washer)	2	ea			$134.45	$50.00	$0	$0	$269	$100	$369
4 SITE PREPARATION											
4.1 Erosion Control Fencing	780	lf		$0.23	$1.17		$0	$179	$913	$0	$1,092
4.2 Collect/Analyze Delineation Samples (TPH & PAH	10	ea	$178.33	$10.00	$23.52		$1,783	$100	$235	$0	$2,119
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location and Site Delineation/Layou	16	hrs			$33.23		$0	$0	$532	$0	$532
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	1787	cy			$1.27	$2.23	$0	$0	$2,269	$3,985	$6,255
5.2 Standby. Crawler Mounted 1.0 CY Hydraulic Excavator	36	hrs				$20.50	$0	$0	$0	$738	$738
5.3 Health & Safety Monitoring with OVA during Excavatior	15	day			$188.16	$100.00	$0	$0	$2,822	$1,500	$4,322
5.4 Collect/Analyze Confirmatory Samples	10	ea	$178.33	$10.00	$23.52		$1,783	$100	$235	$0	$2,119
5.5 Import (Offsite) Place, Compact Clean Fill Materia	1415	cy		$7.82	$0.85	$1.81	$0	$11,065	$1,203	$2,561	$14,829
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	2680	ton	$45.00				$120,600	$0	$0	$0	$120,600
6.3 Prepare Shipment Manifests	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	372	cy		$15.00			$0	$5,580	$0	$0	$5,580
7.2 Place/Grade Topsoil (6")	2	day			$227.20	$435.00	$0	$0	$454	$870	$1,324
7.3 Sod Disturbed Area	0.507	acre	$20,859.00				$10,576	$0	$0	$0	$10,576
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$19,350	$27,183	$10,409	$56,942
Local Area Adjustment								84%	84%	84%	
								$16,254	$22,834	$8,744	$47,831
Overhead on Labor Cost @ 30%									$6,850		$6,850
G & A on Labor Cost @ 10%									$2,283		$2,283
G & A on Material Cost @ 10%								$1,625			$1,625
Total Direct Capital Cost								$17,879	$31,967	$8,744	$58,590

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$23,975		$23,975
Profit on Total Direct Cost @ 10%											$5,859
Subtotal											$88,424
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$6,827
Total Field Cost											**$95,251**
Subtotal Subcontractor Cost							$139,157				$139,157
G & A on Subcontract Cost @ 10%							$13,916				$13,916
Profit on Subcontractor Cost @ 5%											$6,958
Subcontractor Cost											**$160,031**
Contingency on Total Field and Subcontractor Costs @ 10%											**$25,528**
Engineering on Total Field and Subcontractor Costs @ 5%											**$12,764**
TOTAL Capital COST											**$293,575**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-2: EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$293,575			$293,575	1.000	$293,575
1		$0	$3,092	$3,092	0.943	$2,917
2		$0	$3,092	$3,092	0.890	$2,752
3		$0	$3,092	$3,092	0.840	$2,596
4		$0	$3,092	$3,092	0.792	$2,449
5		$0	$10,467	$10,467	0.747	$7,822
6		$0	$3,092	$3,092	0.705	$2,180
7		$0	$3,092	$3,092	0.665	$2,057
8		$0	$3,092	$3,092	0.627	$1,940
9		$0	$3,092	$3,092	0.592	$1,830
10		$0	$10,467	$10,467	0.558	$5,845
11		$0	$3,092	$3,092	0.527	$1,629
12		$0	$3,092	$3,092	0.497	$1,537
13		$0	$3,092	$3,092	0.469	$1,450
14		$0	$3,092	$3,092	0.442	$1,368
15		$0	$10,467	$10,467	0.417	$4,368
16		$0	$3,092	$3,092	0.394	$1,217
17		$0	$3,092	$3,092	0.371	$1,148
18		$0	$3,092	$3,092	0.350	$1,083
19		$0	$3,092	$3,092	0.331	$1,022
20		$0	$10,467	$10,467	0.312	$3,264
21		$0	$3,092	$3,092	0.294	$910
22		$0	$3,092	$3,092	0.278	$858
23		$0	$3,092	$3,092	0.262	$810
24		$0	$3,092	$3,092	0.247	$764
25		$0	$10,467	$10,467	0.233	$2,439
26		$0	$3,092	$3,092	0.220	$680
27		$0	$3,092	$3,092	0.207	$641
28		$0	$3,092	$3,092	0.196	$605
29		$0	$3,092	$3,092	0.185	$571
30		$0	$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	**$354,147**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	250	hr			$33.79		$0	$0	$8,448	$0	$8,448
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.2 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	5	drum	$125.00				$625	$0	$0	$0	$625
3.3 Decon Water Storage Drums	5	ea		$45.00			$0	$225	$0	$0	$225
3.4 PPE (2 p * 6 days * 2 Weeks)	22	m-day		$30.00			$0	$660	$0	$0	$660
3.5 Decontaminate Equipment (Pressure Washer)	12	ea			$134.45	$50.00	$0	$0	$1,613	$600	$2,213
4 SITE PREPARATION											
4.1 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.2 Utility Location/Site Layout	16	hrs			$33.23		$0	$0	$532	$0	$532
5 OFF-SITE TRANSPORTATION/DISPOSAL											
5.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
5.2 Transport/Dispose of Soil Cuttings (Non-Haz) in Landfil	8	drum	$125.00				$1,000	$0	$0	$0	$1,000
5.3 Prepare Shipment Manifests	8	hrs			$33.23		$0	$0	$266	$0	$266
6 SITE RESTORATION											
6.1 Sod Disturbed Area	0.1	acre	$20,859.00				$2,086	$0	$0	$0	$2,086
8 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)											
8.1 Soil Vapor Extraction (SVE) System Layout (30' radius	24	hrs			$33.23		$0	$0	$798	$0	$798
8.2 Mobilize/Demobilize Drill Rig and Trenching Equipmer	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
8.3 SVE Well Install. 11" H. S. Auger (12 wells x 10' depth	120	lf	$27.01				$3,241	$0	$0	$0	$3,241
8.4 PVC Well Screen, 4" dia	60	lf	$17.84				$1,070	$0	$0	$0	$1,070
8.5 PVC Well Riser, 4" dia	60	lf	$13.39				$803	$0	$0	$0	$803
8.6 Well Box and Surface Completion	12	well	$250.00				$3,000	$0	$0	$0	$3,000
8.7 PVC Piping, Schedule 40, 4"	650	lf		$1.62	$4.60		$0	$1,053	$2,990	$0	$4,043
8.8 Install SVE Piping and System Equipmen	1	ls	$6,000.00				$6,000	$0	$0	$0	$6,000
8.9 Piping Values, fittings, etc	1	ls	$1,200.00				$1,200	$0	$0	$0	$1,200
8.10 Soil Cover, 20 mil Plastic	20100	sf		$0.80	$0.20		$0	$16,080	$4,020	$0	$20,100
8.11 QA/QC Inspection of System Installation	100	hrs			$31.08		$0	$0	$3,108	$0	$3,108
8.12 Vapor Recovery System, 127 SCFM, 1.5 Hp	1	ea	$4,615.00				$4,615	$0	$0	$0	$4,615
8.13 Trailer for SVE System (8' x 20')	1	ea	$5,240.00				$5,240	$0	$0	$0	$5,240
8.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM	1	ea	$2,520.00				$2,520	$0	$0	$0	$2,520
8.15 Electrical System Installatior	1	ls	$4,000.00				$4,000	$0	$0	$0	$4,000
9 LAND USE CONTROLS											
9.1 Site Survey (2-man crew)	3	days	$648.36				$1,945	$0	$0	$0	$1,945
9.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
9.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$18,468	$29,608	$755	$48,831

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$15,513	$24,871	$634	$41,018
Overhead on Labor Cost @ 30%									$7,461		$7,461
G & A on Labor Cost @ 10%									$2,487		$2,487
G & A on Material Cost @ 10%								$1,551			$1,551
Total Direct Capital Cost								$17,064	$34,819	$634	$52,517
Indirects on Total Direct Labor Cost @ 75%									$26,114		$26,114
Profit on Total Direct Cost @ 10%											$5,252
Subtotal											$83,883
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$3,796
Total Field Cost											**$87,680**
Subtotal Subcontractor Cost							$42,667				$42,667
G & A on Subcontract Cost @ 10%							$4,267				$4,267
Profit on Subcontractor Cost @ 5%											$2,133
Subcontractor Cost											**$49,067**
Contingency on Total Field and Subcontractor Costs @ 10%											**$13,675**
Engineering on Total Field and Subcontractor Costs @ 5%											**$6,837**
TOTAL Capital COST											**$157,258**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
ANNUAL OPERATION AND MAINTENANCE COSTS

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Soil Venting System	9,800	kWh	$0.06	$588	Electrical Load is approx. 6 Hp.
2	Maintenance	1	ls	$2,070.00	$2,070	3% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon	800	pound	$3.00	$2,400	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies	12	mo	$1,000.00	$12,000	Monthly O&M Site Visit (1 person , 2 days)
6	Analysis of Off-gas samples	12	ea	$300.00	$3,600	1 per month, VOCs
7	Geoprobe Mob/Demob. & 1 day Operation	1	ea	$650.00	$650	
8	Soil Sample Analysis (TPH & PAHs)	8	ea	$178.33	$1,427	Samples collected annually to confirm cleanup.
9	Quarterly Reports	4	ea	$4,000.00	$16,000	
	Total Cost for One Year Operation				**$38,735**	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$157,258			$157,258	1.000	$157,258
1		$38,735	$2,839	$41,574	0.943	$39,221
2		$38,735	$2,839	$41,574	0.890	$37,001
3		$38,735	$2,839	$41,574	0.840	$34,906
4			$2,839	$2,839	0.792	$2,249
5			$10,214	$10,214	0.747	$7,633
6			$2,839	$2,839	0.705	$2,002
7			$2,839	$2,839	0.665	$1,888
8			$2,839	$2,839	0.627	$1,781
9			$2,839	$2,839	0.592	$1,681
10			$10,214	$10,214	0.558	$5,704
11			$2,839	$2,839	0.527	$1,496
12			$2,839	$2,839	0.497	$1,411
13			$2,839	$2,839	0.469	$1,331
14			$2,839	$2,839	0.442	$1,256
15			$10,214	$10,214	0.417	$4,262
16			$2,839	$2,839	0.394	$1,118
17			$2,839	$2,839	0.371	$1,054
18			$2,839	$2,839	0.350	$995
19			$2,839	$2,839	0.331	$938
20			$10,214	$10,214	0.312	$3,185
21			$2,839	$2,839	0.294	$835
22			$2,839	$2,839	0.278	$788
23			$2,839	$2,839	0.262	$743
24			$2,839	$2,839	0.247	$701
25			$10,214	$10,214	0.233	$2,380
26			$2,839	$2,839	0.220	$624
27			$2,839	$2,839	0.207	$589
28			$2,839	$2,839	0.196	$555
29			$2,839	$2,839	0.185	$524
30			$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$317,887**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	3	mo	$74.18				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	$98.33				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	$221.49				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	10	drum	$125.00				$1,250	$0	$0	$0	$1,250
3.3 Decon Water Storage Drums	10	ea		$45.00			$0	$450	$0	$0	$450
3.4 PPE (3 p * 5 days * 6 Weeks)	90	m-day		$30.00			$0	$2,700	$0	$0	$2,700
3.5 Decontaminate Equipment (Pressure Washer)	3	ea			$134.45	$50.00	$0	$0	$403	$150	$553
4 SITE PREPARATION											
4.1 Erosion Control Fencing	810	lf		$0.23	$1.17		$0	$186	$948	$0	$1,134
4.2 Collect/Analyze Delineation Samples (TPH & PAHs)	20	ea	$178.33	$10.00	$23.52		$3,567	$200	$470	$0	$4,237
4.3 Construction Surveys (2-man crew)	3	day	$648.36				$1,945	$0	$0	$0	$1,945
4.4 Utility Location and Site Delineation/Layou	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	3574	cy			$0.68	$1.71	$0	$0	$2,430	$6,112	$8,542
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavator	40	hrs				$37.54	$0	$0	$0	$1,502	$1,502
5.3 Wheel Loader, 3 cy	240	hrs			$27.20	$56.31	$0	$0	$6,528	$13,514	$20,042
5.4 Standby, Wheel Loader, 3 cy	24	hrs				$14.07	$0	$0	$0	$338	$338
5.5 Health & Safety Monitoring with OVA during Excavatior	30	day			$188.16	$100.00	$0	$0	$5,645	$3,000	$8,645
5.6 Collect/Analyze Confirmatory Samples	10	ea	$178.33	$10.00	$23.52		$1,783	$100	$235	$0	$2,119
5.7 Import (Offsite) Place, Compact Clean Fill Materia	3202	cy		$7.82	$0.85	$1.81	$0	$25,040	$2,722	$5,796	$33,557
5.8 Backfill with Clean Excavated Materia	0	cy		$0.28	$2.02	$0.76	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	3	ls	$750.00				$2,250	$0	$0	$0	$2,250
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	5361	ton	$45.00				$241,245	$0	$0	$0	$241,245
6.3 Prepare Shipment Manifests	240	hrs			$33.23		$0	$0	$7,975	$0	$7,975
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	372	cy		$15.00			$0	$5,580	$0	$0	$5,580
7.2 Place/Grade Topsoil (6")	2	day			$227.20	$435.00	$0	$0	$454	$870	$1,324
7.3 Sod Disturbed Area	0.507	acre	$20,859.00				$10,576	$0	$0	$0	$10,576
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$35,831	$49,963	$32,186	$117,979

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$30,098	$41,969	$27,036	$99,103
Overhead on Labor Cost @ 30%									$12,591		$12,591
G & A on Labor Cost @ 10%									$4,197		$4,197
G & A on Material Cost @ 10%								$3,010			$3,010
Total Direct Capital Cost								$33,108	$58,756	$27,036	$118,900
Indirects on Total Direct Labor Cost @ 75%									$44,067		$44,067
Profit on Total Direct Cost @ 10%											$11,890
Subtotal											$174,857
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$13,289
Total Field Cost											**$188,146**
Subtotal Subcontractor Cost							$268,094				$268,094
G & A on Subcontract Cost @ 10%							$26,809				$26,809
Profit on Subcontractor Cost @ 5%											$13,405
Subcontractor Cost											**$308,308**
Contingency on Total Field and Subcontractor Costs @ 10%											**$49,645**
Engineering on Total Field and Subcontractor Costs @ 5%											**$24,823**
TOTAL Capital COST											**$570,922**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 6
SOIL ALTERNATIVE S6-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$570,922			$570,922	1.000	$570,922
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$628,012**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Extended Cost Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-2: UST REMOVAL, EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.4 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	5	drum	$125.00				$625	$0	$0	$0	$625
3.3 Decon Water Storage Drums	5	ea		$45.00			$0	$225	$0	$0	$225
3.4 PPE (2 p * 5 days * 2 Weeks)	20	m-day		$30.00			$0	$600	$0	$0	$600
3.5 Decontaminate Equipment (Pressure Washer)	2	ea			$134.45	$50.00	$0	$0	$269	$100	$369
4 SITE PREPARATION											
4.1 Erosion Control Fencing	348	lf		$0.23	$1.17		$0	$80	$407	$0	$487
4.2 Collect/Analyze Delineation Samples (TPH & inorganics	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
4.3 Construction Surveys (2-man crew)	2	day	$648.36				$1,297	$0	$0	$0	$1,297
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	322	cy			$1.27	$2.23	$0	$0	$409	$718	$1,127
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	24	hrs				$20.50	$0	$0	$0	$492	$492
5.3 Health & Safety Monitoring with OVA during Excavatior	5	day			$188.16	$100.00	$0	$0	$941	$500	$1,441
5.4 Collect/Analyze Confirmatory Samples	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
5.5 Import (Offsite) Place, Compact Clean Fill Materia	255	cy		$7.82	$0.85	$1.81	$0	$1,994	$217	$462	$2,672
5.6 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	3	ls	$750.00				$2,250	$0	$0	$0	$2,250
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	483	ton	$45.00				$21,735	$0	$0	$0	$21,735
6.3 Prepare Shipment Manifests	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	67	cy		$15.00			$0	$1,005	$0	$0	$1,005
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.129	acre	$20,859.00				$2,691	$0	$0	$0	$2,691
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	3	days	$648.36				$1,945	$0	$0	$0	$1,945
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$6,667	$22,599	$9,914	$39,180
Local Area Adjustment								84%	84%	84%	
								$5,600	$18,983	$8,328	$32,911
Overhead on Labor Cost @ 30%									$5,695		$5,695
G & A on Labor Cost @ 10%									$1,898		$1,898
G & A on Material Cost @ 10%								$560			$560
Total Direct Capital Cost								$6,160	$26,576	$8,328	$41,064

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-2: UST REMOVAL, EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$19,932		$19,932
Profit on Total Direct Cost @ 10%											$4,106
Subtotal											$65,103
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$3,102
Total Field Cost											**$68,205**
Subtotal Subcontractor Cost							$38,282				$38,282
G & A on Subcontract Cost @ 10%							$3,828				$3,828
Profit on Subcontractor Cost @ 5%											$1,914
Subcontractor Cost											**$44,024**
Contingency on Total Field and Subcontractor Costs @ 10%											**$11,223**
Engineering on Total Field and Subcontractor Costs @ 5%											**$5,611**
TOTAL Capital COST											**$129,063**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-2: UST REMOVAL, EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-2: UST REMOVAL, EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-2: UST REMOVAL, EXCAVATION OF SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$129,063			$129,063	1.000	$129,063
1		$0	$3,092	$3,092	0.943	$2,917
2		$0	$3,092	$3,092	0.890	$2,752
3		$0	$3,092	$3,092	0.840	$2,596
4		$0	$3,092	$3,092	0.792	$2,449
5		$0	$10,467	$10,467	0.747	$7,822
6		$0	$3,092	$3,092	0.705	$2,180
7		$0	$3,092	$3,092	0.665	$2,057
8		$0	$3,092	$3,092	0.627	$1,940
9		$0	$3,092	$3,092	0.592	$1,830
10		$0	$10,467	$10,467	0.558	$5,845
11		$0	$3,092	$3,092	0.527	$1,629
12		$0	$3,092	$3,092	0.497	$1,537
13		$0	$3,092	$3,092	0.469	$1,450
14		$0	$3,092	$3,092	0.442	$1,368
15		$0	$10,467	$10,467	0.417	$4,368
16		$0	$3,092	$3,092	0.394	$1,217
17		$0	$3,092	$3,092	0.371	$1,148
18		$0	$3,092	$3,092	0.350	$1,083
19		$0	$3,092	$3,092	0.331	$1,022
20		$0	$10,467	$10,467	0.312	$3,264
21		$0	$3,092	$3,092	0.294	$910
22		$0	$3,092	$3,092	0.278	$858
23		$0	$3,092	$3,092	0.262	$810
24		$0	$3,092	$3,092	0.247	$764
25		$0	$10,467	$10,467	0.233	$2,439
26		$0	$3,092	$3,092	0.220	$680
27		$0	$3,092	$3,092	0.207	$641
28		$0	$3,092	$3,092	0.196	$605
29		$0	$3,092	$3,092	0.185	$571
30		$0	$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	**$189,635**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Extended Cost Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob.Demob (Exc. & Dozier	2	ea			$200.00	$250.00	$0	$0	$400	$500	$900
2.2 Mobilize/Demobilize Personnel (2-persons	2	ea		$375.00	$300.00		$0	$750	$600	$0	$1,350
2.3 Portable Toilet	2	mo	$74.18				$148	$0	$0	$0	$148
2.4 Storage Trailer (28' x 10')	2	mo	$98.33				$197	$0	$0	$0	$197
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	8	drum	$125.00				$1,000	$0	$0	$0	$1,000
3.3 Decon Water Storage Drums	8	ea		$45.00			$0	$360	$0	$0	$360
3.4 PPE (2 p * 5 days * 2 Weeks)	20	m-day		$30.00			$0	$600	$0	$0	$600
3.5 Decontaminate Equipment (Pressure Washer)	7	ea			$134.45	$50.00	$0	$0	$941	$350	$1,291
4 SITE PREPARATION											
4.1 Erosion Control Fencing	348	lf		$0.23	$1.17		$0	$80	$407	$0	$487
4.2 Collect/Analyze Delineation Samples (inorganics & TPH	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	322	cy			$1.27	$2.23	$0	$0	$409	$718	$1,127
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	24	hrs				$20.50	$0	$0	$0	$492	$492
5.3 Health & Safety Monitoring with OVA during Excavatior	5	day			$188.16	$100.00	$0	$0	$941	$500	$1,441
5.4 Collect/Analyze Confirmatory Samples	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
5.5 Import (Offsite) Place, Compact Clean Fill Materia	255	cy		$7.82	$0.85	$1.81	$0	$1,994	$217	$462	$2,672
5.6 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	3	ls	$750.00				$2,250	$0	$0	$0	$2,250
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	483	ton	$45.00				$21,735	$0	$0	$0	$21,735
6.3 Prepare Shipment Manifests	40	hrs			$33.23		$0	$0	$1,329	$0	$1,329
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	56	cy		$15.00			$0	$840	$0	$0	$840
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.129	acre	$20,859.00				$2,691	$0	$0	$0	$2,691
8 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)											
8.1 Soil Vapor Extraction (SVE) System Layout (30' radius	24	hrs			$33.23		$0	$0	$798	$0	$798
8.2 Mobilize/Demobilize Drill Rig and Trenching Equipmer	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
8.3 SVE Well Install, 11" H. S. Auger (6 wells x 17' depth	102	lf	$27.01				$2,755	$0	$0	$0	$2,755
8.4 PVC Well Screen, 4" dia	60	lf	$17.84				$1,070	$0	$0	$0	$1,070
8.5 PVC Well Riser, 4" dia.	42	lf	$13.39				$562	$0	$0	$0	$562
8.6 Well Box and Surface Completion	6	well	$250.00				$1,500	$0	$0	$0	$1,500
8.7 PVC Piping, Schedule 40, 4'	450	lf		$1.62	$4.60		$0	$729	$2,070	$0	$2,799
8.8 Install SVE Piping and System Equipmen	1	ls	$6,000.00				$6,000	$0	$0	$0	$6,000
8.9 Piping Values, fittings, etc	1	ls	$600.00				$600	$0	$0	$0	$600
8.10 Backfill with Excavated Material	85	cy		$0.28	$2.02	$0.76	$0	$24	$172	$65	$260
8.11 QA/QC Inspection of System Installation	80	hrs			$31.08		$0	$0	$2,486	$0	$2,486
8.12 Vapor Recovery System, 127 SCFM, 1.5 Hp	1	ea	$4,615.00				$4,615	$0	$0	$0	$4,615
8.13 Trailer for SVE System (8' x 20')	1	ea	$5,240.00				$5,240	$0	$0	$0	$5,240
8.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM	1	ea	$2,520.00				$2,520	$0	$0	$0	$2,520
8.15 Electrical System Installatior	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
9 LAND USE CONTROLS											
9.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
9.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
9.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$7,390	$33,527	$10,229	$51,146

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$6,207	$28,163	$8,592	$42,962
Overhead on Labor Cost @ 30%									$8,449		$8,449
G & A on Labor Cost @ 10%									$2,816		$2,816
G & A on Material Cost @ 10%								$621			$621
Total Direct Capital Cost								$6,828	$39,428	$8,592	$54,848
Indirects on Total Direct Labor Cost @ 75%									$29,571		$29,571
Profit on Total Direct Cost @ 10%											$5,485
Subtotal											$89,904
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$4,749
Total Field Cost											**$94,653**
Subtotal Subcontractor Cost							$68,395				$68,395
G & A on Subcontract Cost @ 10%							$6,840				$6,840
Profit on Subcontractor Cost @ 5%											$3,420
Subcontractor Cost											**$78,655**
Contingency on Total Field and Subcontractor Costs @ 10%											**$17,331**
Engineering on Total Field and Subcontractor Costs @ 5%											**$8,665**
TOTAL Capital COST											**$199,304**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC:
ANNUAL OPERATION AND MAINTENANCE COSTS

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Soil Venting System	39,210	kWh	$0.06	$2,353	Electrical Load is approx. 6 Hp.
2	Maintenance	1	ls	$1,950.00	$1,950	3% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon	800	pound	$3.00	$2,400	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies	12	mo	$1,000.00	$12,000	Monthly O&M Site Visit (1 person , 2 days)
6	Analysis of Off-gas samples	12	ea	$300.00	$3,600	1 per month, VOCs
7	Geoprobe Mob/Demobilization and 1 day Operation	1	ls	$650.00	$650	
8	Soil Samples (TPH)	8	ea	$73.33	$587	Samples collected annually to confirm site cleanup.
9	Quarterly Reports	4	ea	$4,000.00	$16,000	
	Total Cost for One Year Operation				**$39,539**	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
2.3 Soil Cover Maintenance	1	ls	$200.00		$200
Subtotal Land Use Control Monitoring					$2,444
G&A and Profit @ 15%					$367
Subtotal					$2,811
Contingency @ 10%					$281.12
Total Land Use Control Monitoring Cost					**$3,092**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-3: EXCAVATE SURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, IN SITU SOIL VENTING, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$199,304			$199,304	1.000	$199,304
1		$39,539	$3,092	$42,632	0.943	$40,218
2		$39,539	$3,092	$42,632	0.890	$37,942
3		$39,539	$3,092	$42,632	0.840	$35,794
4			$3,092	$3,092	0.792	$2,449
5			$10,467	$10,467	0.747	$7,822
6			$3,092	$3,092	0.705	$2,180
7			$3,092	$3,092	0.665	$2,057
8			$3,092	$3,092	0.627	$1,940
9			$3,092	$3,092	0.592	$1,830
10			$10,467	$10,467	0.558	$5,845
11			$3,092	$3,092	0.527	$1,629
12			$3,092	$3,092	0.497	$1,537
13			$3,092	$3,092	0.469	$1,450
14			$3,092	$3,092	0.442	$1,368
15			$10,467	$10,467	0.417	$4,368
16			$3,092	$3,092	0.394	$1,217
17			$3,092	$3,092	0.371	$1,148
18			$3,092	$3,092	0.350	$1,083
19			$3,092	$3,092	0.331	$1,022
20			$10,467	$10,467	0.312	$3,264
21			$3,092	$3,092	0.294	$910
22			$3,092	$3,092	0.278	$858
23			$3,092	$3,092	0.262	$810
24			$3,092	$3,092	0.247	$764
25			$10,467	$10,467	0.233	$2,439
26			$3,092	$3,092	0.220	$680
27			$3,092	$3,092	0.207	$641
28			$3,092	$3,092	0.196	$605
29			$3,092	$3,092	0.185	$571
30			$10,467	$10,467	0.174	$1,822
					TOTAL PRESENT WORTH	**$365,566**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Extended Cost Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	3	mo	$74.18				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	$98.33				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	$221.49				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	20	drum	$125.00				$2,500	$0	$0	$0	$2,500
3.3 Decon Water Storage Drums	20	ea		$45.00			$0	$900	$0	$0	$900
3.4 PPE (3 p * 5 days * 8 Weeks)	120	m-day		$30.00			$0	$3,600	$0	$0	$3,600
3.5 Decontaminate Equipment (Pressure Washer)	8	ea			$134.45	$50.00	$0	$0	$1,076	$400	$1,476
4 SITE PREPARATION											
4.1 Erosion Control Fencing	700	lf		$0.23	$1.17		$0	$161	$819	$0	$980
4.2 Collect/Analyze Delineation Samples (inorganics & TPH	20	ea	$378.33	$10.00	$23.52		$7,567	$200	$470	$0	$8,237
4.3 Construction Surveys (2-man crew)	4	day	$648.36				$2,593	$0	$0	$0	$2,593
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
4.5 Concrete Demolition/Removal (6" reinforced)	94	cy	$45.58				$4,285	$0	$0	$0	$4,285
4.6 Concrete Debris Disposal	94	cy	$20.70				$1,946	$0	$0	$0	$1,946
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	8500	cy			$0.68	$1.71	$0	$0	$5,780	$14,535	$20,315
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavato	64	hrs				$37.54	$0	$0	$0	$2,403	$2,403
5.3 Wheel Loader, 3 cy	240	hrs			$27.20	$56.31	$0	$0	$6,528	$13,514	$20,042
5.4 Standby, Wheel Loader, 3 cy	40	hrs				$14.07	$0	$0	$0	$563	$563
5.5 Health & Safety Monitoring with OVA during Excavatior	40	day			$188.16	$100.00	$0	$0	$7,526	$4,000	$11,526
5.6 Collect/Analyze Confirmatory Samples	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
5.7 Import (Offsite) Place, Compact Clean Fill Materia	5.46	cy		$7.82	$0.85	$1.81	$0	$43	$5	$10	$57
5.8 Backfill with Clean Excavated Materia	3558	cy		$0.28	$2.02	$0.76	$0	$996	$7,187	$2,704	$10,887
5.9 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	3	ls	$750.00				$2,250	$0	$0	$0	$2,250
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	4269.6	ton	$45.00				$192,132	$0	$0	$0	$192,132
6.3 Prepare Shipment Manifests	1000	hrs			$33.23		$0	$0	$33,230	$0	$33,230
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	137	cy		$15.00			$0	$2,055	$0	$0	$2,055
7.2 Place/Grade Topsoil (6")	2	day			$227.20	$435.00	$0	$0	$454	$870	$1,324
7.3 Sod Disturbed Area	0.216	acre	$20,859.00				$4,506	$0	$0	$0	$4,506
7.4 Concrete Slab (Reinforced) on Grade (6")	5050	sf	$4.03				$20,352	$0	$0	$0	$20,352
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$10,993	$86,871	$46,456	$144,320

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$9,234	$72,972	$39,023	$121,229
Overhead on Labor Cost @ 30%									$21,891		$21,891
G & A on Labor Cost @ 10%									$7,297		$7,297
G & A on Material Cost @ 10%								$923			$923
Total Direct Capital Cost								$10,157	$102,160	$39,023	$151,341
Indirects on Total Direct Labor Cost @ 75%									$76,620		$76,620
Profit on Total Direct Cost @ 10%											$15,134
Subtotal											$243,095
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$14,715
Total Field Cost											**$257,810**
Subtotal Subcontractor Cost							$247,391				$247,391
G & A on Subcontract Cost @ 10%							$24,739				$24,739
Profit on Subcontractor Cost @ 5%											$12,370
Subcontractor Cost											**$284,500**
Contingency on Total Field and Subcontractor Costs @ 10%											**$54,231**
Engineering on Total Field and Subcontractor Costs @ 5%											**$27,115**
TOTAL Capital COST											**$623,656**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE S30-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$623,656			$623,656	1.000	$623,656
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$680,746**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavato		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavatior		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	100	hr			$33.79		$0	$0	$3,379	$0	$3,379
1.2 Project Scheduling and Procuremen	20	hr			$33.79		$0	$0	$676	$0	$676
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	1	ea			$200.00	$250.00	$0	$0	$200	$250	$450
2.2 Mobilize/Demobilize Personnel (2-persons	1	ea		$375.00	$300.00		$0	$375	$300	$0	$675
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$250.00	$200.00	$75.00	$0	$250	$200	$75	$525
3.2 Decon Water Disposal	1	drum	$125.00				$125	$0	$0	$0	$125
3.3 Decon Water Storage Drums	1	ea		$45.00			$0	$45	$0	$0	$45
3.4 PPE (2 p * 2 days)	4	m-day		$30.00			$0	$120	$0	$0	$120
3.5 Decontaminate Equipment (Pressure Washer)	1	ea			$134.45	$50.00	$0	$0	$134	$50	$184
4 SITE PREPARATION											
4.1 Erosion Control Fencing	314	lf		$0.23	$1.17		$0	$72	$368	$0	$440
4.2 Collect/Analyze Delineation Samples (TPH & inorganics	8	ea	$378.33	$10.00	$23.52		$3,027	$80	$188	$0	$3,295
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location and Site Delineation/Layou	2	hrs			$33.23		$0	$0	$66	$0	$66
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	40.00	cy			$1.27	$2.23	$0	$0	$51	$89	$140
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	12	hrs				$20.50	$0	$0	$0	$246	$246
5.3 Health & Safety Monitoring with OVA during Excavation	2	day			$188.16	$100.00	$0	$0	$376	$200	$576
5.4 Collect/Analyze Confirmatory Samples	8	ea	$378.33	$10.00	$23.52		$3,027	$80	$188	$0	$3,295
5.5 Import (Offsite) Place, Compact Clean Fill Materia	40.00	cy		$7.82	$0.85	$1.81	$0	$313	$34	$72	$419
5.6 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	1	ls	$750.00				$750	$0	$0	$0	$750
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	60.00	ton	$45.00				$2,700	$0	$0	$0	$2,700
6.3 Prepare Shipment Manifests	20	hrs			$33.23		$0	$0	$665	$0	$665
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	5.82	cy		$15.00			$0	$87	$0	$0	$87
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.0500	acre	$20,859.00				$1,043	$0	$0	$0	$1,043
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$2,785	$15,075	$7,970	$25,830
Local Area Adjustment								84%	84%	84%	
								$2,340	$12,663	$6,695	$21,697
Overhead on Labor Cost @ 30%									$3,799		$3,799
G & A on Labor Cost @ 10%									$1,266		$1,266
G & A on Material Cost @ 10%								$234			$234
Total Direct Capital Cost								$2,574	$17,728	$6,695	$26,996

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$13,296		$13,296
Profit on Total Direct Cost @ 10%											$2,700
Subtotal											$42,992
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$1,668
Total Field Cost											**$44,660**
Subtotal Subcontractor Cost							$12,616				$12,616
G & A on Subcontract Cost @ 10%							$1,262				$1,262
Profit on Subcontractor Cost @ 5%											$631
Subcontractor Cost											**$14,509**
Contingency on Total Field and Subcontractor Costs @ 10%											**$5,917**
Engineering on Total Field and Subcontractor Costs @ 5%											**$2,958**
TOTAL Capital COST											**$68,044**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$68,044			$68,044	1.000	$68,044
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$125,135**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.2 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$250.00	$200.00	$75.00	$0	$250	$200	$75	$525
3.2 Decon Water Disposal	1	drum	$125.00				$125	$0	$0	$0	$125
3.3 Decon Water Storage Drums	1	ea		$45.00			$0	$45	$0	$0	$45
3.4 PPE (2 p * 2 days * 1 Weeks)	4	m-day		$30.00			$0	$120	$0	$0	$120
3.5 Decontaminate Equipment (Pressure Washer)	1	ea			$134.45	$50.00	$0	$0	$134	$50	$184
4 SITE PREPARATION											
4.1 Erosion Control Fencing	314	lf		$0.23	$1.17		$0	$72	$367	$0	$440
4.2 Collect/Analyze Delineation Samples (TPH & inorganics	2	ea	$378.33	$10.00	$23.52		$757	$20	$47	$0	$824
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location/Site Layout	2	hrs			$33.23		$0	$0	$66	$0	$66
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	40	cy			$1.27	$2.23	$0	$0	$51	$89	$140
5.2 Standby: Crawler Mounted 1.0 CY Hydraulic Excavator	12	hrs				$20.50	$0	$0	$0	$246	$246
5.3 Health & Safety Monitoring with OVA during Excavation	2	day			$188.16	$100.00	$0	$0	$376	$200	$576
5.4 Collect/Analyze Confirmatory Samples	4	ea	$305.00	$10.00	$23.52		$1,220	$40	$94	$0	$1,354
5.5 Import (Offsite) Place, Compact Clean Fill Materia	40	cy		$7.82	$0.85	$1.81	$0	$313	$34	$72	$419
5.6 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	1	ls	$750.00				$750	$0	$0	$0	$750
6.2 Transport/Dispose of Soil Cuttings (Non-Haz) in Landfil	50	ton	$45.00				$2,250	$0	$0	$0	$2,250
6.3 Prepare Shipment Manifests	20	hrs			$33.23		$0	$0	$665	$0	$665
7 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)											
7.1 Soil Vapor Extraction (SVE) System Layout (30' radius	4	hrs			$33.23		$0	$0	$133	$0	$133
7.2 Mobilize/Demobilize Drill Rig and Trenching Equipmer	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
7.3 SVE Well Install, 11" H. S. Auger (1 wells x 37' depth	37	lf	$27.01				$999	$0	$0	$0	$999
7.4 PVC Well Screen, 4" dia	30	lf	$17.84				$535	$0	$0	$0	$535
7.5 PVC Well Riser, 4" dia.	7	lf	$13.39				$94	$0	$0	$0	$94
7.6 Well Box and Surface Completion	1	well	$250.00				$250	$0	$0	$0	$250
7.7 PVC Piping, Schedule 40, 4'	20	lf		$1.62	$4.60		$0	$32	$92	$0	$124
7.8 Install SVE Piping and System Equipmen	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
7.9 Piping Values, fittings, etc	1	ls	$100.00				$100	$0	$0	$0	$100
7.10 Electrical System Installatior	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
7.11 QA/QC Inspection of System Installation	40	hrs			$31.08		$0	$0	$1,243	$0	$1,243
7.12 Vapor Recovery System, 127 SCFM, 1.5 Hp	1	ea	$4,615.00				$4,615	$0	$0	$0	$4,615
7.13 Portable Building for Treatment System	1	ea	$1,000.00				$1,000	$0	$0	$0	$1,000
7.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM	1	ea	$2,520.00				$2,520	$0	$0	$0	$2,520
8 SITE RESTORATION											
8.1 Import Vegetative Cover Material (Topsoil)	5.82	cy		$15.00			$0	$87	$0	$0	$87
8.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
8.1 Sod Disturbed Area	0.0500	acre	$20,859.00				$1,043	$0	$0	$0	$1,043
9 LAND USE CONTROLS											
9.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
9.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
9.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$2,343	$19,862	$7,720	$29,925

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$1,968	$16,684	$6,485	$25,137
Overhead on Labor Cost @ 30%									$5,005		$5,005
G & A on Labor Cost @ 10%									$1,668		$1,668
G & A on Material Cost @ 10%								$197			$197
Total Direct Capital Cost								$2,165	$23,358	$6,485	$32,008
Indirects on Total Direct Labor Cost @ 75%									$17,519		$17,519
Profit on Total Direct Cost @ 10%											$3,201
Subtotal											$52,727
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$2,283
Total Field Cost											**$55,010**
Subtotal Subcontractor Cost							$23,376				$23,376
G & A on Subcontract Cost @ 10%							$2,338				$2,338
Profit on Subcontractor Cost @ 5%											$1,169
Subcontractor Cost											**$26,882**
Contingency on Total Field and Subcontractor Costs @ 10%											**$8,189**
Engineering on Total Field and Subcontractor Costs @ 5%											**$4,095**
TOTAL Capital COST											**$94,176**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
ANNUAL OPERATION AND MAINTENANCE COSTS

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Soil Venting System	9,800	kWh	$0.06	$588	Electrical Load is approx. 1.5 Hp.
2	Maintenance	1	ls	$500.00	$500	3% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon	200	pound	$3.00	$600	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies	12	mo	$500.00	$6,000	Monthly O&M Site Visit (1 person , 1 days)
6	Analysis of Off-gas samples	12	ea	$300.00	$3,600	1 per month, VOCs
7	Geoprobe Mob/Demob. & 1-day Operation	1	ea	$650.00	$650	
8	Soil Samples (TPH)	8	ea	$73.33	$587	Samples collected annually to confirm cleanup.
9	Quarterly Reports	4	ea	$3,000.00	$12,000	
	Total Cost for One Year Operation				**$24,525**	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-3: IN SITU SOIL VENTING, AND LAND USE CONTROLS
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$94,176			$94,176	1.000	$94,176
1		$24,525	$2,839	$27,364	0.943	$25,815
2		$24,525	$2,839	$27,364	0.890	$24,354
3		$24,525	$2,839	$27,364	0.840	$22,975
4			$2,839	$2,839	0.792	$2,249
5			$10,214	$10,214	0.747	$7,633
6			$2,839	$2,839	0.705	$2,002
7			$2,839	$2,839	0.665	$1,888
8			$2,839	$2,839	0.627	$1,781
9			$2,839	$2,839	0.592	$1,681
10			$10,214	$10,214	0.558	$5,704
11			$2,839	$2,839	0.527	$1,496
12			$2,839	$2,839	0.497	$1,411
13			$2,839	$2,839	0.469	$1,331
14			$2,839	$2,839	0.442	$1,256
15			$10,214	$10,214	0.417	$4,262
16			$2,839	$2,839	0.394	$1,118
17			$2,839	$2,839	0.371	$1,054
18			$2,839	$2,839	0.350	$995
19			$2,839	$2,839	0.331	$938
20			$10,214	$10,214	0.312	$3,185
21			$2,839	$2,839	0.294	$835
22			$2,839	$2,839	0.278	$788
23			$2,839	$2,839	0.262	$743
24			$2,839	$2,839	0.247	$701
25			$10,214	$10,214	0.233	$2,380
26			$2,839	$2,839	0.220	$624
27			$2,839	$2,839	0.207	$589
28			$2,839	$2,839	0.196	$555
29			$2,839	$2,839	0.185	$524
30			$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$216,821**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	3	mo	$74.18				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	$98.33				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	$221.49				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	10	drum	$125.00				$1,250	$0	$0	$0	$1,250
3.3 Decon Water Storage Drums	10	ea		$45.00			$0	$450	$0	$0	$450
3.4 PPE (3 p * 5 days * 4 Weeks)	60	m-day		$30.00			$0	$1,800	$0	$0	$1,800
3.5 Decontaminate Equipment (Pressure Washer)	6	ea			$134.45	$50.00	$0	$0	$807	$300	$1,107
4 SITE PREPARATION											
4.1 Erosion Control Fencing	664	lf		$0.23	$1.17		$0	$153	$777	$0	$930
4.2 Collect/Analyze Delineation Samples (TPH	20	ea	$73.33	$10.00	$23.52		$1,467	$200	$470	$0	$2,137
4.3 Construction Surveys (2-man crew)	2	day	$648.36				$1,297	$0	$0	$0	$1,297
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
4.5 Concrete Demolition/Removal (6" reinforced)	50	cy	$45.58				$2,279	$0	$0	$0	$2,279
4.6 Concrete Debris Disposal	50	cy	$20.70				$1,035	$0	$0	$0	$1,035
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	10768	cy			$0.68	$1.71	$0	$0	$7,322	$18,413	$25,736
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavato	100	hrs				$37.54	$0	$0	$0	$3,754	$3,754
5.3 Wheel Loader, 3 cy	100	hrs			$27.20	$56.31	$0	$0	$2,720	$5,631	$8,351
5.4 Standby, Wheel Loader, 3 cy	40	hrs				$14.07	$0	$0	$0	$563	$563
5.5 Health & Safety Monitoring with OVA during Excavatio	20	day			$188.16	$100.00	$0	$0	$3,763	$2,000	$5,763
5.6 Collect/Analyze Confirmatory Samples	10	ea	$73.33	$10.00	$23.52		$733	$100	$235	$0	$1,069
5.7 Import (Offsite) Place, Compact Clean Fill Materia	1162	cy		$7.82	$0.85	$1.81	$0	$9,087	$988	$2,103	$12,178
5.8 Backfill with Clean Excavated Materia	9605	cy		$0.28	$2.02	$0.76	$0	$2,689	$19,402	$7,300	$29,391
5.9 UST Removal	4	ea		$340.72	$485.04	$1,638.12	$0	$1,363	$1,940	$6,552	$9,856
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	1743	ton	$45.00				$78,435	$0	$0	$0	$78,435
6.3 Prepare Shipment Manifests	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
7 SITE RESTORATION											
7.1 Concrete Slab (Reinforced) on Grade (6")	2700	sf	$4.03				$10,881	$0	$0	$0	$10,881
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$17,417	$59,324	$47,522	$124,262

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$14,630	$49,832	$39,918	$104,380
Overhead on Labor Cost @ 30%									$14,950		$14,950
G & A on Labor Cost @ 10%									$4,983		$4,983
G & A on Material Cost @ 10%								$1,463			$1,463
Total Direct Capital Cost								$16,093	$69,765	$39,918	$125,776
Indirects on Total Direct Labor Cost @ 75%									$52,324		$52,324
Profit on Total Direct Cost @ 10%											$12,578
Subtotal											$190,677
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$8,851
Total Field Cost											**$199,528**
Subtotal Subcontractor Cost							$104,355				$104,355
G & A on Subcontract Cost @ 10%							$10,436				$10,436
Profit on Subcontractor Cost @ 5%											$5,218
Subcontractor Cost											**$120,009**
Contingency on Total Field and Subcontractor Costs @ 10%											**$31,954**
Engineering on Total Field and Subcontractor Costs @ 5%											**$15,977**
TOTAL Capital COST											**$367,468**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 32
SOIL ALTERNATIVE S32-4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC:
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$367,468			$367,468	1.000	$367,468
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$424,558**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan		hr			$33.79		$0	$0	$0	$0	$0
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier		ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons		ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet		mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')		mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad		ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal		drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums		ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)		m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)		ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing		lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (inorganics		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)		day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou		hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)		cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator		hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavation		day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples		ea	$305.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia		cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile		ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazardous) in Landfil		ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests		hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil		cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")		day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area		acre	$20,859.00				$0	$0	$0	$0	$0
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)		days	$648.36				$0	$0	$0	$0	$0
8.2 Prepare Land Use Plan		hours			$33.79		$0	$0	$0	$0	$0
8.3 Modify Master Plan and Prepare Deed Restrictions		hours			$33.79		$0	$0	$0	$0	$0
Subtotal Direct Capital Costs less Subcontract								$0	$0	$0	$0
Local Area Adjustment								84%	84%	84%	
								$0	$0	$0	$0
Overhead on Labor Cost @ 30%									$0		$0
G & A on Labor Cost @ 10%									$0		$0
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$0	$0	$0

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-1: NO ACTION
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$0		$0
Profit on Total Direct Cost @ 10%											$0
Subtotal											$0
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$0
Total Field Cost											**$0**
Subtotal Subcontractor Cost							$0				$0
G & A on Subcontract Cost @ 10%							$0				$0
Profit on Subcontractor Cost @ 5%											$0
Subcontractor Cost											**$0**
Contingency on Total Field and Subcontractor Costs @ 10%											**$0**
Engineering on Total Field and Subcontractor Costs @ 5%											**$0**
TOTAL Capital COST											**$0**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-1: NO ACTION
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-1: NO ACTION
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-4: UST REMOVAL, EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$336,869			$336,869	1.000	$336,869
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$393,959**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-4: UST REMOVAL, EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-4: UST REMOVAL, EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-4: UST REMOVAL, EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$12,960	$40,364	$26,712	$80,036
Overhead on Labor Cost @ 30%									$12,109		$12,109
G & A on Labor Cost @ 10%									$4,036		$4,036
G & A on Material Cost @ 10%								$1,296			$1,296
Total Direct Capital Cost								$14,256	$56,510	$26,712	$97,478
Indirects on Total Direct Labor Cost @ 75%									$42,382		$42,382
Profit on Total Direct Cost @ 10%											$9,748
Subtotal											$149,608
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$8,018
Total Field Cost											**$157,626**
Subtotal Subcontractor Cost							$117,655				$117,655
G & A on Subcontract Cost @ 10%							$11,766				$11,766
Profit on Subcontractor Cost @ 5%											$5,883
Subcontractor Cost											**$135,303**
Contingency on Total Field and Subcontractor Costs @ 10%											**$29,293**
Engineering on Total Field and Subcontractor Costs @ 5%											**$14,646**
TOTAL Capital COST											**$336,869**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-4: UST REMOVAL, EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUC
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc., Loader, & Dozier	3	ea			$200.00	$250.00	$0	$0	$600	$750	$1,350
2.2 Mobilize/Demobilize Personnel (3-persons	3	ea		$375.00	$300.00		$0	$1,125	$900	$0	$2,025
2.3 Portable Toilet	3	mo	$74.18				$223	$0	$0	$0	$223
2.4 Storage Trailer (28' x 10')	3	mo	$98.33				$295	$0	$0	$0	$295
2.5 Office Trailer (32' x 8')	3	mo	$221.49				$664	$0	$0	$0	$664
2.6 Site Utilities	3	mo	$1,000.00				$3,000	$0	$0	$0	$3,000
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$450.00	$400.00	$155.00	$0	$450	$400	$155	$1,005
3.2 Decon Water Disposal	6	drum	$125.00				$750	$0	$0	$0	$750
3.3 Decon Water Storage Drums	6	ea		$45.00			$0	$270	$0	$0	$270
3.4 PPE (3 p * 5 days * 2 Weeks)	30	m-day		$30.00			$0	$900	$0	$0	$900
3.5 Decontaminate Equipment (Pressure Washer)	6	ea			$134.45	$50.00	$0	$0	$807	$300	$1,107
4 SITE PREPARATION											
4.1 Erosion Control Fencing	590	lf		$0.23	$1.17		$0	$136	$690	$0	$826
4.2 Collect/Analyze Delineation Samples (inorganics & TPH	20	ea	$378.33	$10.00	$23.52		$7,567	$200	$470	$0	$8,237
4.3 Construction Surveys (2-man crew)	2	day	$648.36				$1,297	$0	$0	$0	$1,297
4.4 Utility Location and Site Delineation/Layou	24	hrs			$33.23		$0	$0	$798	$0	$798
4.5 Concrete Demolition/Removal (6" reinforced)	24	cy	$45.58				$1,094	$0	$0	$0	$1,094
4.6 Concrete Debris Disposal	24	cy	$20.70				$497	$0	$0	$0	$497
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (2.0 cy Hyd. Exc.)	7250	cy			$0.68	$1.71	$0	$0	$4,930	$12,398	$17,328
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavato	40	hrs				$37.54	$0	$0	$0	$1,502	$1,502
5.3 Wheel Loader, 3 cy	100	hrs			$27.20	$56.31	$0	$0	$2,720	$5,631	$8,351
5.4 Standby, Wheel Loader, 3 cy	40	hrs				$14.07	$0	$0	$0	$563	$563
5.5 Health & Safety Monitoring with OVA during Excavatior	20	day			$188.16	$100.00	$0	$0	$3,763	$2,000	$5,763
5.6 Collect/Analyze Confirmatory Samples	10	ea	$378.33	$10.00	$23.52		$3,783	$100	$235	$0	$4,119
5.7 Import (Offsite) Place, Compact Clean Fill Materia	1311	cy		$7.82	$0.85	$1.81	$0	$10,252	$1,114	$2,373	$13,739
5.8 Backfill with Clean Excavated Materia	5910	cy		$0.28	$2.02	$0.76	$0	$1,655	$11,938	$4,492	$18,085
5.9 UST Removal	1	ea		$340.72	$485.04	$1,638.12	$0	$341	$485	$1,638	$2,464
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	2	ls	$750.00				$1,500	$0	$0	$0	$1,500
6.2 Transport and Dispose of Soil (Non-haz.) in Landfil	2010	ton	$45.00				$90,450	$0	$0	$0	$90,450
6.3 Prepare Shipment Manifests	80	hrs			$33.23		$0	$0	$2,658	$0	$2,658
7 SITE RESTORATION											
7.1 Concrete Slab (Reinforced) on Grade (6")	1300	sf	$4.03				$5,239	$0	$0	$0	$5,239
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$15,428	$48,053	$31,801	$95,281

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-3: UST REMOVAL, IN SITU SOIL VENTING AND LAND USE CONTROLS
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$80,495			$80,495	1.000	$80,495
1		$24,525	$2,839	$27,364	0.943	$25,815
2		$24,525	$2,839	$27,364	0.890	$24,354
3		$24,525	$2,839	$27,364	0.840	$22,975
4			$2,839	$2,839	0.792	$2,249
5			$10,214	$10,214	0.747	$7,633
6			$2,839	$2,839	0.705	$2,002
7			$2,839	$2,839	0.665	$1,888
8			$2,839	$2,839	0.627	$1,781
9			$2,839	$2,839	0.592	$1,681
10			$10,214	$10,214	0.558	$5,704
11			$2,839	$2,839	0.527	$1,496
12			$2,839	$2,839	0.497	$1,411
13			$2,839	$2,839	0.469	$1,331
14			$2,839	$2,839	0.442	$1,256
15			$10,214	$10,214	0.417	$4,262
16			$2,839	$2,839	0.394	$1,118
17			$2,839	$2,839	0.371	$1,054
18			$2,839	$2,839	0.350	$995
19			$2,839	$2,839	0.331	$938
20			$10,214	$10,214	0.312	$3,185
21			$2,839	$2,839	0.294	$835
22			$2,839	$2,839	0.278	$788
23			$2,839	$2,839	0.262	$743
24			$2,839	$2,839	0.247	$701
25			$10,214	$10,214	0.233	$2,380
26			$2,839	$2,839	0.220	$624
27			$2,839	$2,839	0.207	$589
28			$2,839	$2,839	0.196	$555
29			$2,839	$2,839	0.185	$524
30			$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$203,140**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-3: UST REMOVAL, IN SITU SOIL VENTING AND LAND USE CONTROLS
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-3: UST REMOVAL, IN SITU SOIL VENTING AND LAND USE CONTROLS
ANNUAL OPERATION AND MAINTENANCE COSTS

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Soil Venting System	9,800	kWh	$0.06	$588	Electrical Load is approx. 1.5 Hp.
2	Maintenance	1	ls	$500.00	$500	3% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon	200	pound	$3.00	$600	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies	12	mo	$500.00	$6,000	Monthly O&M Site Visit (1 person , 1 days)
6	Analysis of Off-gas samples	12	ea	$300.00	$3,600	1 per month, VOCs
7	Geoprobe Mob/Demob. & 1-day Operation	1	ea	$650.00	$650	
8	Soil Sample Analysis	8	ea	$73.33	$587	Sampling performed annually to confirm cleanup.
9	Quarterly Reports	4	ea	$3,000.00	$12,000	
	Total Cost for One Year Operation				**$24,525**	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-3: UST REMOVAL, IN SITU SOIL VENTING AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$1,124	$15,582	$2,465	$19,170
Overhead on Labor Cost @ 30%									$4,675		$4,675
G & A on Labor Cost @ 10%									$1,558		$1,558
G & A on Material Cost @ 10%								$112			$112
Total Direct Capital Cost								$1,236	$21,815	$2,465	$25,516
Indirects on Total Direct Labor Cost @ 75%									$16,361		$16,361
Profit on Total Direct Cost @ 10%											$2,552
Subtotal											$44,428
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$1,949
Total Field Cost											**$46,377**
Subtotal Subcontractor Cost							$20,538				$20,538
G & A on Subcontract Cost @ 10%							$2,054				$2,054
Profit on Subcontractor Cost @ 5%											$1,027
Subcontractor Cost											**$23,619**
Contingency on Total Field and Subcontractor Costs @ 10%											**$7,000**
Engineering on Total Field and Subcontractor Costs @ 5%											**$3,500**
TOTAL Capital COST											**$80,495**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-3: UST REMOVAL, IN SITU SOIL VENTING AND LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	200	hr			$33.79		$0	$0	$6,758	$0	$6,758
1.2 Project Scheduling and Procuremen	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	1	ea			$200.00	$250.00	$0	$0	$200	$250	$450
2.2 Mobilize/Demobilize Personnel (2-persons	1	ea		$375.00	$300.00		$0	$375	$300	$0	$675
2.3 Portable Toilet	1	mo	$74.18				$74	$0	$0	$0	$74
2.4 Storage Trailer (28' x 10')	1	mo	$98.33				$98	$0	$0	$0	$98
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$250.00	$200.00	$75.00	$0	$250	$200	$75	$525
3.2 Decon Water Disposal	1	drum	$125.00				$125	$0	$0	$0	$125
3.3 Decon Water Storage Drums	1	ea		$45.00			$0	$45	$0	$0	$45
3.4 PPE (2 p * 2 days * 1 Weeks)	4	m-day		$30.00			$0	$120	$0	$0	$120
3.5 Decontaminate Equipment (Pressure Washer)	1	ea			$134.45	$50.00	$0	$0	$134	$50	$184
4 SITE PREPARATION											
4.1 Erosion Control Fencing	63	lf		$0.23	$1.17		$0	$14	$74	$0	$88
4.2 Collect/Analyze Delineation Samples (TPH & inorganics	2	ea	$378.33	$10.00	$23.52		$757	$20	$47	$0	$824
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location/Site Layout	2	hrs			$33.23		$0	$0	$66	$0	$66
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	10.00	cy			$1.27	$2.23	$0	$0	$13	$22	$35
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	12	hrs				$20.50	$0	$0	$0	$246	$246
5.3 Health & Safety Monitoring with OVA during Excavation	2	day			$188.16	$100.00	$0	$0	$376	$200	$576
5.4 Collect/Analyze Confirmatory Samples	4	ea	$378.33	$10.00	$23.52		$1,513	$40	$94	$0	$1,647
5.5 Import (Offsite) Place, Compact Clean Fill Materia	10.00	cy		$7.82	$0.85	$1.81	$0	$78	$9	$18	$105
5.6 UST Removal	1	ea		$340.72	$485.04	$1,638.12	$0	$341	$485	$1,638	$2,464
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	1	ls	$750.00				$750	$0	$0	$0	$750
6.2 Transport/Dispose of Soil Cuttings (Non-Haz) in Landfil	12.57	ton	$45.00				$566	$0	$0	$0	$566
6.3 Prepare Shipment Manifests	20	hrs			$33.23		$0	$0	$665	$0	$665
7 SOIL VAPOR EXTRACTION (SUBSURFACE SOIL)											
7.1 Soil Vapor Extraction (SVE) System Layout (30' radius	4	hrs			$33.23		$0	$0	$133	$0	$133
7.2 Mobilize/Demobilize Drill Rig and Trenching Equipmer	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
7.3 SVE Well Install, 11" H. S. Auger (1 wells x 27' depth	27	lf	$27.01				$729	$0	$0	$0	$729
7.4 PVC Well Screen, 4" dia	22	lf	$17.84				$392	$0	$0	$0	$392
7.5 PVC Well Riser, 4" dia.	5	lf	$13.39				$67	$0	$0	$0	$67
7.6 Well Box and Surface Completion	1	well	$250.00				$250	$0	$0	$0	$250
7.7 PVC Piping, Schedule 40, 4'	20	lf		$1.62	$4.60		$0	$32	$92	$0	$124
7.8 Install SVE Piping and System Equipmen	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
7.9 Piping Values, fittings, etc	1	ls	$100.00				$100	$0	$0	$0	$100
7.10 Electrical System Installatior	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
7.11 QA/QC Inspection of System Installation	40	hrs			$31.08		$0	$0	$1,243	$0	$1,243
7.12 Vapor Recovery System, 127 SCFM, 1.5 Hp	1	ea	$4,615.00				$4,615	$0	$0	$0	$4,615
7.13 Portable Building for Treatment System	1	ea	$1,000.00				$1,000	$0	$0	$0	$1,000
7.14 Off Gas Treatment, Dual GAC Units (400#), 250 CFM	1	ea	$2,520.00				$2,520	$0	$0	$0	$2,520
8 SITE RESTORATION											
8.1 Import Vegetative Cover Material (Topsoil)	1.45	cy		$15.00			$0	$22	$0	$0	$22
8.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
8.3 Sod Disturbed Area	0.0017	acre	$20,859.00				$36	$0	$0	$0	$36
9 LAND USE CONTROLS											
9.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
9.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
9.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$1,338	$18,550	$2,935	$22,822

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$46,226			$46,226	1.000	$46,226
1		$0	$2,839	$2,839	0.943	$2,679
2		$0	$2,839	$2,839	0.890	$2,527
3		$0	$2,839	$2,839	0.840	$2,384
4		$0	$2,839	$2,839	0.792	$2,249
5		$0	$10,214	$10,214	0.747	$7,633
6		$0	$2,839	$2,839	0.705	$2,002
7		$0	$2,839	$2,839	0.665	$1,888
8		$0	$2,839	$2,839	0.627	$1,781
9		$0	$2,839	$2,839	0.592	$1,681
10		$0	$10,214	$10,214	0.558	$5,704
11		$0	$2,839	$2,839	0.527	$1,496
12		$0	$2,839	$2,839	0.497	$1,411
13		$0	$2,839	$2,839	0.469	$1,331
14		$0	$2,839	$2,839	0.442	$1,256
15		$0	$10,214	$10,214	0.417	$4,262
16		$0	$2,839	$2,839	0.394	$1,118
17		$0	$2,839	$2,839	0.371	$1,054
18		$0	$2,839	$2,839	0.350	$995
19		$0	$2,839	$2,839	0.331	$938
20		$0	$10,214	$10,214	0.312	$3,185
21		$0	$2,839	$2,839	0.294	$835
22		$0	$2,839	$2,839	0.278	$788
23		$0	$2,839	$2,839	0.262	$743
24		$0	$2,839	$2,839	0.247	$701
25		$0	$10,214	$10,214	0.233	$2,380
26		$0	$2,839	$2,839	0.220	$624
27		$0	$2,839	$2,839	0.207	$589
28		$0	$2,839	$2,839	0.196	$555
29		$0	$2,839	$2,839	0.185	$524
30		$0	$10,214	$10,214	0.174	$1,778
					TOTAL PRESENT WORTH	**$103,316**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
ANNUAL COSTS

Cost Item	Quantity	Unit	Unit Cost	Labor Overhead[a]	Total Cost
1 FIVE YEAR SITE REVIEWS (FOR 30 YEAR PERIOD)					
1.1 Site Review Meeting (2-persons for 2-days)					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	16	hr	$26.02	$26.02	$833
ODCs (travel, etc.)	1	ls	$800.00		$800
1.2 Five Year Review Report					
Project Manager	16	hr	$38.00	$38.00	$1,216
Staff Engineer	32	hr	$26.02	$26.02	$1,665
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Five Year Review Cost					$5,830
G&A and Profit @ 15%					$874
Subtotal					$6,704
Contingency @ 10%					$670.44
Total Five Year Review Cost					**$7,375**
2 LAND USE CONTROL MONITORING (FOR 30 YEAR PERIOD)					
2.1 Quarterly Site Inspections					
Project Manager (2 hrs for each Inspection)	8	hr	$38.00	$38.00	$608
2.2 Annual Review and Report					
Project Manager	12	hr	$38.00	$38.00	$912
Staff Engineer	12	hr	$26.02	$26.02	$624
ODCs (photocopies, telephone, etc.)	1	ls	$100.00		$100
Subtotal Land Use Control Monitoring					$2,244
G&A and Profit @ 15%					$337
Subtotal					$2,581
Contingency @ 10%					$258.12
Total Land Use Control Monitoring Cost					**$2,839**

[a] Overhead on professional labor @ 100%.

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
Operation and Maintenance Costs per Year

	Item	Qty	Unit	Unit Cost	Subtotal Cost	Notes
1	Energy - Electric		kWh	$0.06	$0	
2	Maintenance		ls		$0	5% of Installation Cost
3	Carbon Unit Changeout/Regeneration of Spent Carbon		pound	$3.00	$0	once a year
4	Labor, Mobilization/Demobilization, Per Diem, Supplies		wk	$925.00	$0	1 visit per week - 1 day
5	Labor, Mobilization/Demobilization, Per Diem, Supplies		mo	$1,950.00	$0	1 visit per quarter - 2 laborers, 2 days
6	Analysis of Off-gas samples		ea	$250.00	$0	1 per month, VOCs
7	Quarterly Reports		ea	$4,000.00	$0	
	Total Cost for One Year Operation				$0	

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$11,490		$11,490
Profit on Total Direct Cost @ 10%											$1,899
Subtotal											$32,379
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$1,145
Total Field Cost											**$33,525**
Subtotal Subcontractor Cost							$5,801				$5,801
G & A on Subcontract Cost @ 10%							$580				$580
Profit on Subcontractor Cost @ 5%											$290
Subcontractor Cost											**$6,671**
Contingency on Total Field and Subcontractor Costs @ 10%											**$4,020**
Engineering on Total Field and Subcontractor Costs @ 5%											**$2,010**
TOTAL Capital COST											**$46,226**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-2: UST REMOVAL, OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	100	hr			$33.79		$0	$0	$3,379	$0	$3,379
1.2 Project Scheduling and Procuremen	20	hr			$33.79		$0	$0	$676	$0	$676
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier)	1	ea			$200.00	$250.00	$0	$0	$200	$250	$450
2.2 Mobilize/Demobilize Personnel (2-persons	1	ea		$375.00	$300.00		$0	$375	$300	$0	$675
3 DECONTAMINATION											
3.1 Temporary Decon Pad	1	ls		$250.00	$200.00	$75.00	$0	$250	$200	$75	$525
3.2 Decon Water Disposal	1	drum	$125.00				$125	$0	$0	$0	$125
3.3 Decon Water Storage Drums	1	ea		$45.00			$0	$45	$0	$0	$45
3.4 PPE (2 p * 2 days)	4	m-day		$30.00			$0	$120	$0	$0	$120
3.5 Decontaminate Equipment (Pressure Washer)	1	ea			$134.45	$50.00	$0	$0	$134	$50	$184
4 SITE PREPARATION											
4.1 Erosion Control Fencing	63	lf		$0.23	$1.17		$0	$14	$74	$0	$88
4.2 Collect/Analyze Delineation Samples (TPH & inorganics	2	ea	$378.33	$10.00	$23.52		$757	$20	$47	$0	$824
4.3 Construction Surveys (2-man crew)	1	day	$648.36				$648	$0	$0	$0	$648
4.4 Utility Location and Site Delineation/Layou	2	hrs			$33.23		$0	$0	$66	$0	$66
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator)	10.00	cy			$1.27	$2.23	$0	$0	$13	$22	$35
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavator	12	hrs				$20.50	$0	$0	$0	$246	$246
5.3 Health & Safety Monitoring with OVA during Excavatior	2	day			$188.16	$100.00	$0	$0	$376	$200	$576
5.4 Collect/Analyze Confirmatory Samples	4	ea	$378.33	$10.00	$23.52		$1,513	$40	$94	$0	$1,647
5.5 Import (Offsite) Place, Compact Clean Fill Materia	10.00	cy		$7.82	$0.85	$1.81	$0	$78	$9	$18	$105
5.6 UST Removal	1	ea		$340.72	$485.04	$1,638.12	$0	$341	$485	$1,638	$2,464
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	1	ls	$750.00				$750	$0	$0	$0	$750
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfil	15.00	ton	$45.00				$675	$0	$0	$0	$675
6.3 Prepare Shipment Manifests	20	hrs			$33.23		$0	$0	$665	$0	$665
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	1.45	cy		$15.00			$0	$22	$0	$0	$22
7.2 Place/Grade Topsoil (6")	1	day			$227.20	$435.00	$0	$0	$227	$435	$662
7.3 Sod Disturbed Area	0.0017	acre	$20,859.00				$36	$0	$0	$0	$36
8 LAND USE CONTROLS											
8.1 Site Survey (2-man crew)	2	days	$648.36				$1,297	$0	$0	$0	$1,297
8.2 Prepare Land Use Plan	100	hours			$33.79		$0	$0	$3,379	$0	$3,379
8.3 Modify Master Plan and Prepare Deed Restrictions	80	hours			$33.79		$0	$0	$2,703	$0	$2,703
Subtotal Direct Capital Costs less Subcontract								$1,305	$13,027	$2,935	$17,267
Local Area Adjustment								84%	84%	84%	
								$1,096	$10,943	$2,465	$14,504
Overhead on Labor Cost @ 30%									$3,283		$3,283
G & A on Labor Cost @ 10%									$1,094		$1,094
G & A on Material Cost @ 10%								$110			$110
Total Direct Capital Cost								$1,206	$15,320	$2,465	$18,991

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 33
SOIL ALTERNATIVE S33-1: NO ACTION
PRESENT WORTH ANALYSIS

Year	Capital Cost	Operation and Maintenance Cost	Annual Cost	Total Yearly Cost	Present-Worth Factor (i = 6%)	Present Worth
0	$0			$0	1.000	$0
1		$0	$0	$0	0.943	$0
2		$0	$0	$0	0.890	$0
3		$0	$0	$0	0.840	$0
4		$0	$0	$0	0.792	$0
5		$0	$7,375	$7,375	0.747	$5,511
6		$0	$0	$0	0.705	$0
7		$0	$0	$0	0.665	$0
8		$0	$0	$0	0.627	$0
9		$0	$0	$0	0.592	$0
10		$0	$7,375	$7,375	0.558	$4,118
11		$0	$0	$0	0.527	$0
12		$0	$0	$0	0.497	$0
13		$0	$0	$0	0.469	$0
14		$0	$0	$0	0.442	$0
15		$0	$7,375	$7,375	0.417	$3,077
16		$0	$0	$0	0.394	$0
17		$0	$0	$0	0.371	$0
18		$0	$0	$0	0.350	$0
19		$0	$0	$0	0.331	$0
20		$0	$7,375	$7,375	0.312	$2,300
21		$0	$0	$0	0.294	$0
22		$0	$0	$0	0.278	$0
23		$0	$0	$0	0.262	$0
24		$0	$0	$0	0.247	$0
25		$0	$7,375	$7,375	0.233	$1,718
26		$0	$0	$0	0.220	$0
27		$0	$0	$0	0.207	$0
28		$0	$0	$0	0.196	$0
29		$0	$0	$0	0.185	$0
30		$0	$7,375	$7,375	0.174	$1,284
					TOTAL PRESENT WORTH	**$18,008**

APPENDIX F

RESPONSES TO USEPA AND FDEP DRAFT FS REVIEW COMMENTS

RESPONSE TO COMMENTS

United States Environmental Protection Agency Comments
Feasability Study for Surface and Subsurface Soil at
Sites 3, 4, 6, 30, 32, & 33

March 30, 2000

Specific Comments

1. **Page ES-4, Site 30 Description. In the first sentence of the second paragraph, remove the word "organics".**

Response:

The document will be revised as suggested.

2. **Page 1-1, Section 1.0. The first sentence of the first paragraph should state that the FS is intended to address the surface and subsurface soils at Sites 3, 4, 6, 30, 32, and 33 rather than for the direct contact of soil.**

Response:

The document will be revised as suggested.

3. **Page 2-4, Section 2.2. the word "addressing" should be changed to "address" in the second sentence of the first paragraph.**

Response:

The document will be revised as suggested.

4. **Page 2-8, Section 2.2.2. In the second sentence of the second paragraph, insert the word "anticipated" in between the words "and" and "future". It cannot be stated with complete certainty that the site will remain industrial in the future; however, it is anticipated that the site will continue to be utilized for industrial purposes. This change should also be made elsewhere in the document where future land use is discussed.**

Response:

The document will be revised as suggested.

5. **Page 2-12, Section 2.2.5, Areas and Volumes. The first sentence of the second paragraph should be reworded as follows: "Arsenic was detected in Sample 3SB01 at 0-2 feet bgs and 5-7 feet bgs."**

Response:

The document will be revised as suggested.

United States Environmental Protection Agency Comments
Feasability Study for Surface and Subsurface Soil at
Sites 3, 4, 6, 30, 32, & 33

March 30, 2000

(continued)

6. **In the "Summary of Comparative Analysis of Soil Alternatives" table for all sites included in the FS, Appendix E should be referenced in order to provide information related to how the Total Projected Present Worth Cost figure was calculated for each remedial alternative.**

Response:

The document will be revised as suggested.

7. **Page 7-3, Section 7.1.2. Delete the second paragraph on this page, this information is repeated in the Ecological Risk Assessment Results section further down the page.**

Response:

The document will be revised as suggested.

RESPONSE TO COMMENTS

Florida Department of Environmental Protection Comments
Feasability Study for Surface and Subsurface Soil at
Sites 3, 4, 6, 30, 32, & 33

March 30, 2000

Comments

1. **The media, classes of contaminants, remedial action objectives, general response actions, process options, alternatives, etc., are virtually identical for each of the sites with minor exception. The text for each chapter is essentially the same for each site with only minor modification. The Navy could have created a much more succinct document if it creatively combined the feasibility analysis for each site to eliminate redundancy.**

Response:

The feasibility study (FS) was originally prepared with the media, classes of contaminants, remedial action objectives, general response actions, process options, alternatives, etc., for all six sites discussed together to reduce redundancy. However, since six sites were being discussed there was no site continuity and it was hard to follow and keep straight what was proposed for each site. To make it easier to follow and understand, the FS was restructured to have each site discussed in a separate chapter of the report. In hindsight, the report could have been more concise and still have each site discussed in separate chapters for continuity.

2. **Preliminary Remediation Goals are based in part on a future industrial land use assumption. This creates a *de facto* land use control element in each alternative before the feasibility analysis even begins in earnest. Risk manager should be given an opportunity to assess the tradeoffs of alternatives with and without restricted land use since there are opportunities costs with land use controls.**

Response:

Due to the infrastructure (runways, aircraft hangers, and maintenance buildings) present at or adjacent to the sites in questions it is it is almost certain they will remain industrial in the future. In consideration of the above information, the NAS Whiting Field Partnering Team decided during preparation of the Draft FS to evaluate remedial alternatives based on the anticipated future industrial land use.

In addition based on preliminary cost estimates, the cost to implement a residential land use remedial alternative (without land use controls) will be much greater than the cost of the industrial land use remedial alternatives included in the FS making it highly unlikely to be selected by the Navy.

Florida Department of Environmental Protection Comments
Feasability Study for Surface and Subsurface Soil at
Sites 3, 4, 6, 30, 32, & 33

March 30, 2000

(continued)

3. **Some sites have a few isolated surface soil sample locations with arsenic slightly above the PRG of 3.7 mg/kg (commercial/industrial land use assumption). The Navy may be able to show with additional characterization that these minor isolated surface soil exceedances are consistent with reference background concentrations. There may not be a need for remedial action of arsenic in surface soil.**

Response:

The Navy has recently prepared and submitted to the State of Florida for review and concurrence a background study titled "Comprehensive Analysis of NAS Whiting Field Background Condition – Statistical Testing and Geochemical Evaluation. This comprehensive study documents that many of the minor inorganic surface soil exceedances are consistent with background concentrations. Upon concurrence of this report by the State of Florida, the procedures used in this background studywill be used to reevaluate the background concentrations of inorganics in surface and subsurface soils at NAS Whiting Field.

RESPONSE TO COMMENTS

United States Environmental Protection Agency Comments, Revised Feasibility Study Chapters 5, 6, and 7 for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, & 33

February 21, 2001

Specific Comments

1. **Page 5-25 - In the second paragraph of the Description, I would suggest the second sentence be reworded as follows: "Subsurface soil in the areas surrounding sample locations 30SB01 and 30SB04 would be treated using in-situ soil venting.....".**

Response:

The document will be revised as suggested.

2. **Page 5-26 - In the section describing Long-Term Effectiveness and Permanence, the text states that removal of the USTs would provide long-term effectiveness and permanence. Long-term effectiveness and permanence typically relate to the remedial action affecting contaminated media and would not specifically apply to the removal of the USTs. I would state that the removal of the USTs as a potential source would prevent future contamination of soil once the initial remedial action is conducted and for this reason lends to the overall long-term effectiveness and permanence of the remedy. This comment also applies to each of the three chapters and should be applied wherever long-term effectiveness and permanence are discussed.**

Response:

The document will be revised as suggested.

3. **Page 5-30 - In the section describing Reduction of Mobility, Toxicity, or Volume through Treatment, the text states that removal of the USTs would reduce the volume of contamination at Site 30. Again, reduction of mobility, toxicity or volume relate to contamination that occurs in environmental media and how it is addressed through remedial actions. If the statement is going to be made that removal of USTs would reduce the volume of contamination then additional information should be provided in the text as to why this is the case. This comment also applies to each of the three chapters.**

Response:

The statement that removal of USTs would reduce the volume of contamination will be deleted.

RESPONSE TO COMMENTS

United States Environmental Protection Agency Comments, Revised Feasibility Study Chapters 5, 6, and 7 for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, & 33

February 21, 2001

(continued)

4. **Page 5-37 - In the Magnitude of Residual Risks section, I would suggest revising the sentence that was added as follows: "No alternative, except No Action, for Site 30 would produce or leave residuals requiring treatment and/or disposal posing any future potential risk to the environment." Even though no ecological impact is expected, it is not known what long term effects to the environment may occur. Since we are not contemplating a no further action response, this statement will cover the potential for future harm or impact.**

Response:

The document will be revised as suggested.

5. **Page 6-20 - In the Overall Protection of Human Health and the Environment section, add the word "and" between "USTs" and "impacted."**

Response:

The document will be revised as suggested.