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FINAL FEASIBILITY STUDY ADDENDUM FOR SITE 30 NAS WHITING FIELD FL
9/30/2004
TETRA TECH NUS

Feasibility Study Addendum
for
Site 30, South Field Maintenance Hangar Surface and Subsurface Soil

Naval Air Station Whiting Field
Milton, Florida
USEPA ID No. FL2170023244

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888

Contract Task Order 0028

September 2004

FEASIBILITY STUDY ADDENDUM
FOR
SITE 30, SOUTH FIELD MAINTENANCE HANGAR
SURFACE AND SUBSURFACE SOIL

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

USEPA ID No. FL2170023244

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

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I hereby certify this document, *Feasibility Study Addendum for Site 30, South Field Maintenance Hangar, Surface and Subsurface Soil, Naval Air Station Whiting Field, Milton, Florida*, was prepared under my direct supervision in accordance with acceptable standards of engineering practice.

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ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable or relevant and appropriate requirement
BaPEq	benzo(a)pyrene equivalent
bls	below land surface
CCI	CH2M Hill Constructors, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CG	cleanup goal
COC	constituent of concern
COPCs	constituent of potential concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
CSF	cancer slope factor
ECs	engineering controls
(equiv)	equivalent
ELCR	excess lifetime cancer risk
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FS	Feasibility Study
FSA	Feasibility Study Assessment
GIR	General Information Report
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
LUC	land use control
mg/kg	milligrams per kilogram
NAS	Naval Air Station
NCEA	National Center for Environmental Assessment
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PRG	preliminary remediation goal
RAO	Remedial Action Objective
RBC	risk-based concentration
RfD	reference dose
RI	Remedial Investigation

RME	reasonable maximum exposure
SCTL	soil cleanup target level
SSL	soil screening level
TBC	to be considered
TCE	trichloroethene
TEF	Toxicity Equivalency Factors
TRPH	total recoverable petroleum hydrocarbon
TtNUS	Tetra Tech NUS, Inc.
UCL	upper confidence level
USEPA	United States Environmental Protection Agency
UST	underground storage tank

1.0 INTRODUCTION

Tetra Tech NUS, Inc. (TtNUS), under contract N62467-94-D-0888 to the Department of the Navy, Southern Division, Naval Facilities Engineering Command is submitting this Feasibility Study (FS) Addendum (FSA) to address changes at Site 30, South Field Maintenance Hangar, since submittal of the original FS was submitted in March 2001 (TtNUS, 2001a). The original FS included six Naval Air Station (NAS) Whiting Field sites: Sites 3, 4, 6, 30, 32, and 33. Surface and subsurface soil at Site 30 was addressed in Section 5.0 of the FS.

The changes at Site 30 addressed in this FS include the following activities undertaken and determinations made after the submittal of the FS:

- Underground Storage Tank (UST) Removal - In August 2000, the four USTs at Site 30 were removed along with a small amount of petroleum-contaminated soil [CH2M HILL Constructors Inc. (CCI), 2001]. Confirmation soil sampling identified the following contaminants at concentrations exceeding regulatory screening levels: naphthalene, 1,2,4-trimethylbenzene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, and total recoverable petroleum hydrocarbons (TRPH).

- Arsenic, originally identified as a constituent of concern (COC), was determined to be naturally occurring at Site 30 - Based on additional review of inorganic data from the facility and area soil geology in April 2001, the observed arsenic values were determined to represent naturally occurring levels [Florida Department of Environmental Protection (FDEP), 2001]. Because the identified human health risks associated with arsenic are now considered to be due to naturally occurring levels, arsenic will not be retained as a COC and remediation of arsenic in surface and subsurface soil is not required at Site 30.

- Change in Screening Criteria - Over the course of the investigations at this site, United States Environmental Protection Agency (USEPA) Region IV changed its screening criteria for evaluation of hazardous waste-related sites from USEPA Region III Risk-Based Concentrations (RBCs) to USEPA Region IX preliminary remediation goals (PRGs) (USEPA, 2002a). Therefore, analytical results are now compared to the USEPA Region IX PRGs and FDEP soil cleanup target levels (SCTLs) (FDEP, 1999).

- The individual metal constituents aluminum, iron, manganese and vanadium have no direct evidence of site-related use at Site 30 and the process and procedures at this site did not likely contribute to the presence of these inorganic analytes in surface or subsurface soil. Additionally,

the site-specific values for these inorganics are within the range of levels found at NAS Whiting Field and of naturally occurring levels throughout the southeastern United States. The Remedial Investigation (RI) for NAS Whiting Field Site 40, Basewide Groundwater, contains the appendix "Inorganics in Soil at NAS Whiting Field", presenting the technical basis for this determination. Considering the information presented above, aluminum, iron, manganese, and vanadium are not considered constituents of potential concern (COPCs) for Site 30 surface and subsurface soils.

1.1 PURPOSE

The purpose of this FSA is to evaluate the impact of the changes discussed above on the remedial alternatives for surface and subsurface soil at Site 30, as developed for the FS (TtNUS, 2001a). The specific items to be evaluated include:

- Removal of the four abandoned USTs including the excavation and removal of petroleum-contaminated soil in late summer 2000
- New analytical data collected during UST removal activities
- Soil screening criteria changed to USEPA Region IX PRGs
- Revised Human Health Risk Assessment (HHRA) and COC selection

1.2 REPORT ORGANIZATION

This FSA is organized into four chapters. Chapter 1.0 presents the purpose of the FSA. Chapter 2.0 discusses environmental conditions at the site including a summary of UST removal activities and the revised HHRA, and Chapter 3.0 presents remedial action objectives. Revised remedial action alternatives are discussed in Chapter 4.0.

This FSA also includes the following Appendices.

Appendix A	UST Removal Data
Appendix B	Revised Human Health Risk Assessment
Appendix C	Summary of Constituents Remaining in Surface and Subsurface Soil
Appendix D	Original FS (TtNUS, 2001a) Tables 5-8 and 5-9
Appendix E	Remedial Alternatives Cost Estimate

2.0 ENVIRONMENTAL CONDITIONS

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 former abandoned waste oil tanks west of Building 1406 (Figure 2-1).

Environmental conditions at Site 30 are described in detail in the RI Report issued in 1999 (TtNUS, 1999) and the FS (TtNUS, 2001a). Only UST removal activities and the associated revised HHRA at Site 30 are discussed in the following sections.

2.1 UST REMOVAL ACTIVITIES

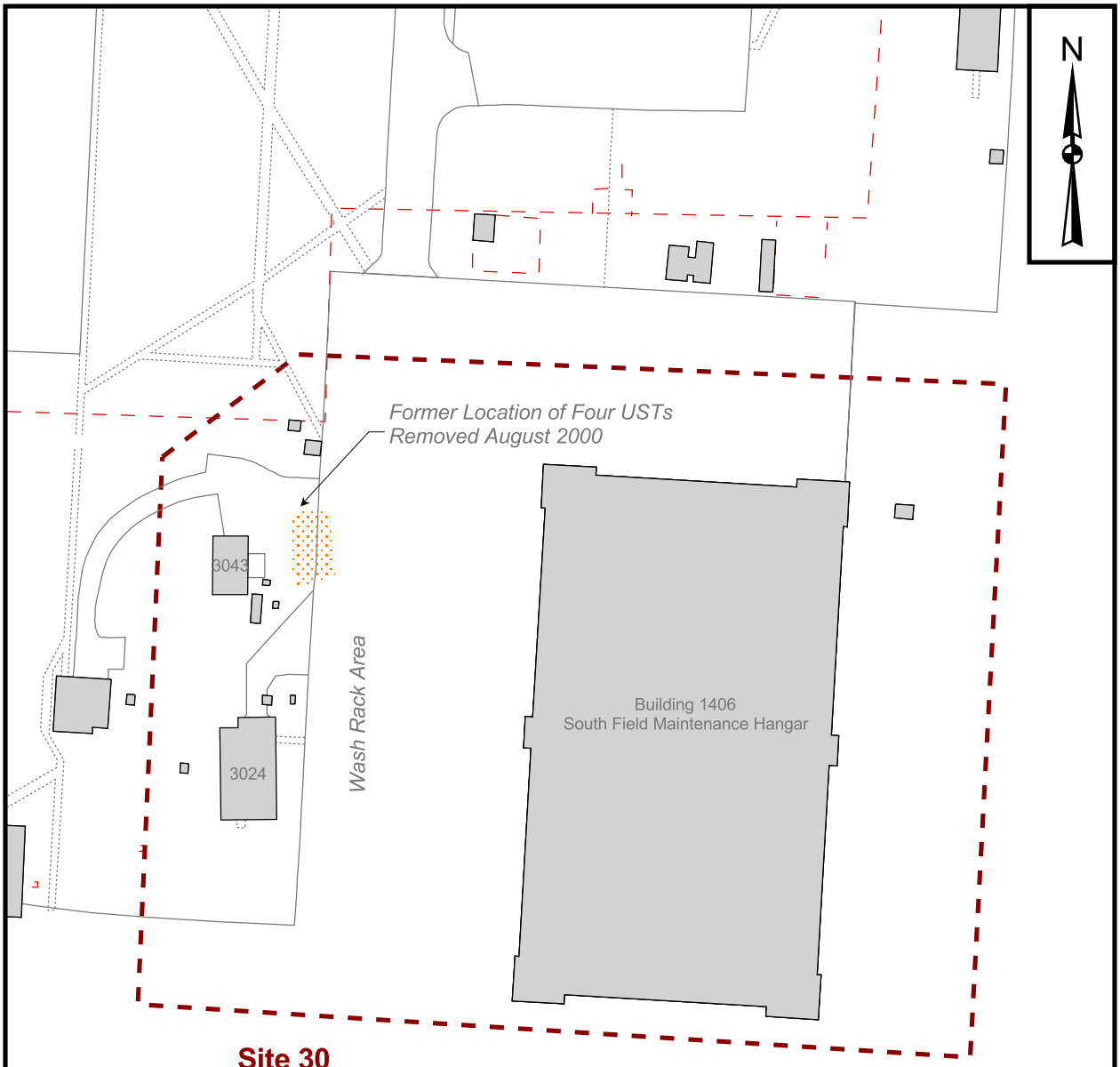
In August 2000, the USTs at Site 30 were removed by CCI. Removal activities are described in detail in the Project Completion Report, UST Removal at Sites 30, 32, and 33 (CCI, 2001). The project scope included excavation and removal of four previously abandoned USTs, transportation and disposal of petroleum-contaminated soil, collection and analysis of confirmatory soil samples, placement and compaction of clean backfill soil in excavation areas, and site restoration.

The four USTs ranged in capacity from 846 to 1,868 gallons and were in operation from 1943 through 1986. Upon inspection, the tanks were determined to be either partially or totally full of liquids with minor amounts of sand. Waste disposal profile samples were collected from the individual tanks, and all solid and liquid wastes were disposed of off site in accordance with state and local regulations.

The intent of the limited excavation was to remove contaminated soil surrounding the USTs, thereby eliminating the potential contamination source and to obtain clean closure, if possible. Depth to groundwater is approximately 80 to 90 feet below land surface (bls) and was not encountered during the soil excavation.

Site 30 excavation activities began on 19 August 2000. The concrete cradles were uncovered under all four USTs at a depth of 9 feet bls but were left in place because a 10- to 12-inch fire main was encountered along the western edge of the excavation. Soil surrounding the southern, eastern and northern sides of the cradles was removed to an average depth of 8 to 10 feet bls. The excavation measured approximately 25 feet by 40 feet and was approximately 10 feet deep. Approximately 232 cubic yards of TRPH-contaminated soil were removed and disposed as nonhazardous waste. The areal extent of the excavation and confirmation sample data are included in Appendix A.

Post-excavation confirmation sampling included collection of five soil samples plus a duplicate (Appendix A). Samples from the sidewalls of the excavation were collected from 6 to 7 feet bls, with the



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exception of the west wall. The west wall sample was collected from approximately 5 feet bls. The bottom sample and its duplicate were collected from 9 to 10 feet bls. Analytical results are summarized in Appendix A.

After the confirmation samples were collected, the excavation was filled with clean back fill to within 6 inches of the surrounding surface, compacted, and a new concrete pad was constructed.

The TRPH concentrations in three samples exceeded the FDEP SCTL (industrial) for direct exposure [2,500 milligrams per kilogram (mg/kg)]. The east wall sample TRPH concentration was 6,600 mg/kg, and the two samples from the bottom of the excavation had TRPH concentrations of 7,000 mg/kg and 5,700 mg/kg. Several polynuclear aromatic hydrocarbons (PAHs) were also identified in the post-excavation confirmation samples. Benzo(a)pyrene was detected in the bottom sample and its duplicate at 1.4 mg/kg and 0.87 mg/kg, respectively. These concentrations exceed the FDEP SCTL (industrial) of 0.5 mg/kg, as well as the USEPA Region IX PRG industrial of 0.211 mg/kg. Benzo(a)anthracene was detected at 3.4 mg/kg, exceeding the USEPA Region IX PRG industrial of 2.11 mg/kg but did not exceed the FDEP SCTL (industrial) of 5.0 mg/kg.

Since several PAHs exceeding regulatory standards were identified during UST removal activities, the human health risk was evaluated. A summary of the results of the revised HHRA is described in the following section.

2.2 SUMMARY OF REVISED HHRA

This revised HHRA conservatively estimates the potential risk to human health considering historic analytical data, recent UST removal analytical data, and arsenic, aluminum, iron, manganese and vanadium being present at naturally occurring concentrations at Site 30. The UST removal subsurface analytical data was combined with previous subsurface soil data collected from 2 to 15 feet bls to evaluate human health risk due to subsurface soil. Since additional surface soil analytical data was not collected during UST removal activities, human health risks due to surface soil were not recalculated. The human health risk due to surface soil remains the same as reported in the RI Report (TtNUS, 1999) except the calculated risk due to arsenic is deleted since arsenic is present at naturally occurring concentrations. Details of the revised HHRA are presented in Appendix B. A summary of the revised HHRA is provided below.

2.2.1 Results

Cancer risk estimates and hazard indices calculated for the subsurface soil COPCs are presented in Appendix B, Table 1-2.

The ELCR calculated for the hypothetical future resident and the typical construction worker (based on PRGs and construction worker SSLs, respectively) are 3.3E-05 and 9.6E-07, respectively. The risk estimate for the construction worker does not exceed the USEPA target risk range often used to evaluate the need for environmental remediation or the FDEP benchmark of 1.0E-06. The risk estimate for the resident does exceed the FDEP benchmark of 1.0E-06, although it is within the USEPA target risk range often used to evaluate the need for environmental remediation. It should be noted that both the residential and construction worker risks were estimated using the maximum detected concentration; therefore, the risk may be overestimated. BaPEq is the main risk driver, responsible for 91 percent of the carcinogenic risk; however, benzo(a)pyrene and other cPAHs were detected in only four of 31 total samples.

The total hazard index exceeds unity for the hypothetical future resident (HI = 1.68). HIs calculated on a target organ specific basis for the resident do exceed 1 for adverse effects to body weight and adverse nasal effects. The total HI for the construction worker is 0.02, indicating no unacceptable risks. Hazard indices calculated on a target organ specific basis for the construction worker do not exceed 1.

3.0 REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for Site 30 are:

- To prevent residential development on the site.
- To protect the industrial worker from carcinogenic and non-carcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated soils.
- To comply with federal and state applicable or relevant and appropriate requirements (ARARs) and to be considered (TBC) guidance in accordance with accepted USEPA and FDEP guidelines.

The RAOs for this site are 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.
- FDEP SCTLs (commercial/industrial land use).
- USEPA Region IX PRGs (commercial/industrial land use).

The current and future use of the property at this site remains industrial, and the current and future receptors are occupational and construction workers in direct contact with the soil.

3.1 REVISED CLEANUP GOALS

Cleanup Goals (CGs) establish acceptable exposure levels protective of human health and the environment. CGs are based on regulatory requirements, USEPA-acceptable risk levels, and assumptions regarding ultimate land uses, as well as contaminant pathways. Specifically, CGs are used to determine COCs, to estimate areas and volumes of impacted media, and set performance standards for potential remedial alternatives.

CGs are determined based on ARARs and “to be considered” criteria, constituents and media of interest, and exposure pathways. The revised CGs for this site are now formulated based on the following criteria: FDEP SCTLs (Chapter 62-777, F.A.C.) for direct commercial/industrial exposure, and USEPA Region IX PRGs. The current and future use of the site is for industrial purposes; therefore, the exposure pathways are occupational and construction workers.

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

1. The FDEP SCTLs (Chapter 62-777, F.A.C.) and the USEPA Region IX PRGs 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 CG of inorganic COCs.

Table 3-1 provides a list of the revised surface and subsurface soil CGs for Site 30.

3.2 REVISED CONSTITUENTS OF CONCERN

A re-evaluation of the constituents remaining in surface and subsurface soil was conducted for this FSA. Appendix C contains a summary of the location and depths of constituents remaining in surface soil (Table C-1) and subsurface soil (Table C-2) at the site. Table C-2 includes the subsurface soil analytical data collected during the RI and the UST removal project.

The original FS identified two COCs: Arsenic in surface soil and TRPH in both surface and subsurface soil. Because arsenic has been determined to be naturally occurring, it is no longer retained as a COC. The revised COCs for Site 30 have been determined by comparing the soil CG value against the COPC's site-specific representative concentration (or maximum value if less than 10 samples). The site specific representative concentration for a COPC was determined by calculating the 95 percent upper confidence limit (UCL) concentrations (Appendix B-1) and comparing the 95 percent UCL concentration to the maximum detected concentrations (Table 3-2). Any COPC with a site-specific representative concentration exceeding the CG becomes a COC. In summary, as shown in Table 3-2, TRPH remains the only surface soil COC and both benzo(a)pyrene equivalent (BaPEq) and TRPH were identified as COCs in subsurface soil. Areas impacted by COCs in surface and subsurface soil are shown on Figure 3-1.

3.3 REVISED AREAS AND VOLUMES OF SOIL REQUIRING REMEDIAL ACTION

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

The revised estimated volume of impacted soil calculated for each location exceeding CGs is based on Table 5-4 of the original FS. The rationale for estimating the area and vertical extent of impacted soil at each location is presented in the following paragraphs.

The areas around samples 30SB13 and 30SB06 are not included in the revised calculations for volume of impacted surface and subsurface soil because arsenic at Site 30 is naturally occurring and is not a COC.

TABLE 3-1
DETERMINATION OF CLEANUP GOALS AT SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Constituents of Potential Concern[1]	Units	62-777, F.A.C. Commercial/ Industrial SCTL[2]	USEPA Region IX Industrial PRGs[3]	Lower Value	Risk Driver[4]	Surface Soil Background[5]	Surface Soil CG	Subsurface Soil Background[5]	Subsurface Soil CG
Trichloroethene	mg/kg	8.5	0.11	0.11	C	NA	0.11	NA	0.11
Napthalene	mg/kg	27	18.8	18.8	N	NA	18.8	NA	18.8
1,2,4 Trimethylbenzene	mg/kg	8.8	17.0	8.8	N	NA	8.8	NA	8.8
1-Methylnaphthalene	mg/kg	47	18.8	18.8	N	NA	18.8	NA	18.8
2-Methylnaphthalene	mg/kg	56	18.8	18.8	N	NA	18.8	NA	18.8
Benzo(a)Anthracene	mg/kg	5	2.1	2.1	C	NA	2.1	NA	2.1
Benzo(a)Pyrene	mg/kg	0.5	0.21	0.21	C	NA	0.21	NA	0.21
Benzo(b)Fluoranthene	mg/kg	4.8	2.1	2.1	C	NA	2.1	NA	2.1
Benzo(k)Fluoranthene	mg/kg	52	21.1	21.1	C	NA	21.1	NA	21.1
Chrysene	mg/kg	450	211	211	C	NA	211	NA	211
Indeno(1,2,3,cd)Pyrene	mg/kg	5.3	2.1	2.1	C	NA	2.1	NA	2.1
TRPH (C8-C40)	mg/kg	2,500	NA	2,500	NA	NA	2,500	NA	2,500

[1]Combined list of all COPCs for Site 30 (surface and subsurface soil).

[2]Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C. (May 1999). (Note: 1/10th value used for non-carcinogens.

[3]USEPA Region IX Preliminary Remediation Goal Table, October 2002. (Note: 1/10th value used for noncarcinogens)

[4]Soil Basis Codes: N = Non-carcinogen, C = Carcinogen

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

mg/kg – milligrams per kilogram

NA – Not Applicable

CG – Cleanup Goal

TABLE 3-2
CONSTITUENTS OF CONCERN EVALUATION FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

Surface Soil

Constituents of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			CG	COC
				Value	Statistic[2]	Rationale		
Naphthalene	mg/kg	8.6	--	8.6	Maximum	Max*	18.8	No
Trichloroethene	mg/kg	0.18	--	0.045	95% UCL	UCL < max	0.11	No
TRPH	mg/kg	9610	--	2,660	Maximum	UCL > max	2,500	**Yes**

Subsurface Soil

Constituents of Potential Concern	Units	Maximum Detected Concentration	Maximum Qualifier	Representative Concentration[1]			CG	COC
				Value	Statistic[2]	Rationale		
Naphthalene	mg/kg	20	--	3.5	95% UCL	UCL < max	18.8	no
1,2,4 Trimethybenzene	mg/kg	11	--	6.3	95% UCL	UCL < max	8.8	no
1-Methylnaphthalene	mg/kg	27	--	14.1	95% UCL	UCL < max	18.8	no
2-Methylnaphthalene	mg/kg	35	--	4.4	95%UCL	UCL < max	18.8	no
BaPEq	mg/kg	2.02	--	1.12	95%UCL	UCL < max	0.21	**Yes**
TRPH	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).

CG = Cleanup goal

mg/kg = milligrams per kilogram

UCL = upper confidence limit

UCL-T = UCL of log-transformed data

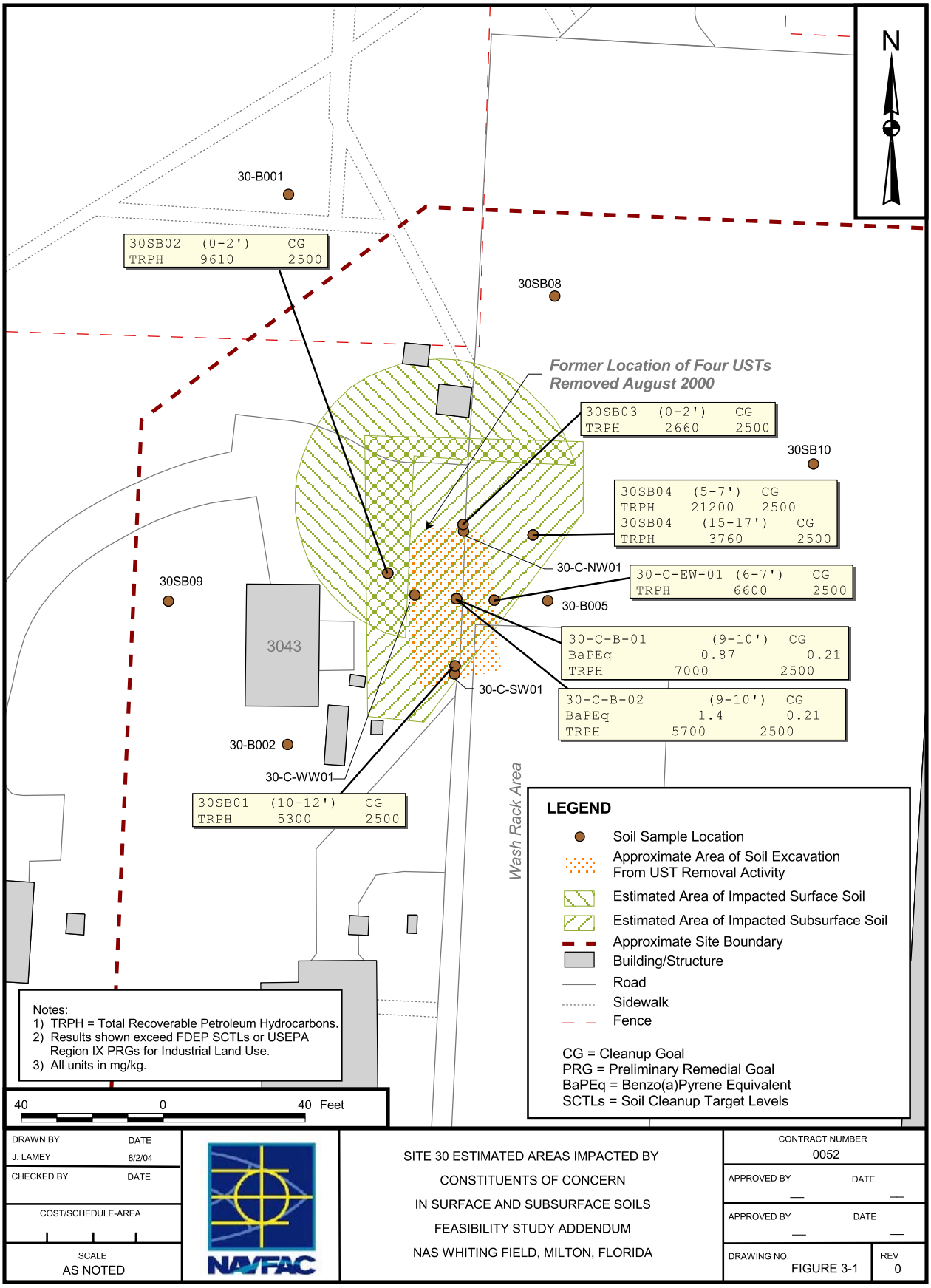
BaPEq = benzo(a)pyrene equivalent

CG = Cleanup Goal

COC = Constituent of Concern

* The 95% UCL concentration for naphthalene in surface soil was not calculated.

Constituents exceeding the CG are bolded.



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The area excavated during the UST removal project is shown on Figure 2-1 and in Appendix A. Due to the presence of a 10- to 12-inch fire main (water line) along the western edge of the excavation, the concrete cradles were left in place. The depth of excavation around the cradles was 8 to 10 feet. Samples from the bottom of the excavation (30-C-B-01 and 30-C-B-02) had BaPEq and TRPH concentrations above CGs at the 9 to 10 foot interval.

Although arsenic is no longer considered a COC at Site 30, the estimated contaminated surface soil volume associated with sample locations 30SB01, 30SB02, 30SB03, and 30SB04 remains the same (372 cubic yards) as the original estimate presented in the FS due to TRPH remaining at those locations. The revised estimate for contaminated surface soil volume is 372 cubic yards.

Sample locations 30-C-B-01, 30-C-B-02, and 30-EW-01 all fall within the effective radius of 55 square feet for impacted subsurface soil estimated in the original FS. The contaminated subsurface soil volume estimate has been reduced by the amount of TRPH-contaminated soil excavated (approximately 232 cubic yards) during the UST removal project and the previous estimate associated with arsenic at sample locations 30SB04 (93 cubic yards) and 30SB06 (186 cubic yards). The revised estimate for contaminated subsurface soil volume is 2,360 cubic yards.

4.0 AMENDED DESCRIPTION AND EVALUATION OF REMEDIAL ALTERNATIVES

4.1 AMENDED DESCRIPTION OF ALTERNATIVES

Identification and screening appropriate technologies for remedial alternatives addressing the RAOs developed for Site 30 were presented in the FS. Each technology was then screened based on site- and waste-limiting characteristics. Four soil remedial alternatives were developed in the original FS representing a range of options. All of those options, except the No Action alternative, included UST removal. For reference, Appendix C contains a copy of the original FS description and evaluation of remedial alternatives for Site 30. This section of the FSA presents a revised description of the four original remedial alternatives eliminating the UST removal component, as well as the surface soil removal component for soil containing arsenic. Table 4-1 shows a comparison between the soil remedial alternatives identified in the orginal FS and this FSA.

4.2 AMENDED EVALUATION OF ALTERNATIVES

This section compares the impact of the changes in soil COCs (deletion of arsenic in surface soil and addition of BaPEq in subsurface soil) upon the evaluation of the four above remedial alternatives in accordance with the seven Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) criteria, as originally provided in the FS. A summary of this comparison is provided in Table 4-2.

4.2.1 Overall Protection Of Human Health and The Environment

There is no change in the relative overall protection of human health and the environment of Alternatives 1 through 4. Alternative 1 remains least protective and Alternative 4 still provides the highest level of overall protection.

4.2.2 Compliance with ARARs

The changes in COCs only impact the compliance of Alternatives 2 and 3 with chemical-specific ARARs. Compliance with the ARARs for BaPEq will require significant time but compliance with the ARARs for arsenic is no longer required.

There is no change in the compliance of Alternatives 1 and 4 with chemical-specific ARARs and with the compliance of Alternatives 1, 2, 3, and 4 and with location- and action-specific-ARARs.

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TABLE 4-1

COMPARISON OF ORIGINAL FS AND FSA DESCRIPTION OF SOIL REMEDIAL ALTERNATIVES
SITE 30
NAS WHITING FIELD
MILTON, FLORIDA

Alternative Number		Alternative Type		Representative Process Options Combined into Alternatives		Alternative Description	
FS (March 2001)	**FSA (September 2004)**	FS (March 2001)	**FSA (September 2004)**	FS (March 2001)	**FSA (September 2004)**	FS (March 2001)	**FSA (September 2004)**
Alternative S30-1 No Action	Alternative 1 No Action	No Action	None	None	None	• Five –year Reviews.	• No Action
Alternative S30-2 UST Removal, Surface Soil (exceeding PRGs) Removal, and LUCs	Alternative 2 ECs and LUCs	Source Removal / Containment /Limited Action – No or Minimal Treatment	Limited Action – No or Minimal Treatment	LUCs, Remove USTs, Excavation, Disposal, Soil Cover	ECs and LUCs	• LUCs including LUCAP and LUCIP • Delineation/confirmatory sampling of surface soil adjacent to 30SB02, 30SB03, 30SB04, 30SB06, 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, 30SB13. • Backfill excavations with clean fill. • Replace concrete / asphalt and establish vegetative cover. • Posting of warning signs. • Five-year site reviews.	• ECs and LUCs *(LUC RD will establish LUCIP).* • *(No delineation sampling, no surface soil excavation planned)* • *(USTs removed August 2000)* • *(Arsenic determined to be naturally occurring; no surface soil excavation planned*) • *(Completed during UST removal, August 2000)* • *(This component, now considered part of the ECs, was completed during UST removal, August 2000)* • Posting of warning signs • *(Five-year review will be part of LUC RD).*
Alternative S30-3 UST Removal, Surface Soil (exceeding PRGs) Removal, Soil Venting, and LUCs	Alternative 3 Soil Venting and LUCs	Source Removal / Containment / Limited Action – Minimal Treatment	Limited Treatment Action – Minimal Treatment	LUCs, Remove USTs, Excavation, Disposal, Soil Cover Soil Venting	LUCs and Soil Venting	• LUCs including LUCAP and LUCIP • Delineation/confirmatory sampling of surface soil adjacent to 30SB02, 30SB03, 30SB04, 30SB06, 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, 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.	• LUCs *(LUC RD will establish LUCIP)* • *(No delineation sampling, no surface soil excavation planned)* • *(USTs removed during August 2000)* • *(Arsenic determined to be naturally occurring; no surface soil excavation planned*) • *(Completed during UST removal, August 2000)* • *(This component, now considered part of the ECs, was completed during UST removal, August 2000)* • Install, operate, and monitor a soil venting system for subsurface soil at locations 30SB01 and 30SB04. • Posting of warning signs. • *(Five-year review will be part of LUC RD).*
Alternative S30-4 UST Removal, Surface and Subsurface Soil (exceeding PRGs) Removal, and LUCs	Alternative 4 Surface and Subsurface Soil (exceeding CGs) Removal and LUCs	Treatment / Bulk Removal – Minimizes Long-Term Management	Treatment/Bulk Removal – Minimizes Long-Term Management	LUCs, Remove USTs, , Bulk Excavation, Disposal	LUCs, Bulk Excavation, Disposal	• LUCs including LUCAP and LUCIP • Delineation/confirmatory sampling of surface soil adjacent to 30SB02, 30SB03, 30SB04, 30SB06, 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.	• LUCs *(LUC RD will establish LUCIP).* • Delineation/confirmatory sampling of surface and subsurface soil adjacent to 30SB01, 30SB02, 30SB03, 30SB04, 30-C-B-01, and 30-C-EW-01. • *(USTs removed, August 2000)* • Demolition and removal/disposal of asphalt and concrete pavement and uncontaminated surface soil. • Excavation/disposal of surface and subsurface soil exceeding CGs at 30SB01, 30SB02, 30SB03, 30SB04, 30-C-B-01, and 30-C-EW-01. • Backfill excavations with clean fill. • Replace asphalt or concrete pavement. • Establish vegetative cover. • Posting of warning signs. • *(Five-year review will be part of LUC RD).*

CG = Cleanup goal
ECs = Engineering Controls
LUCs = Land Use Controls
LUCAP = LUC Assurance Plan
LUCIP = LUC Implementation Plan
RD = Remedial Design
TPH = Total Petroleum Hydrocarbons
TRPH = Total Recoverable Petroleum Hydrocarbons (FS refers to TPH; FSA refers to TRPH)
Reference Table 5-8, FS (TtNUS, 2001a)
*The Project Completion Report, UST Removal at Sites 30, 32, and 33 (CCI, 2001) documenting the August 2000 removal of the UST at Site 30 was finalized in August 2001. The FS (TtNUS, 2001a) was finalized in March 2001 and did not incorporate the UST removal activities

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TABLE 4-2

SUMMARY OF COMPARATIVE IMPACT OF CHANGES IN COCs ON EVALUATION OF REMEDIAL ALTERNATIVES
SITE 30
NAS WHITING FIELD
MILTON, FLORIDA

PAGE 1 OF 2

Criteria	Alternative 1 No Action	Alternative 2 LUCs and ECs	Alternative 3 Soil Venting and LUCs	Alternative 4 Surface and Subsurface Soil (exceeding CGs) Removal, and LUCs
THRESHOLD CRITERIA				
Overall Protection of Human Health and the Environment				
Human Health Protection	No change	No change	No change	No change
Environmental Protection	No change	No change	No change	No change
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)				
Compliance with Chemical-Specific ARARs	No change	Compliance with ARARs for BaPEq will take significant time. Compliance with ARAR for arsenic no longer required.	Compliance with ARARs for BaPEq will take significant time. Compliance with ARAR for arsenic no longer required.	No change
Compliance with Action-Specific ARARs	No change	No change	No change	No change
Compliance with Location-Specific ARARs	No change	No change	No change	No change
Compliance with Other Criteria	No change	No change	No change	No change
BALANCING CRITERIA				
Long-Term Effectiveness and Permanence				
Reduction in Residual Risk	No change	Increased residual risk because of added BaPEq. Decreased residual risk because of elimination of arsenic	Increased residual risk because of added BaPEq. Decreased residual risk because of elimination of arsenic	No change
Long-Term Reliability of Controls	No change	No change	No change	No change
Need for 5-Year Review	No change	No change	No change	No change
Prevention of Exposure to Residuals	No change	No change	No change	No change
Potential Need for Replacement of Technical Components after Remedial Objectives Are Achieved	No change	No change	No change	No change
Long-Term Management	No change	No change	No change	No change
Reduction of Mobility, Toxicity, or Volume through Treatment				
Amount Destroyed or Treated	No change	Less COCs destroyed because of added BaPEq.	Less COCs destroyed because of added BaPEq.	Greater amount of COCs removed.
Reduction in Mobility, Toxicity, or Volume	No change	No change of reduction in mobility and toxicity. Decrease reduction of volume.	No change of reduction in mobility and toxicity. Decrease reduction of volume.	Increase reduction of volume.
Irreversibility of Treatment	No change	No change	No change	No change
Type and Quantity of Residuals Remaining after Treatment	No change	No change	No change	No change

TABLE 4-2

SUMMARY OF COMPARATIVE IMPACT OF CHANGES IN COCs ON EVALUATION OF REMEDIAL ALTERNATIVES
SITE 30
NAS WHITING FIELD
MILTON, FLORIDA

Criteria	Alternative 1 No Action	Alternative 2 LUCs and ECs	Alternative 3 Soil Venting and LUCs	Alternative 4 Surface and Subsurface Soil (exceeding CGs) Removal and LUCs
Short-Term Effectiveness				
Community Protection During Implementation	No change	No change	No change	No change
Worker Protection During Implementation	No change	No change	No change	No change
Environmental Impacts	No change	No change	No change	No change
Construction Time	No change	No change	No change	No change
Time Until RAOs and CGs are Achieved	No change	No change for time to meet RAOs. More time required to meet CGs because of added BaPEq.	No change for time to meet RAOs. More time required to meet CGs because of added BaPEq.	No change
Implementability				
Ability to Construct and Operate the Technology	No change.	No change	No change	No change
Reliability of Technology	No change	No change	No change	No change
Ease of Undertaking Additional Remedial Action, if Required	No change	No change	No change	No change
Ability to Monitor Effectiveness	No change	No change	No change	No change
Permitting Requirements	No change	No change	No change	No change
Coordination with Other Agencies	No change	No change	No change	No change
Availability of Services and Capabilities	No change	No change	No change	No change
Availability of Equipment, Specialists, and Materials	No change	No change	No change	No change
Cost[a]				
Capital Costs	No change	$107,450 (decrease)	$95,167 (decrease)	$71,049 (decrease)
Short-Term O&M	No change	No change	No change	No change
Long-Term O&M				
5-Year Review	b	No change	No change	No change
Land-Use Controls	No change	No change	$253 (decrease)	No change
Total Project Present Worth Cost	No change $0 (Total) b	$107,450 (decrease) $82,186 (Total)	$95,167 (decrease) $270,399 (Total)	$71,049 (decrease) $609,697 (Total)

NOTES:

ARAR Applicable or relevant and appropriate requirement
BaPEq Benzo(a)pyrene equivalent
COC Constituent of concern
EC Engineering Controls to prohibit digging into or disturbing existing concrete or asphalt covered areas on the site
LUC Land use control
RAO Remedial Action Objective
CG Cleanup Goal
a Values shown represent the amount of decrease or increase in cost from original FS estimate. Present worth cost details are provided in Appendix E.
b The original FS included costs for 5-year reviews; however, no 5 year reviews are included for the No Action alternative in this re-evaluation.

4.2.3 Long-Term Effectiveness and Permanence

The changes in COCs only impact the long-term effectiveness and permanence of Alternatives 2 and 3. Residual risks associated with these two alternatives slightly increase because of the addition of BaPEq as a COC, but residual risks associated with these two alternatives are also reduced because of the elimination of arsenic as a COC.

4.2.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

The changes in COCs do not impact the reduction of mobility, toxicity, or volume provided by Alternative 1, remaining non-existent. The changes in COCs do not impact the reduction of mobility or toxicity provided by Alternatives 2, 3, and 4. The changes in COCs decrease the reduction of volume provided by Alternatives 2 and 3 and increase the reduction of volume provided by Alternative 4 because of the addition of BaPEq as a COC.

4.2.5 Short-Term Effectiveness

The changes in COCs have no impact on the short-term effectiveness of any of the four alternatives.

4.2.6 Implementability

The changes in COCs have no impact on the implementability of any of the four alternatives.

4.2.7 Cost

The changes in COCs have an impact on the cost of Alternatives 2, 3, and 4. The removal of arsenic as a COC reduces the cost of Alternative 2, 3, and 4 due to the elimination of the surface soil removal component. The UST removal (CCI, 2001) also reduces the cost of Alternatives 2, 3, and 4 due to the elimination of this component from these three alternatives. Table 4-2 shows the amount of decreased in cost for Alternatives 2, 3, and 4 as well as the overall total present worth cost for each alternative. The net present worth costs are detailed in Appendix E.

4.3 SUMMARY

As discussed in Sections 4.1 and 4.2 and as further illustrated on Tables 4-1 and 4-2, recent developments at Site 30 have had very little impact on the findings of the original FS. In particular, the addition of BaPEq as a subsurface soil COC, the most significant development, has resulted in no significant changes to the CERCLA evaluation of remedial alternatives. Therefore, the remedial alternatives and their comparative evaluation as presented in this FSA are not significantly different from those presented in the original FS report.

REFERENCES

ABB-ES (ABB Environmental Services), 1998. Remedial Investigation and Feasibility Study, General Information Report, Naval Air Station Whiting Field, Milton, Florida. Prepared for Southern Division, Naval Facilities Engineering Command (NAVFAC EFOSOUTH), North Charleston, South Carolina.

CH2M Hill Constructors, Inc. (CCI), 2001. *Project Completion Report, UST Removal at Sites 30, 32, and 33, Naval Air Station, Whiting Field, Milton, Florida.* August.

Florida Department of Environmental Protection (FDEP), 1999. Technical Report: Development of Soil Cleanup Target Levels (SCTLs), for Chapter 62-777, F.A.C. Final Report. May 26.

FDEP, 2001. Letter from James Cason, FDEP, to James Holland, Whiting Field, April 11.

Tetra Tech NUS (TtNUS), 1999. *Remedial Investigation for Surface and Subsurface Soil at Sites 3, 4, 6,* 30, 32, and 33, Naval Air Station Whiting Field, Milton, Florida. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina. September.

TtNUS, 2001a. *Feasibility Study for Surface and Subsurface Soil at Sites 3, 4, 6, 30, 32, and 33, Naval* Air Station Whiting Field, Milton, Florida. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina. March.

TtNUS, 2001b. Proposed Plan for Site 30, South Field Maintenance Hangar, NAS Whiting Field, Milton, Florida. July.

U.S. Environmental Protection Agency (USEPA), 1995. *Supplemental Guidance to Risk Assessment Guidance for Superfund: Region 4 Bulletins, Human Health Risk Assessment.* Waste Management Division, Atlanta, Georgia.

USEPA, 2002a. *Region IX PRGs Table 2002 Update.* USEPA Region IX, San Francisco, California. October 1.

USEPA, 2002b. Region IX PRGs Table User's Guide/Technical Background Document, http://www.epa.gov/region09/waste/sfund/prg/index.htm.

APPENDIX A

UST REMOVAL DATA

Legend

▲ Soil Sample Location

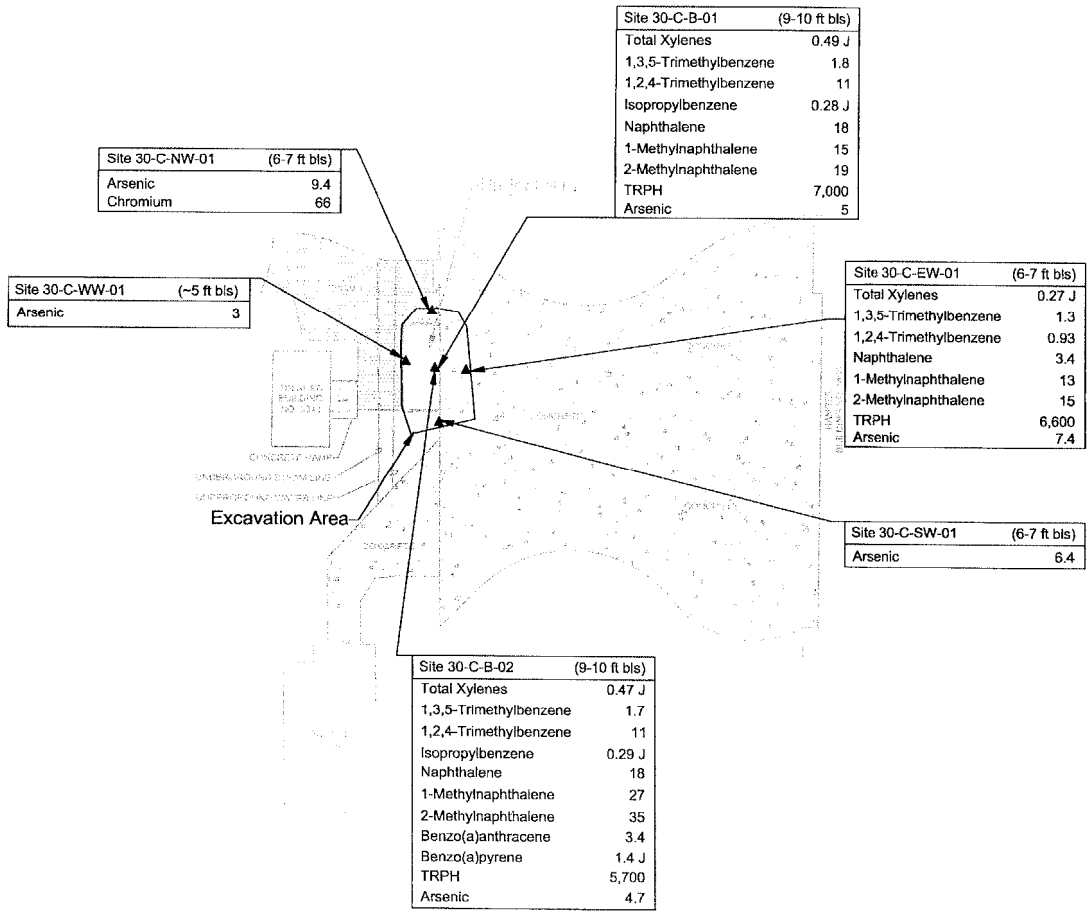
Notes:

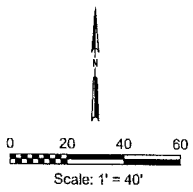
1. All units are mg/kg.
2. TRPH = Total Recoverable Petroleum Hydrocarbons
3. The applicable residential/industrial soil criteria for Site 30 are:

	62-777 FAC Direct Exposure Residential	62-777 FAC Direct Exposure Industrial	62-777 FAC Leachability
Total Xylenes	5,900	40,000	0.2
1,3,5-Trimethylbenzene	11	74	0.3
1,2,4-Trimethylbenzene	13	88	0.3
Isopropylbenzene	160	1,100	0.2
Naphthalene	40	270	1.7
1-Methylnaphthalene	68	470	2.2
2-Methylnaphthalene	80	560	6.1
Benzo(a)anthracene	1.4	5	3.2
Benzo(a)pyrene	0.1	0.5	8
TRPH	340	2,500	340
Arsenic*	0.8	3.7	29
Chromium	210	420	38

(*Arsenic has been determined to be natuarlly occurring throughout NASWF and does not appear to be site related.)

4. J = estimated value
5. ft bls = feet below land surface





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06-Aug-2001 ATL#1\NAVY RAC\WHITING FIELD\CTO0011\PCR\PCRREV01.DOC

FIGURE 3-2
Excavation Area and Soil Sample Locations for Site 30
Project Completion Report, NAS Whiting Field

TABLE 3-3
Analytical Summary Results for Site 30
Project Completion Report, NAS Whiting Field

Sample ID No.		Site 30-C-EW-01 East Wall	Site 30-C-SW-01 South Wall	Site 30-C-NW-01 North Wall	Site 30-C-WW-01 West Wall	Site 30-C-B-01 Bottom	Site 30-C-B-02 Bottom	62-777 FAC Direct Exposure Residential	62-777 FAC Direct Exposure Industrial	62-777 FAC Leachability
Laboratory ID No.		08682-1	08682-2	08682-3	08682-4	08682-5	08682-6			
Depth		6-7 ft bls	6-7 ft bls	6-7 ft bls	5 ft bls	9-10 ft bls	9-10 ft bls			
LABORATORY ANALYSES	Units	Soil	Soil	Soil	Soil	Soil	Soil			
Volatile Organic Compounds (8260B)										
Dichlorodifluoromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	56	370	44
Chloromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	1.7	2.3	0.01
Vinyl Chloride	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.03	0.04	0.007
Bromomethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	2.2	15	0.05
Chloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	2.9	4	0.06
Trichlorofluoromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	200	1300	33
1,1-Dichloroethene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.09	0.1	0.06
Methylene Chloride	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	16	23	0.02
trans-1,2-Dichloroethene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	31	210	0.7
1,1-Dichloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	290	2000	0.4
2,2-Dichloropropane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
cis-1,2-Dichloroethene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	19	130	0.4
Bromochloromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	57	390	0.6
Chloroform	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.4	0.5	0.03
1,1,1-Trichloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	400	3300	1.9
Carbon Tetrachloride	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.4	0.6	0.04
1,1-Dichloropropene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
Benzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	1.1	1.6	0.007
1,2-Dichloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.5	0.7	0.01
Trichloroethene	mg/kg	0.3 U	0.006 U	0.0049 U	0.006	0.57 U	0.53 U	6	8.5	0.03
Vinyl Acetate	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	230	1600	0.4
1,2-Dichloropropane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.6	0.8	0.03
Dibromomethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.01	0.04	0.0001
Bromodichloromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	1.4	2	0.004
cis-1,3-Dichloropropene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.2	0.2	0.001
Toluene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	380	2600	0.5
trans-1,3-Dichloropropene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.2	0.2	0.001
1,1,2-Trichloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	1.3	1.8	0.03
Tetrachloroethene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	8.9	17	0.03
1,3-Dichloropropane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			

TABLE 3-3
Analytical Summary Results for Site 30
Project Completion Report, NAS Whiting Field

Sample ID No.		Site 30-C-EW-01 East Wall	Site 30-C-SW-01 South Wall	Site 30-C-NW-01 North Wall	Site 30-C-WW-01 West Wall	Site 30-C-B-01 Bottom	Site 30-C-B-02 Bottom	62-777 FAC Direct Exposure Residential	62-777 FAC Direct Exposure Industrial	62-777 FAC Leachability
Laboratory ID No.		08682-1	08682-2	08682-3	08682-4	08682-5	08682-6			
Depth		6-7 ft bls	6-7 ft bls	6-7 ft bls	5 ft bls	9-10 ft bls	9-10 ft bls			
LABORATORY ANALYSES	Units	Soil	Soil	Soil	Soil	Soil	Soil			
Dibromochloromethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	1.4	2.1	0.003
1,2-Dibromoethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.01	0.04	0.0001
Chlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	30	200	1.3
1,1,1,2-Tetrachloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	4	5.7	0.01
Ethylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.22 J	0.20 J	1100	8400	0.6
Total Xylenes	mg/kg	**0.27 J**	0.018 U	0.015 U	0.015 U	**0.49 J**	**0.47 J**	5900	40000	0.2
Styrene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	2700	21000	3.6
Bromoform	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	48	84	0.03
1-Methylethylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
Bromobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
1,1,2,2-Tetrachloroethane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.7	1.1	0.002
1,2,3-Trichloropropane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.01	0.02	0.001
n-Propylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.75	0.7			
2-Chlorotoluene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	120	850	2.8
4-Chlorotoluene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	100	730	2.5
1,3,5-Trimethylbenzene	mg/kg	**1.3**	0.006 U	0.0049 U	0.005 U	**1.8**	**1.7**	11	74	0.3
tert-Butylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
1,2,4-Trimethylbenzene	mg/kg	**0.93**	0.006 U	0.0049 U	0.005 U	**11**	**11**	13	88	0.3
sec-Butylbenzene	mg/kg	0.11 J	0.006 U	0.0049 U	0.005 U	1.1	0.95			
1,3-Dichlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	27	180	0.3
1,4-Dichlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	6	9	2.2
Isopropylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	**0.28 J**	**0.29 J**	160	1100	0.2
p-Isopropyltoluene	mg/kg	1.6	0.006 U	0.0049 U	0.005 U	2.7	2.5			
n-Butylbenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U			
1,2-Dichlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	650	4600	17
1,2-Dibromo-3-chloropropane	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	0.8	2.7	0.001
1,2,4-Trichlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	560	7500	5.3
Hexachlorobutadiene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	6.3	12	1.1
Naphthalene	mg/kg	0.3 U	0.0028 J	0.0049 U	0.005 U	**18**	**18**	40	270	1.7
1,2,3-Trichlorobenzene	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	560	7400	4.6
Methyl-tert-butyl-ether	mg/kg	0.3 U	0.006 U	0.0049 U	0.005 U	0.57 U	0.53 U	3200	22000	0.2

TABLE 3-3
Analytical Summary Results for Site 30
Project Completion Report, NAS Whiting Field

		Site 30-C-EW-01	Site 30-C-SW-01	Site 30-C-NW-01	Site 30-C-WW-01	Site 30-C-B-01	Site 30-C-B-02	62-777 FAC Direct Exposure	62-777 FAC Direct Exposure	62-777 FAC
Sample ID No.		East Wall	South Wall	North Wall	West Wall	Bottom	Bottom			
Laboratory ID No.		08682-1	08682-2	08682-3	08682-4	08682-5	08682-6	Residential	Industrial	Leachability
Depth		6-7 ft bls	6-7 ft bls	6-7 ft bls	5 ft bls	9-10 ft bls	9-10 ft bls			
LABORATORY ANALYSES	Units	Soil	Soil	Soil	Soil	Soil	Soil			
Total Recoverable Petroleum Hydrocarbons (FL-PRO)										
TRPH	mg/kg	**6600**	320	15	87	**7000**	**5700**	340	2500	340
Metals (6010)										
Arsenic	mg/kg	**7.4**	**6.4**	**9.4**	**3**	**5**	**4.7**	0.8	3.7	29
Chromium	mg/kg	26	25	**66**	18	14	12	210	420	38
Cadmium	mg/kg	0.14 J	0.08 U	0.10 U	0.07 U	0.10 U	0.11 U	75	1300	8
Lead	mg/kg	8.2	7.2	6.6	21	5.7	3.8	400	920	
Polycyclic Aromatic Hydrocarbons (8310)										
Naphthalene	mg/kg	**3.4**	0.4 U	0.39 U	0.38 U	**5.9**	**11**	40	270	1.7
Acenaphthylene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	1100	11000	27
1-Methyl naphthalene	mg/kg	**13**	0.096 J	0.39 U	0.38 U	**15**	**27**	68	470	2.2
2-Methyl naphthalene	mg/kg	**15**	0.100 J	0.39 U	0.38 U	**19**	**35**	80	560	6.1
Acenaphthene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	1900	18000	2.1
Fluorene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	2.1	4.2	2200	28000	160
Phenanthrene	mg/kg	0.500 J	0.4 U	0.39 U	0.38 U	6.1	11	2000	30000	250
Anthracene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	1.2	2.1	18000	260000	2500
Fluoranthene	mg/kg	0.320 J	0.4 U	0.39 U	0.38 U	7.1	12	2900	48000	1200
Pyrene	mg/kg	0.340 J	0.4 U	0.39 U	0.38 U	5.5	9.0	2200	37000	880
Benzo(a)anthracene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	2	**3.4**	1.4	5	3.2
Chrysene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	1.6	2.6	140	450	77
Benzo(b)fluoranthene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	1.5	2.4 J	1.4	4.8	10
Benzo(k)fluoranthene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.6	0.98 J	15	52	25
Benzo(a)pyrene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.87	**1.4 J**	0.1	0.5	8
Dibenz(a,h)anthracene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.39 U	0.39 U	0.1	0.5	30
Benzo(g,h,i)perylene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.22 J	0.72 J	2300	41000	32000
Ideno(1,2,3-cd)pyrene	mg/kg	2.0 U	0.4 U	0.39 U	0.38 U	0.24 J	0.76 J	1.5	5.3	28

Note: results exceeding criteria are shown in **bold text.**
U = undetected
J = estimated

APPENDIX B

REVISED HUMAN HEALTH RISK ASSESSMENT

REVISED HUMAN HEALTH RISK ASSESSMENT FOR SITE 30, SOUTH MIDFIELD MAINTENANCE HANGER

SURFACE AND SUBSURFACE SOILS

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

SEPTEMBER 2004

ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
BaPEq	benzo(a)pyrene equivalent
bls	below land surface
COPC	constituent of potential concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
CSF	cancer slope factor
CTE	central tendency exposure
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
FDEP	Florida Department of Environmental Protection
FL PRO	Florida Petroleum Range Organics
FSA	Feasibility Study Addendum
GIR	General Information Report
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
mg/kg	milligrams per kilogram
PRG	Preliminary Remedial Goal
RfD	reference dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SCTL	soil cleanup target level
SSL	soil screening level
TEF	Toxicity Equivalency Factors
TRPH	total recoverable petroleum hydrocarbon
USEPA	United States Environmental Protection Agency
UST	underground storage tank

1.0 INTRODUCTION

This revised Human Health Risk Assessment (HHRA) was conducted in conjunction with the Feasibility Study Addendum (FSA) for NAS Whiting Field Site 33 for surface and subsurface soils. The revised HHRA conservatively estimates the potential risk to human health considering historic analytical data, underground storage tank (UST) confirmation soil analytical data (August 2000), and arsenic, aluminum, iron, manganese, and vanadium being present at naturally occurring concentrations at Site 30. The original HHRA was included in the Remedial Investigation (RI) Report (TtNUS, 1999).

The first step of the re-evaluation was to determine a revised list of constituents of potential concern (COPCs). United States Environmental Protection Agency (USEPA) Region IV currently requires the use of USEPA Region IX Preliminary Remedial Goal (PRGs) to select COPCs, therefore, Florida Department of Environmental Protection (FDEP) soil cleanup target level (SCTLs) and USEPA's Region IX PRGs were used in this analysis to select COPCs in surface and subsurface soils for this evaluation.

Arsenic concentrations at NAS Whiting Field have been determined to be naturally occurring (FDEP, 2001). The individual metal constituents aluminum, iron, manganese and vanadium have no direct evidence of site-related use at Site 33 and the process and procedures at this site did not likely contribute to the presence of these inorganic analytes in surface or subsurface soil. Additionally, the site-specific values for these inorganics are within the range of levels found at NAS Whiting Field and of naturally occurring levels throughout the southeastern United States. The RI for NAS Whiting Field Site 40, Basewide Groundwater, contains the appendix “Inorganics in Soil at NAS Whiting Field” presenting the technical basis for this determination. Considering the information presented above, aluminum, arsenic, iron, manganese, and vanadium are not considered COPCs for Site 30 surface and subsurface soils.

The steps employed in the RI baseline HHRA have been used in this revised HHRA. The steps include:

- Selection of COPCs – Section 1.1
- Exposure Assessment – Section 1.2
- Toxicity Assessment – Section 1.3
- Risk Characterization – Section 1.4
- Uncertainty Analysis – Section 1.6

The risk screening for human health uses the FDEP SCTLs (FDEP, 1999) and the USEPA Region IX PRGs (USEPA, 2002a) to conservatively assess exposure and toxicity. The five steps for performing the risk screening are described in detail in the following sections.

1.1 Selection of COPCs

The following factors are considered in the selection of COPCs for human receptors:

1) Occurrence and distribution of constituents in the environmental media
2) Individual constituent toxicity
3) Adjustment for multiple constituent exposures
4) Comparisons of site-specific concentrations with corresponding background concentrations

Subsurface Soil COPCs

Candidate subsurface soil COPCs for Site 30 include any constituent detected at least once in the environmental samples collected from 2 to 15 feet below land surface (bls). The initial list of COPCs consists of those constituents where the maximum concentration detected in subsurface soil exceeds the lower of the FDEP SCTLs or USEPA Region IX PRGs for the constituent.

The USEPA Region IX PRGs are screening levels corresponding to fixed levels of risk, either an excess lifetime cancer risk (ELCR) of one in a million (1.0E-06) or a non-cancer hazard quotient (HQ) of 1 or more. The USEPA Region IX PRGs consider the most sensitive receptor, a residential child, for chemicals associated with non-cancer toxicity. For carcinogenic chemicals, exposure is based upon the assumption of cumulative exposure for a residential child and a residential adult. The FDEP residential SCTLs are risk-based screening levels based on either cancer risk or non-cancer toxicity, using the lower of values protective against ELCR of 1.0E-06 or a non-cancer HQ of 1.0. Like the Region IX PRGs, the FDEP SCTLs account for exposure to chemicals in soil via incidental ingestion, dermal contact, inhalation of volatiles, and inhalation of particulate dusts. To account for possible additivity of non-carcinogenic effects, screening levels for non-carcinogenic constituents were divided by 10.

As described in the RI (TtNUS, 1999), some constituents did not have PRGs or RBCs and, therefore, surrogate screening values were selected. Essential nutrients (calcium, magnesium, potassium, and sodium) were not considered COPCs. Inorganic analytes were screened against background concentrations but all constituents selected as COPCs had maximum concentrations above background values.

Constituents detected in soils were retained as COPCs if the maximum detected concentrations exceeded the adjusted screening levels and twice the mean of the background concentration. The development of the background concentrations for NAS Whiting Field, Florida is presented in the General Information Report (GIR), NAS Whiting Field [ABB Environmental Services, Inc. (ABB-ES), 1998].

Additional information regarding site-specific background concentrations for arsenic, aluminum, iron, manganese, and vanadium at NAS Whiting Field has been discussed previously in this FSA.

Table 1-1 lists the candidate COPCs (those with at least one detection) and shows those selected as subsurface soil COPCs for the risk evaluation. The following COPCs were identified for subsurface soil at Site 30: naphthalene, 1,2,4-trimethylbenzene, 1-methylnaphthalene, 2-methylnaphthalene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and TRPH.

As stated in USEPA Region IV guidance, when one carcinogenic polynuclear aromatic hydrocarbon (cPAH) is selected as a COPC, they all are selected. The cPAHs are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. For Site 30, dibenzo(a,h)anthracene, benzo(k)fluoranthene, and chrysene did not have maximum detected concentrations exceeding any screening levels but rather were selected as COPCs because other cPAHs were selected.

1.2 Exposure Assessment

This exposure assessment was conducted to identify the pathways humans are potentially exposed, the magnitude of potential exposure, and the frequency and duration of exposure. The regional and site-specific environmental setting of Site 30 is discussed in the RI (TtNUS, 1999). The site is non-residential and is expected to remain non-residential in the foreseeable future. The receptors to be evaluated were selected based on the current and realistic future use of the sites and surrounding areas. Given the current and anticipated future use of the site, only a construction (excavation) worker is likely to be exposed to COPCs in subsurface soils at Site 30. Future residential use of the sites is not anticipated for military or non-military housing; however, the residential pathway was retained for completeness and comparison purposes. In most cases, exposures to environmental media predicted for the expected individuals are likely to be less intense than those anticipated for a home resident. Consequently, the use of the PRGs and SCTLs discussed in Section 1.1 to select COPCs and evaluate risk is a conservative approach toward exposure assessment because the PRGs and SCTLs were developed assuming exposure occurred under a residential land-use scenario. This conservative approach assures sites will not be inappropriately dismissed as “no further action” sites during the COPC selection process.

TABLE 1-1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 30
NAS WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 2

Scenario Time Frame:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil (2 to 15 feet)
Exposure Point:	Site 30

CAS Number	Constituent	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Sample Maximum	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value [1]	Screening Toxicity Value					COPC Flag	Rationale for Contaminant Deletion or Selection [10]
									Region IX [2]			Florida [3]			
									Soil Residential	Soil [11] Basis	Soil Industrial	Soil Residential	Soil Industrial		
Volatiles															
78933	2-Butanone	0.005	0.01	30B00302	3/20	0.011-7.6	0.01	NA	733	N	2710	310	2100	No	BSL
67641	Acetone	0.004	0.69	30SB1-10-12	10/24	0.006-7.6	0.69	NA	157	N	604	78	550	No	BSL
100414	Ethylbenzene	0.008	0.22	30-C-B-01	4/30	0.0049-7.6	0.22	NA	8.9	C	19.5	1100	8400	No	BSL
75092	Methylene Chloride	0.002	0.01	30B00302	5/30	0.0049-7.6	0.01	NA	9.1	C	20.5	16	23	No	BSL
91203	**Naphthalene**	0.0028	20	30SB04-5-7	8/32	0.0049-0.3	20	NA	5.59	N	18.8	4	27	**Yes**	ASL
108883	Toluene	0.02	0.02	30B00302	1/30	0.0049-7.6	0.02	NA	52	N	52	38	260	No	BSL
540590	1,2-Dichloroethene (Total) [4]	1.3	1.8	30B00302	1/24	0.005-7.6	1.8	NA	4.29	N	14.6	1.9	13	No	BSL
79016	Trichloroethene	0.001	0.0395	30SB1-2-4	4/32	0.0049-7.6	0.0395	NA	0.053	C	0.11	6	8.5	No	BSL
108383	M-Xylene [5]	0.12	0.49	30-C-B-01	3/6	0.0098-0.012	0.49	NA	27.5	N	42	590	4000	No	BSL
95476	O-Xylene [5]	0.15	0.15	30-C-EW	1/6	0.0049-0.55	0.15	NA	27.5	N	42	590	4000	No	BSL
1330207	Xylenes, Total	0.00047	0.042	30B00302	3/27	0.005-7.6	0.042	NA	27.5	N	42	590	4000	No	BSL
Semivolatiles															
95636	**1,2,4-Trimethylbenzene**	0.93	11	30-C-B-02	3/7	0.0049-0.006	11	NA	5.16	N	17	1.3	8.8	**Yes**	ASL
108678	1,3,5-Trimethylbenzene	0.31	0.31	30-C-B-01	3/7	0.0049-0.006	0.31	NA	2.13	N	6.97	1.1	7.4	No	BSL
90120	**1-Methylnaphthalene** [6]	0.096	27	30-C-B-02	4/7	0.38-0.39	27	NA	5.59	N	18.8	6.8	47	**Yes**	ASL
91576	**2-Methylnaphthalene** [6]	0.042	35	30-C-B-02	9/31	0.35-3.9	35	NA	5.59	N	18.8	8	56	**Yes**	ASL
106445	4-Methylphenol	0.044	0.044	30SB02-10-12	1/24	0.35-3.9	0.044	NA	30.6	N	308	25	300	No	BSL
120127	Anthracene	1.2	2.1	30-C-B-02	2/30	0.35-3.9	2.1	NA	2190	N	100000	1800	26000	No	BSL
56553	**Benzo(a)anthracene**	2	3.4	30-C-B-02	2/31	0.35-3.9	3.4	NA	0.62	C	2.1	1.4	5	**Yes**	ASL
50328	**Benzo(a)pyrene**	0.047	1.4	30-C-B-02	3/30	0.11-3.9	1.4	NA	0.062	C	0.21	0.1	0.5	**Yes**	ASL
205992	**Benzo(b)fluoranthene**	0.062	2.4	30-C-B-02	3/30	0.35-3.9	2.4	NA	0.62	C	2.1	1.4	4.8	**Yes**	ASL
191242	Benzo(g,h,i)perylene [7]	0.065	0.72	30-C-B-02	4/30	0.35-3.9	0.72	NA	232	N	2913	230	4100	No	BSL
207089	**Benzo(k)fluoranthene**	0.6	0.98	30-C-B-02	2/30	0.35-3.9	0.98	NA	6.2	C	21.1	15	52	**Yes**	PAH
117817	Bis(2-Ethylhexyl)Phthalate	0.039	16	30B00303	5/24	0.37-2	16	NA	34.7	C	123	76	280	No	BSL
218019	**Chrysene**	1.6	2.6	30-C-B-02	2/30	0.35-3.9	2.6	NA	62.1	C	211	140	450	**Yes**	PAH
131113	Dimethyl Phthalate	0.33	0.33	30SB1-10-12	1/24	0.35-3.9	0.33	NA	10000	N	100000	59000	*	No	BSL
206440	Fluoranthene	0.32	12	30-C-B-02	3/30	0.35-3.9	12	NA	229	N	2200	290	4800	No	BSL
86737	Fluorene	2.1	4.2	30-C-B-02	2/30	0.35-3.9	4.2	NA	275	N	2628	220	2800	No	BSL
193395	**Indeno(1,2,3-Cd)Pyrene**	0.071	0.76	30-C-B-02	3/30	0.35-3.9	0.76	NA	0.62	C	2.1	1.5	5.3	**Yes**	ASL
98828	Isopropylbenzene	0.28	0.29	30-C-B-02	2/6	0.0049-0.3	0.29	NA	57.2	N	198	16	110	No	BSL
86306	N-Nitrosodiphenylamine	0.71	0.71	30B00303	1/26	0.0049-1.9	0.71	NA	99.3	C	352	170	440	No	BSL
103651	N-Propylbenzene	0.7	0.75	30-C-B-01	2/6	0.35-3.9	0.75	NA	24	N	24	NA	NA	No	BSL
85018	Phenanthrene [7]	0.5	11	30-C-B-02	4/30	0.35-2	11	NA	232	N	2913	200	3000	No	BSL
99876	P-Isopropyltoluene [8]	0.0025	2.7	30-C-B-01	4/6	0.005-0.006	2.7	NA	57.2	N	198	NA	NA	No	BSL
129000	Pyrene	0.34	9	30-C-B-02	3/30	0.35-3.9	9	NA	232	N	2913	220	3700	No	BSL
135988	Sec-Butylbenzene	0.11	1.1	30-C-B-01	3/6	0.0049-0.006	1.1	NA	22	N	22	NA	NA	No	BSL
Pesticides/PCBs															
72548	4,4'-DDD	0.0063	0.0063	30SB1-10-12(92)	1/12	0.0035-0.0042	0.0063	NA	2.4	C	10	4.6	18	No	BSL
Inorganics															
7429905	Aluminum	436	41800	W30SB01201	14/14	--	41800	27834	7614	N	100000	7200	*	No	NOIC
7440382	Arsenic	0.67	9.4	30-C-NW	18/18	--	9.4	6.2	0.39	C	1.6	0.8	3.7	No	NOIC
7440393	Barium	0.8	16.6	30SB1-2-4	11/12	0.38	16.6	15.8	537	N	6658	110	8700	No	BSL
7440439	Cadmium	0.14	0.575	30SB1-2-4-AVG	2/18	0.07-0.97	0.575	0.92	3.7	N	45.1	75	130	No	BSL
7440702	Calcium	65.4	557.5	30SB1-2-4	8/12	7.6-92.8	557.5	444	N/A	nutrient	N/A	N/A	N/A	No	NUT
7440473	Chromium [9]	0.93	66	30-C-NW	19/19	--	66	22.8	210	C	448	210	420	No	BSL
7440484	Cobalt	0.51	2.3	30SB6-10-12	5/14	0.38-1.35	2.3	1.48	903	C	1920	4700	110000	No	BSL
7440508	Copper	0.76	19.2	30SBE0207	11/14	0.37-0.39	19.2	8.8	3130	N	4088	110	7600	No	BSL
57125	Cyanide	0.37	0.53	30SB6-10-12	6/8	0.17-0.18	0.53	ND	122	N	1231	160	3900	No	BSL
7439896	Iron	1330	25300	30SBE0207	14/14	--	25300	18110	2346	N	100000	2300	48000	No	NOIC
7439921	Lead	0.84	22	30SB04-5-7	33/33	--	22	8.4	400	N	75	400	92	No	BSL
7439954	Magnesium	14	185.5	30SB1-2-4-AVG	10/12	6.5-16.1	185.5	272	N/A	nutrient	N/A	N/A	N/A	No	NUT
7439965	Manganese	0.47	111.15	30SB1-2-4	14/14	--	111.15	42.6	176	N	1946	160	2200	No	BSL
7439976	Mercury	0.02	0.045	30SB1-2-4-AVG	4/12	0.02-0.04	0.045	ND	2.35	N	30.7	0.34	2.6	No	BSL

TABLE 1-1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 30
NAS WHITING FIELD, MILTON, FLORIDA

Scenario Time Frame:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil (2 to 15 feet)
Exposure Point:	Site 30

CAS Number	Constituent	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Sample Maximum	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value [1]	Screening Toxicity Value					COPC Flag	Rationale for Contaminant Deletion or Selection [10]
									Region IX [2]			Florida [3]			
									Soil Residential	Soil [11] Basis	Soil Industrial	Soil Residential	Soil Industrial		
7440020	Nickel	0.53	3.3	W30SB01201	4/12	0.38-3	3.3	5	156	N	2044	110	2800	No	BSL
7440097	Potassium	7.3	193	30SB1-2-4-AVG	4/10	113-155	193	181	N/A	nutrient	N/A	N/A	N/A	No	NUT
7782492	Selenium	0.455	3.1	30SB7-10-12	4/12	0.11-0.85	3.1	0.3	39	N	511	39	1000	No	BSL
7440224	Silver	0.38	0.94	30SB04-5-7	4/12	0.23-0.56	0.94	1.12	39	N	511	39	910	No	BSL
7440235	Sodium	51.4	199	30SB1-10-12	3/12	12.2-46.4	199	ND	N/A	nutrient	N/A	N/A	N/A	No	NUT
7440622	Vanadium	7.1	63.5	W30SB01201	12/12	--	63.5	45	55	N	715	15	740	No	NOIC
7440666	Zinc	0.64	7.25	30SB1-2-4-AVG	9/12	0.35-0.76	7.25	15.6	2300	N	100000	2300	56000	No	BSL
Petroleum Hydrocarbons															
na	TRPH [12]	4.3	21200	30SB04-5-7	16/28	0.35-0.76	21200	NA	N/A	N	N/A	340	2500	**Yes**	ASL

Notes.

(1) Table 3-18, General Information Report (GIR), Remedial Investigation and Feasibility Study, ABB, January, 1998. Background screening value for inorganics is two times the mean detected concentration.
(2) Region IX Preliminary Remediation Goal Table, October, 2002. (note: 1/10th PRG value used for noncarcinogens)
(3) Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-777, F.A.C. May 1999. (Note: 1/10th value used for non-carcinogens. Values for vanadium based on acute toxicity).
(4) Value is for cis-1,2-dichloroethene.
(5) Value is for xylenes
(6) Value is for naphthalene.
(7) Value is for pyrene.
(8) Value is for isopropylbenzene
(9) FDEP value is for hexavalent chromium only SCTL given. PRGs are for total chromium. Hexavalent chromium is not known to have been used at NASWF.
(10) Rationale codes: Selection or Deletion Reason: Above Screening Level (ASL)
If one cPAH is a COPC, all cPAHs are COPCs. (PAH)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Naturally Occurring Inorganic Chemical (NOIC)
(11) Soil basis codes: N - noncarcinogen C - carcinogen
(12) Total Recoverable Petroleum Hydrocarbons

* Constituent is not a concern for commercial/industrial exposure scenario.
Constituents exceeding criteria bolded.
The average of a sample and its duplicate is used for all calculations.
COPC - Constituent of Potential Concern
mg/kg - milligram per kilogram
NA - not available
ND - not detected
N/A - not applicable

The PRGs and SCTLs consider the following exposure pathways:

- Soil Ingestion
- Dermal Contact
- Inhalation of particulates and volatiles in air

For purpose of the site risk-assessment process, the exposure assessment component of this risk assessment employs the exposure assumptions used to derive the PRGs and SCTLs. The equations and exposure factors used by Region IX to calculate the PRGs are provided in *Region 9 PRGs Table User's Guide/Technical Background Document* (USEPA, 2002b). The equations and exposure factors used by the FDEP to calculate the SCTLs are provided in the *Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777 F.A.C.* (FDEP, 1999).

1.3 Toxicity Assessment

In this human health risk screening assessment, the toxicity assessment incorporates those toxicity values used to derive PRGs and SCTLs. These toxicity values are listed in Section 2.2 of the Technical Background Document referenced above. The tabulation of FDEP SCTLs contains toxicity criteria used to develop the SCTLs and is presented in the Technical Report also referenced above.

For those constituents with both carcinogenic effects and non-carcinogenic effects, USEPA Region IX has developed PRGs using both a cancer slope factor (CSF) and reference dose (RfD). Consequently, non-carcinogenic risks for these constituents are evaluated using PRGs as well as carcinogenic risks.

The maximum detected concentration of each chemical was used as the exposure point concentration for the risk-screening. However, USEPA Region IV guidance (USEPA, 1995) was followed to determine a benzo(a)pyrene equivalent (BaPEq) concentration representative of total cPAHs in each sample. The USEPA Region IV guidance suggests the following Toxicity Equivalency Factors (TEF) for each cPAH to calculate the BaPEq concentration. The following TEFs were used to convert each PAH concentration to a BaPEq concentration:

- benzo(a)pyrene, TEF = 1.0;
- benzo(a)anthracene, TEF = 0.1;
- benzo(b)fluoranthene, TEF = 0.1;
- dibenzo(a,h)anthracene, TEF = 1.0;
- benzo(k)fluoranthene, TEF = 0.01;
- chrysene, TEF = 0.001; and
- indeno(1,2,3-cd)pyrene, TEF = 0.1.

If any cPAHs were detected at a sample location, the BaPEq concentration was calculated for the location by multiplying the concentration of each cPAH by the appropriate TEF and summing these values. If any of the cPAHs were not detected in a sample, then half the detection limit of the PAH was used as a surrogate concentration. If no cPAHs were detected at a sample location, then the BaPEq concentration was calculated by using half the detection limit for benzo(a)pyrene. As with other analytes, the maximum BaPEq concentration in an environmental media was used to estimate potential risks.

1.4 Risk Characterization

Risk characterization evaluates the potential for adverse effects from exposure to COPC concentrations in environmental media by integrating information developed during the exposure and toxicity assessments. As noted previously, the exposure and toxicity assessments for this human health risk screening assessment are largely addressed during the development of the PRGs and SCTLs.

Risk characterization for the risk-screening of Site 30 consists of calculating a ratio between the maximum detected concentration of a constituent in an environmental medium and the PRG and soil screening levels (SSLs) developed for construction workers using methodology presented in Supplemental Guidance For Developing Soil Screening Levels For Superfund Sites, December 2002, Office of Solid Waste and Emergency Response (OSWER) 9355.4-24. Carcinogenic and noncarcinogenic effects were evaluated separately. The algorithms to perform these calculations are presented in the following sections. Ratios were calculated for both the residential land-use scenario and a construction worker land-use scenario. The human health risk estimates produced for the residential scenario are not reflective of actual current or anticipated future conditions at the sites under investigation because the current and anticipated land use at the sites is military industrial, and the only likely exposure to subsurface soil at Site 30 would be by a construction (excavation) worker. However, the risk characterization based on exposure assumptions reflecting a residential land-use scenario is conservative and is helpful for information and comparison purposes.

Human Health Effects – Carcinogens

The following equation is used to evaluate chemicals having potential or known carcinogenic effects.

$$\text{ELCR} = \sum (C_{MAX} / SL) x 10^{-6}$$

where:

ELCR	=	Excess Lifetime Cancer Risk
C_{MX}	=	Maximum detected concentration (mg/kg)
SL	=	Screening level (PRG or SSL)

10^{-6} = Cancer risk at the screening level concentration

Multiplying the C_{MAX}/SL ratio by 1.0E-06, USEPA's point of departure cancer risk level, produces a risk estimate for the detected constituent. The ELCR values for all COPCs are summed to account for potential carcinogenic effects associated with multiple constituent exposures. Because additivity of cancer risks is calculated directly in this manner, the individual screening levels used in the above equation represent the actual PRGs as published or SSLs as calculated and do not require any further adjustment for multiple constituent exposures as was done earlier for the COPC selection step.

The total ELCR is compared to the USEPA's cancer risk benchmarks to determine whether remediation may be necessary. USEPA has defined the range of 1.0E-04 to 1.0E-06 as the ELCR "target range" for most hazardous waste facilities evaluated. Cumulative ELCRs greater than 1.0E-04 generally indicate USEPA will require some degree of remediation, and ELCRs below 1.0E-06 normally will not require USEPA initiate remedial efforts. A 1.0E-04 ELCR estimate corresponds to one potential additional cancer in an exposed population of 10,000 individuals; a 1.0E-06 ELCR estimate corresponds to one potential additional cancer in an exposed population of 1,000,000 individuals.

Human Health Effects – Non-carcinogens

The potential for adverse noncarcinogenic health effects was evaluated using the following equation. The resultant hazard quotients (HQs) and hazard indices (HIs) reflect the potential for adverse noncarcinogenic health effects.

$$HQ = C_{MAX} / SL$$
$$HI = \sum HQ$$

where:

HQ = Hazard Quotient
C_{MX} = Maximum detected concentration (mg/kg)
SL = Screening level (PRG or SSL)
HI = Hazard Index

Additivity of non-carcinogenic effects is measured by summing the HQs associated with each affected target organ. For a given target organ, if the value of the HI exceeds unity (1.0), the potential for non-carcinogenic health risks associated with exposure to the particular constituent mixture cannot be ruled out. In the above equation, the individual screening levels used for each constituent represent the actual PRGs as published or SSLs as calculated and do not require any further adjustment for multiple constituent exposures as was done earlier for the COPC selection step.

1.5 Results

Cancer risk estimates and hazard indices calculated for the subsurface soil COPCs are presented in Table 1-2.

The ELCR calculated for the hypothetical future resident and the typical construction worker (based on PRGs and construction worker SSLs, respectively) are 3.3E-05 and 9.6E-07, respectively. The risk estimate for the construction worker does not exceed the USEPA target risk range often used to evaluate the need for environmental remediation or the FDEP benchmark of 1.0E-06. The risk estimate for the resident does exceed the FDEP benchmark of 1.0E-06, although it is within the USEPA target risk range often used to evaluate the need for environmental remediation. It should be noted that both the residential and construction worker risks were estimated using the maximum detected concentration; therefore, the risk may be overestimated. BaPEq is the main risk driver, responsible for 91 percent of the carcinogenic risk; however, benzo(a)pyrene and other cPAHs were detected in only four of 31 total samples.

The total hazard index exceeds unity for the hypothetical future resident (HI = 1.68). HIs calculated on a target organ specific basis for the resident do exceed 1 for adverse effects to body weight and adverse nasal effects. The total HI for the construction worker is 0.02, indicating no unacceptable risks. HIs calculated on a target organ specific basis for the construction worker do not exceed 1.

1.6 Uncertainty Analysis

Uncertainty in risk evaluation is discussed in the RI Report (TtNUS, 1999). Uncertainties associated specifically with this re-evaluation of Site 30 subsurface soil are provided in this section.

Chemicals Potentially Attributable to Background

COPCs were selected using available background concentrations in soil. Twice the mean of the background values was selected as the representative background concentration and was used to conservatively screen detected concentrations of inorganic analytes. This method of screening inorganic analytes may result in retaining inorganic analytes as COPCs omitted as COPCs based on a more rigorous background evaluation, such as statistical testing. Therefore, overall site-related risks from soil may be overestimated by the background screening process.

A few constituents detected at the sites under investigation do not have screening levels. Surrogate values were chosen. Detected concentrations of phenanthrene and benzo(g,h,i)perylene were screened against 1/10th the values for pyrene. Detected concentrations of m-xylenes and o-xylenes were screened against 1/10th the values for total xylenes. Detected concentrations of total 1,2-dichloroethene were

TABLE 1-1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CONSTITUENTS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 30
NAS WHITING FIELD, MILTON, FLORIDA

Scenario Time Frame:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil (2 to 15 feet)
Exposure Point:	Site 30

CAS Number	Constituent	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Location of Sample Maximum	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value [1]	Screening Toxicity Value					COPC Flag	Rationale for Contaminant Deletion or Selection [10]
									Region IX [2]			Florida [3]			
									Soil Residential	Soil [11] Basis	Soil Industrial	Soil Residential	Soil Industrial		
7440020	Nickel	0.53	3.3	W30SB01201	4/12	0.38-3	3.3	5	156	N	2044	110	2800	No	BSL
7440097	Potassium	7.3	193	30SB1-2-4-AVG	4/10	113-155	193	181	N/A	nutrient	N/A	N/A	N/A	No	NUT
7782492	Selenium	0.455	3.1	30SB7-10-12	4/12	0.11-0.85	3.1	0.3	39	N	511	39	1000	No	BSL
7440224	Silver	0.38	0.94	30SB04-5-7	4/12	0.23-0.56	0.94	1.12	39	N	511	39	910	No	BSL
7440235	Sodium	51.4	199	30SB1-10-12	3/12	12.2-46.4	199	ND	N/A	nutrient	N/A	N/A	N/A	No	NUT
7440622	Vanadium	7.1	63.5	W30SB01201	12/12	--	63.5	45	55	N	715	15	740	No	NOIC
7440666	Zinc	0.64	7.25	30SB1-2-4-AVG	9/12	0.35-0.76	7.25	15.6	2300	N	100000	2300	56000	No	BSL
Petroleum Hydrocarbons															
na	TRPH [12]	4.3	21200	30SB04-5-7	16/28	0.35-0.76	21200	NA	N/A	N	N/A	340	2500	**Yes**	ASL

Notes.

(1) Table 3-18, General Information Report (GIR), Remedial Investigation and Feasibility Study, ABB, January, 1998. Background screening value for inorganics is two times the mean detected concentration.
(2) Region IX Preliminary Remediation Goal Table, October, 2002. (note: 1/10th PRG value used for noncarcinogens)
(3) Table 2, Soil Cleanup Target Levels, Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-777, F.A.C. May 1999. (Note: 1/10th value used for non-carcinogens. Values for vanadium based on acute toxicity).
(4) Value is for cis-1,2-dichloroethene.
(5) Value is for xylenes
(6) Value is for naphthalene.
(7) Value is for pyrene.
(8) Value is for isopropylbenzene
(9) FDEP value is for hexavalent chromium only SCTL given. PRGs are for total chromium. Hexavalent chromium is not known to have been used at NASWF.
(10) Rationale codes: Selection or Deletion Reason: Above Screening Level (ASL)
If one cPAH is a COPC, all cPAHs are COPCs. (PAH)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Naturally Occurring Inorganic Chemical (NOIC)
(11) Soil basis codes: N - noncarcinogen C - carcinogen
(12) Total Recoverable Petroleum Hydrocarbons

* Constituent is not a concern for commercial/industrial exposure scenario.
Constituents exceeding criteria bolded.
The average of a sample and its duplicate is used for all calculations.
COPC - Constituent of Potential Concern
mg/kg - milligram per kilogram
NA - not available
ND - not detected
N/A - not applicable

screened against 1/10th the values for (cis)-1,2-dichloroethene. Detected concentrations of 1-methylnaphthalene and 2-methylnaphthalene were screened against 1/10th the values for naphthalene. In each case, the surrogate screening value was chosen to be as close as possible to the actual constituent, thereby limiting the uncertainty added. Surrogates were chosen to be conservative and are not expected to add significantly to the underestimation of risk.

Exposure Point Concentration

The maximum concentration of each COPC was used to quantify potential risks. As a result of using the maximum concentration, the estimations of potential risk are likely to be overestimated because it is unlikely potential receptors would be exposed to the maximum concentration over the entire site for the assumed exposure period. The method used to calculate the BaPEq concentration for cPAHs also overestimates the risk.

Exposure Routes and Receptor Identification

The USEPA Region IX PRGs and the FDEP SCTLs were calculated based on a combination of ingestion, dermal exposure, and inhalation pathways. Therefore, there was no underestimation of risks by the omission of exposure routes.

Exposure Parameters

The exposure factors, e.g., exposure frequency and duration, used to calculate the USEPA Region IX PRGs and FDEP SCTLs are based on reasonable maximum exposure (RME) assumptions. Generally, exposure factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid underestimation of potential risks, the USEPA and the FDEP used RME exposure factors values in the development of the Region IX PRGs and FDEP SCTLs used in this risk evaluation. Therefore, the risk is not likely to be underestimated for maximum exposed individuals and is more likely to be overestimated for the general populations exposed to the chemicals in the environmental media at the sites.

APPENDIX B-1

STATISTICS SUMMARY
95% UPPER CONFIDENCE LEVEL CONCENTRATIONS
SITE 30

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everything else.xls	
Summary Statistics for	1-methylnaph	
Number of Samples	7	
Minimum	96	
Maximum	27000	
Mean	7953	
Median	195	
Standard Deviation	10648.69302	
Variance	113394663	
Coefficient of Variation	1.338952976	
Skewness	1.062975356	
Shapiro-Wilk Test Statisitic	0.781098097	
Shapiro-Wilk 5% Critical Value	0.803	
Data not Normal at 5% Significance Level		
Data not Lognormal: Try Non-parametric UCL		
95	% UCL (Assuming Normal Data)	
Student's-t	15773.96293	
95	% UCL (Adjusted for Skewness)	
Adjusted-CLT	16301.0858	
Modified-t	16043.47003	
95	% Non-parametric UCL	
CLT	14573.25235	
Jackknife	15773.96293	
Standard Bootstrap	14115.4832	
Bootstrap-t	21012.832	
Chebyshev (Mean, Std)	25496.81697	

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everything else.xls		
Summary Statistics for	1-methylnaph	Summary Statistics for	ln(1-methylnaph)
Number of Samples	7	Minimum	4.564348191
Minimum	96	Maximum	10.20359214
Maximum	27000	Mean	7.089071165
Mean	7953	Standard Deviation	2.524049422
Median	195	Variance	6.370825486
Standard Deviation	10648.69302		
Variance	113394663	Shapiro-Wilk Test Statisitic	0.771675011
Coefficient of Variation	1.338952976	Shapiro-Wilk 5% Critical Value	0.803
Skewness	1.062975356	Data not Lognormal at 5% Significance Level	
		Data not Normal: Try Non-parametric UCL	
95 % UCL (Assuming Normal Data)			
Student's-t	15773.96293	Estimates Assuming Lognormal Distribution	
		MLE Mean	28983.55584
95 % UCL (Adjusted for Skewness)		MLE Standard Deviation	700143.4668
Adjusted-CLT	16301.0858	MLE Coefficient of Variation	24.15657591
Modified-t	16043.47003	MLE Skewness	14168.80189
		MLE Median	1198.793802
95 % Non-parametric UCL		MLE 80% Quantile	10116.19543
CLT	14573.25235	MLE 90% Quantile	30714.0251
Jackknife	15773.96293	MLE 95% Quantile	76201.19811
Standard Bootstrap	14185.33878	MLE 99% Quantile	425070.4171
Bootstrap-t	21012.10423		
Chebyshev (Mean, Std)	25496.81697	MVU Estimate of Median	738.3548804
		MVU Estimate of Mean	10452.58055
		MVU Estimate of Std. Dev.	27905.66931
		MVU Estimate of SE of Mean	8433.571747
		UCL Assuming Lognormal Distribution	
		95% H-UCL	169198200.6
		95% Chebyshev (MVUE) UCL	47213.66753
		99% Chebyshev (MVUE) UCL	94365.55994

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everything e			
Summary Statistics for	2-methylnaph		Summary Statistics for	ln(2-methylnaph)
Number of Samples	32		Minimum	3.73767
Minimum	42		Maximum	10.4631
Maximum	35000		Mean	5.743933
Mean	2400.140625		Standard Deviation	1.508873
Median	190		Variance	2.276697
Standard Deviation	7256.35096			
Variance	52654629.26		Shapiro-Wilk Test Statisitic	0.59174
Coefficient of Variation	3.02330242		Shapiro-Wilk 5% Critical Value	0.93
Skewness	3.68525017		Data not Lognormal at 5% Significance Level	
			Data not Normal: Try Non-parametric UCL	
95 % UCL (Assuming Normal Data)				
Student's-t	4575.073276		Estimates Assuming Lognormal Distribution	
			MLE Mean	974.8477
95 % UCL (Adjusted for Skewness)			MLE Standard Deviation	2882.722
Adjusted-CLT	5403.009228		MLE Coefficient of Variation	2.9571
Modified-t	4714.351758		MLE Skewness	34.72949
			MLE Median	312.2902
95 % Non-parametric UCL			MLE 80% Quantile	1117.59
CLT	4510.082772		MLE 90% Quantile	2170.764
Jackknife	4575.073276		MLE 95% Quantile	3736.963
Standard Bootstrap	4486.562315		MLE 99% Quantile	10441.78
Bootstrap-t	7301.357662			
Chebyshev (Mean, Std)	7991.534559		MVU Estimate of Median	301.3646
			MVU Estimate of Mean	909.2701
			MVU Estimate of Std. Dev.	2094.025
			MVU Estimate of SE of Mean	308.8066
			UCL Assuming Lognormal Distribution	
			95% H-UCL	2245.869
			95% Chebyshev (MVUE) UCL	2255.327
			99% Chebyshev (MVUE) UCL	3981.857

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everyt

Summary Statistics for	1,2,4-trimethylbenzene
Number of Samples	7
Minimum	2.45
Maximum	11000
Mean	3277.235714
Median	3
Standard Deviation	5286.508158
Variance	27947168.51
Coefficient of Variation	1.613099764
Skewness	1.212609967

95 % UCL (Assuming Normal Data)	
Student's-t	7159.926693

95 % UCL (Adjusted for Skewness)	
Adjusted-CLT	7542.364032
Modified-t	7312.55699

95 % Non-parametric UCL	
CLT	6563.837931
Jackknife	7159.926693
Standard Bootstrap	6304.409849
Bootstrap-t	50663.71075
Chebyshev (Mean, Std)	11986.80518

Summary Statistics for	ln(1,2,4-trimethylbenzene)
Minimum	0.896088
Maximum	9.305651
Mean	4.192961
Standard Deviation	4.096332
Variance	16.77993
Shapiro-Wilk Test Statisitic	0.735112
Shapiro-Wilk 5% Critical Value	0.803

Data not Lognormal at 5% Significance Level

Data not Normal: Try Non-parametric UCL

Estimates Assuming Lognormal Distribution	
MLE Mean	291538.8
MLE Standard Deviation	1.28E+09
MLE Coefficient of Variation	4402.673
MLE Skewness	8.53E+10
MLE Median	66.21859
MLE 80% Quantile	2109.828
MLE 90% Quantile	12794.21
MLE 95% Quantile	55906.01
MLE 99% Quantile	909844.6
MVU Estimate of Median	15.1315
MVU Estimate of Mean	7028.763
MVU Estimate of Std. Dev.	31460.18
MVU Estimate of SE of Mean	6748.803

UCL Assuming Lognormal Distribution	
95% H-UCL	1.84E+15
95% Chebyshev (MVUE) UCL	36446.11
99% Chebyshev (MVUE) UCL	74178.5

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everything el				
Summary Statistics for	bap		Summary Statistics for	ln(bap)	
Number of Samples	31		Minimum	5.102455	
Minimum	164.425		Maximum	8.390825	
Maximum	4406.45		Mean	6.353546	
Mean	856.4867		Standard Deviation	0.844168	
Median	451.145		Variance	0.71262	
Standard Deviation	941.8958				
Variance	887167.6		Shapiro-Wilk Test Statisitic	0.843032	
Coefficient of Variation	1.09972		Shapiro-Wilk 5% Critical Value	0.929	
Skewness	2.271288		Data not Lognormal at 5% Significance Level		
			Data not Normal: Try Non-parametric UCL		
95	% UCL (Assuming Normal Data)				
Student's-t	1143.611		Estimates Assuming Lognormal Distribution		
			MLE Mean	820.4526	
95	% UCL (Adjusted for Skewness)		MLE Standard Deviation	836.4297	
Adjusted-CLT	1208.484		MLE Coefficient of Variation	1.019474	
Modified-t	1155.113		MLE Skewness	4.117986	
			MLE Median	574.5266	
95	% Non-parametric UCL		MLE 80% Quantile	1172.47	
CLT	1134.746		MLE 90% Quantile	1699.862	
Jackknife	1143.611		MLE 95% Quantile	2303.541	
Standard Bootstrap	1122.349		MLE 99% Quantile	4093.195	
Bootstrap-t	1264.096				
Chebyshev (Mean, Std)	1593.879		MVU Estimate of Median	567.9585	
			MVU Estimate of Mean	808.1468	
			MVU Estimate of Std. Dev.	779.6901	
			MVU Estimate of SE of Mean	136.5369	
			UCL Assuming Lognormal Distribution		
			95% H-UCL	1160.302	
			95% Chebyshev (MVUE) UCL	1403.297	
			99% Chebyshev (MVUE) UCL	2166.671	

General Statistics

From File	C:\ProUCL\Data\Whiting Site 30 everything else.xls		
Summary Statistics for	naph	Summary Statistics for	ln(naph)
Number of Samples	33	Minimum	0.896088
Minimum	2.45	Maximum	9.903488
Maximum	20000	Mean	5.438984
Mean	1998.674	Standard Deviation	2.042812
Median	190	Variance	4.173079
Standard Deviation	5392.457		
Variance	29078588	Shapiro-Wilk Test Statisitic	0.767625
Coefficient of Variation	2.698017	Shapiro-Wilk 5% Critical Value	0.931
Skewness	2.940899	Data not Lognormal at 5% Significance Level	
		Data not Normal: Try Non-parametric UCL	
95 % UCL (Assuming Normal Data)			
Student's-t	3588.738	Estimates Assuming Lognormal Distribution	
		MLE Mean	1854.784
95 % UCL (Adjusted for Skewness)		MLE Standard Deviation	14828.42
Adjusted-CLT	4056.2	MLE Coefficient of Variation	7.994688
Modified-t	3668.832	MLE Skewness	534.9648
		MLE Median	230.2081
95 % Non-parametric UCL		MLE 80% Quantile	1293.568
CLT	3542.709	MLE 90% Quantile	3177.966
Jackknife	3588.738	MLE 95% Quantile	6630.324
Standard Bootstrap	3529.515	MLE 99% Quantile	26650.51
Bootstrap-t	4222.547		
Chebyshev (Mean, Std)	6090.4	MVU Estimate of Median	216.0775
		MVU Estimate of Mean	1567.081
		MVU Estimate of Std. Dev.	6859.678
		MVU Estimate of SE of Mean	765.0349
		UCL Assuming Lognormal Distribution	
		95% H-UCL	7444.951
		95% Chebyshev (MVUE) UCL	4901.791
		99% Chebyshev (MVUE) UCL	9179.082

General Statistics

From File	C:\ProUCL\Data\Whiting 30 TCE X surface.xls		
Summary Statistics for	TRICHLOROETHENE	Summary Statistics for	ln(TRICHLOROETHENE)
Number of Samples (1)	13	Minimum	1.098612
Minimum	3	Maximum	5.192957
Maximum	180	Mean	2.27081
Mean	24.03846154	Standard Deviation	1.19407
Median	5.5	Variance	1.425803
Standard Deviation	48.02536723		
Variance	2306.435897	Shapiro-Wilk Test Statisitic	0.79101
Coefficient of Variation	1.997855277	Shapiro-Wilk 5% Critical Value	0.866
Skewness	3.317535194	Data not Lognormal at 5% Significance Level	
		Data not Normal: Try Non-parametric UCL	
95 % UCL (Assuming Normal Data)			
Student's-t	47.77824606	Estimates Assuming Lognormal Distribution	
		MLE Mean	19.76102
95 % UCL (Adjusted for Skewness)		MLE Standard Deviation	35.13461
Adjusted-CLT	59.04318569	MLE Coefficient of Variation	1.777976
Modified-t	49.82088511	MLE Skewness	10.95446
		MLE Median	9.687243
95 % Non-parametric UCL		MLE 80% Quantile	26.57043
CLT	45.9476492	MLE 90% Quantile	44.93377
Jackknife	47.77824606	MLE 95% Quantile	69.06546
Standard Bootstrap	45.50722914	MLE 99% Quantile	155.7444
Bootstrap-t	106.2607504		
Chebyshev (Mean, Std)	82.09829941	MVU Estimate of Median	9.168324
		MVU Estimate of Mean	18.19087
		MVU Estimate of Std. Dev.	25.07596
		MVU Estimate of SE of Mean	6.597617
		UCL Assuming Lognormal Distribution	
		95% H-UCL	59.70647
		95% Chebyshev (MVUE) UCL	46.94921
		99% Chebyshev (MVUE) UCL	83.83633

(1) Sample 30SB-04-0-2 was not included in these calculations. An unusually high sample quantitation limit (SQL) of 1500 U was reported from the laboratory for all VOCs in that sample. There were no VOCs detected.

APPENDIX C

SUMMARY OF CONSTITUENTS REMAINING IN SURFACE AND SUBSURFACE SOIL

TABLE C-1
Constitents Remaining in Surface Soil at Site 30
NAS Whiting Field, Milton,Florida

SAMPLE ID	SAMPLE DATE	TOP_DEPTH	BOTTOM_DEP	PARAMETER	DATA QUALIFIER	UNITS	CONCENTRATION	FDEP Residential DE 1999	USEPA Region 9 Residential 2002	FDEP Industrial DE 1999	USEPA Region 9 Industrial 2002	Exceeds FDEP Residential DE 1999	Exceeds USEPA Region 9 Residential 2002	Exceeds FDEP Industrial DE 1999	Exceeds USEPA Region 9 Industrial 2002	**Exceeds at least one Criteria**
30SB02-0-2	1/4/1993	0	2	ARSENIC		MG/KG	4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30SB03-0-2	1/4/1993	0	2	ARSENIC		MG/KG	4.5	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30SB04-0-2	1/4/1993	0	2	ARSENIC		MG/KG	5.2	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30SB5-0-2	1/5/1993	0	2	ARSENIC		MG/KG	2.8	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB6-0-2	1/5/1993	0	2	ARSENIC		MG/KG	4.4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30SB7-0-2	1/5/1993	0	2	ARSENIC		MG/KG	3.3	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
W30SB00901	3/23/1998	0	2	ARSENIC		MG/KG	2.5	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
W30SB01301	3/23/1998	0	2	ARSENIC		MG/KG	4.8	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
W30SB01301	3/23/1998	0	2	IRON		MG/KG	24100	23000	23500	480000	100000	Yes	Yes	No	No	**Yes**
30SB02-0-2	1/4/1993	0	2	TRICHLOROETHENE	J	UG/KG	0.18	6	0.053	8.5	0.115	No	Yes	No	Yes	**Yes**
30SB02-0-2	1/4/1993	0	2	VANADIUM		MG/KG	37.4	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB03-0-2	1/4/1993	0	2	VANADIUM		MG/KG	55	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB04-0-2	1/4/1993	0	2	VANADIUM		MG/KG	44.6	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB5-0-2	1/5/1993	0	2	VANADIUM		MG/KG	29.3	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB6-0-2	1/5/1993	0	2	VANADIUM		MG/KG	33	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB7-0-2	1/5/1993	0	2	VANADIUM		MG/KG	21.1	15	548	7400	7150	Yes	No	No	No	**Yes**
W30SB00901	3/23/1998	0	2	VANADIUM		MG/KG	20.3	15	548	7400	7150	Yes	No	No	No	**Yes**
W30SB01301	3/23/1998	0	2	VANADIUM		MG/KG	63.7	15	548	7400	7150	Yes	No	No	No	**Yes**

TABLE C-2
Constitents Remaining in Subsurface Soil at Site 30
NAS Whiting Field, Milton Florida

SAMPLE ID	SAMPLE DATE	TOP_DEPTH	BOTTOM_DEP	PARAMETER	DATA QUALIFIER	UNITS	CONCENTRATION	FDEP Residential DE 1999	USEPA Region 9 Residential 2002	FDEP Industrial DE 1999	USEPA Region 9 Industrial 2002	Exceeds FDEP Residential DE 1999	Exceeds USEPA Region 9 Residential 2002	Exceeds FDEP Industrial DE 1999	Exceeds USEPA Region 9 Industrial 2002	**Exceeds at least one Criteria**
30-C-B-01	8/23/2000	0	9	ARSENIC		MG/KG	5	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30-C-B-02	8/23/2000	0	9	ARSENIC		MG/KG	4.7	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30-C-EW	8/23/2000	0	6	ARSENIC		MG/KG	7.4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30-C-NW	8/23/2000	0	6	ARSENIC		MG/KG	9.4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30-C-SW	8/23/2000	0	6	ARSENIC		MG/KG	6.4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30-C-WW	8/23/2000	0	5	ARSENIC		MG/KG	3	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB02-10-12	1/4/1993	10	12	ARSENIC	J	MG/KG	2.2	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB03-10-12	1/4/1993	10	12	ARSENIC	J	MG/KG	1.1	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB1-10-12	12/6/1992	10	12	ARSENIC	J	MG/KG	1	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB1-2-4	12/6/1992	2	4	ARSENIC		MG/KG	2.5	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB1-2-4-AVG	12/6/1992	2	4	ARSENIC	J	MG/KG	2	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB1-2-4-D	12/6/1992	2	4	ARSENIC	J	MG/KG	1.5	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB1-5-7	12/6/1992	5	7	ARSENIC	J	MG/KG	1.3	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB4-10-12	1/5/1993	10	12	ARSENIC	J	MG/KG	2.1	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB5-15-17	1/5/1993	15	17	ARSENIC	J	MG/KG	2	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30SB6-10-12	1/5/1993	10	12	ARSENIC		MG/KG	8.6	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
30SB7-10-12	1/5/1993	10	12	ARSENIC		MG/KG	6	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
W30SB00902	3/23/1998	12	14	ARSENIC		MG/KG	2.8	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
W30SB01101	3/21/1998	8	10	ARSENIC		MG/KG	5.4	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
W30SB01201	3/21/1998	12	14	ARSENIC		MG/KG	6.6	0.8	21.7	3.7	256	Yes	No	Yes	No	**Yes**
W30SB01303	3/23/1998	10	12	ARSENIC		MG/KG	1.3	0.8	21.7	3.7	256	Yes	No	No	No	**Yes**
30-C-B-01	8/23/2000	0	9	BENZO(A)ANTHRACENE		UG/KG	2	1.4	0.622	5	2.11	Yes	Yes	No	No	**Yes**
30-C-B-02	8/23/2000	0	9	BENZO(A)ANTHRACENE		UG/KG	3.4	1.4	0.622	5	2.11	Yes	Yes	No	Yes	**Yes**
30-C-B-01	8/23/2000	0	9	BENZO(A)PYRENE		UG/KG	0.87	0.1	0.0622	0.5	0.211	Yes	Yes	Yes	Yes	**Yes**
30-C-B-02	8/23/2000	0	9	BENZO(A)PYRENE	J	UG/KG	1.4	0.1	0.0622	0.5	0.211	Yes	Yes	Yes	Yes	**Yes**
30-C-B-01	8/23/2000	0	9	BENZO(B)FLUORANTHENE		UG/KG	1.5	1.4	0.622	4.8	2.11	Yes	Yes	No	No	**Yes**
30-C-B-02	8/23/2000	0	9	BENZO(B)FLUORANTHENE	J	UG/KG	2.4	1.4	0.622	4.8	2.11	Yes	Yes	No	Yes	**Yes**
30-C-B-02	8/23/2000	0	9	INDENO(1,2,3-CD)PYRENE	J	UG/KG	0.76	1.5	0.622	5.3	2.11	No	Yes	No	No	**Yes**
30SBE0207	6/29/2001	5	7	IRON		MG/KG	25300	23000	23500	480000	100000	Yes	Yes	No	No	**Yes**
W30SB01201	3/21/1998	12	14	IRON		MG/KG	24500	23000	23500	480000	100000	Yes	Yes	No	No	**Yes**
30SB1-5-7	12/6/1992	5	7	TRICHLOROETHENE		UG/KG	0.16	6	0.053	8.5	0.115	No	Yes	No	Yes	**Yes**
30SB03-10-12	1/4/1993	10	12	VANADIUM		MG/KG	21.4	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB04-5-7	1/4/1993	5	7	VANADIUM		MG/KG	32.6	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB1-2-4	12/6/1992	2	4	VANADIUM		MG/KG	34.6	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB1-2-4-AVG	12/6/1992	2	4	VANADIUM		MG/KG	35.4	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB1-2-4-D	12/6/1992	2	4	VANADIUM		MG/KG	36.2	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB1-5-7	12/6/1992	5	7	VANADIUM		MG/KG	27.3	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB4-10-12	1/5/1993	10	12	VANADIUM		MG/KG	39.7	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB6-10-12	1/5/1993	10	12	VANADIUM		MG/KG	40.4	15	548	7400	7150	Yes	No	No	No	**Yes**
30SB7-10-12	1/5/1993	10	12	VANADIUM		MG/KG	43.9	15	548	7400	7150	Yes	No	No	No	**Yes**
W30SB01101	3/21/1998	8	10	VANADIUM		MG/KG	52	15	548	7400	7150	Yes	No	No	No	**Yes**
W30SB01201	3/21/1998	12	14	VANADIUM		MG/KG	63.5	15	548	7400	7150	Yes	No	No	No	**Yes**
W30SB01303	3/23/1998	10	12	VANADIUM		MG/KG	16.3	15	548	7400	7150	Yes	No	No	No	**Yes**

APPENDIX D

ORIGINAL FS
TABLES 5-8 AND 5-9 (TtNUS, 2001a)

Rev. 1
03/26/01

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.

TABLE 5-9

SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES FOR SITE 30

NAS WHITING FIELD
MILTON, FLORIDA

PAGE 1 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
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.

APPENDIX E

REMEDIAL ALTERNATIVES COST ESTIMATE

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 2: 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 Plar	40	hr			$33.79		$0	$0	$1,352	$0	$1,352
1.2 Project Scheduling and Procuremen	8	hr			$33.79		$0	$0	$270	$0	$270
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier	0	ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons	0	ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet	0	mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')	0	mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad	0	ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal	0	drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums	0	ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)	0	m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)	0	ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing	0	lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (TPH	0	ea	$200.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)	0	day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou	0	hrs			$33.23		$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	0	cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavatc	0	hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavatio	0	day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples	0	ea	$200.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia	0	cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
5.6 UST Removal	0	ea		$340.72	$485.04	$1,638.12	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	0	ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfi	0	ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests	0	hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil)	0	cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")	0	day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area	0	acre	$20,859.00				$0	$0	$0	$0	$0
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								$0	$7,704	$0	$7,704
Local Area Adjustment								84%	84%	84%	
								$0	$6,471	$0	$6,471
Overhead on Labor Cost @ 30%									$1,941		$1,941
G & A on Labor Cost @ 10%									$647		$647
G & A on Material Cost @ 10%								$0			$0
Total Direct Capital Cost								$0	$9,060	$0	$9,060

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 2: LAND USE CONTROLS
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
Indirects on Total Direct Labor Cost @ 75%									$6,795		$6,795
Profit on Total Direct Cost @ 10%											$906
Subtotal											$16,761
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$542
Total Field Cost											**$17,303**
Subtotal Subcontractor Cost							$1,297				$1,297
G & A on Subcontract Cost @ 10%							$130				$130
Profit on Subcontractor Cost @ 5%											$65
Subcontractor Cost											**$1,491**
Contingency on Total Field and Subcontractor Costs @ 10%											**$1,879**
Engineering on Total Field and Subcontractor Costs @ 5%											**$940**
TOTAL Capital COST											**$21,613**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 2: LAND USE CONTROLS
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 2: 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
2.3 Concrete/Asphalt 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 2: 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	$21,613			$21,613	1.000	$21,613
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	**$82,186**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING 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	300	hr			$33.79		$0	$0	$10,137	$0	$10,137
1.2 Project Scheduling and Procurement	80	hr			$33.79		$0	$0	$2,703	$0	$2,703
2 MOBILIZATION/DEMOBILIZATION											
2.1 Equipment Mob/Demob (Exc. & Dozier)	0	ea			$200.00	$250.00	$0	$0	$0	$0	$0
2.2 Mobilize/Demobilize Personnel (2-persons)	0	ea		$375.00	$300.00		$0	$0	$0	$0	$0
2.3 Portable Toilet	0	mo	$74.18				$0	$0	$0	$0	$0
2.4 Storage Trailer (28' x 10')	0	mo	$98.33				$0	$0	$0	$0	$0
3 DECONTAMINATION											
3.1 Temporary Decon Pad	0	ls		$450.00	$400.00	$155.00	$0	$0	$0	$0	$0
3.2 Decon Water Disposal	0	drum	$125.00				$0	$0	$0	$0	$0
3.3 Decon Water Storage Drums	0	ea		$45.00			$0	$0	$0	$0	$0
3.4 PPE (2 p * 5 days * 2 Weeks)	0	m-day		$30.00			$0	$0	$0	$0	$0
3.5 Decontaminate Equipment (Pressure Washer)	0	ea			$134.45	$50.00	$0	$0	$0	$0	$0
4 SITE PREPARATION											
4.1 Erosion Control Fencing	0	lf		$0.23	$1.17		$0	$0	$0	$0	$0
4.2 Collect/Analyze Delineation Samples (TPH)	0	ea	$200.00	$10.00	$23.52		$0	$0	$0	$0	$0
4.3 Construction Surveys (2-man crew)	0	day	$648.36				$0	$0	$0	$0	$0
4.4 Utility Location and Site Delineation/Layou	0	hrs			$33.23		$0	$0	$0	$0	$0
4.5 Concrete Demolition/Removal (6" reinforced	0	cy	$45.58				$0	$0	$0	$0	$0
4.6 Concrete Debris Disposal	0	cy	$20.70				$0	$0	$0	$0	$0
5 EXCAVATION/BACKFILL											
5.1 Excavate/Load Contaminated Soil (1.0 cy Hyd. Excavator	0	cy			$1.27	$2.23	$0	$0	$0	$0	$0
5.2 Standby, Crawler Mounted 1.0 CY Hydraulic Excavato	0	hrs				$20.50	$0	$0	$0	$0	$0
5.3 Health & Safety Monitoring with OVA during Excavatior	0	day			$188.16	$100.00	$0	$0	$0	$0	$0
5.4 Collect/Analyze Confirmatory Samples	0	ea	$200.00	$10.00	$23.52		$0	$0	$0	$0	$0
5.5 Import (Offsite) Place, Compact Clean Fill Materia	0	cy		$7.82	$0.85	$1.81	$0	$0	$0	$0	$0
5.6 UST Removal	0	ea		$340.72	$485.04	$1,638.12	$0	$0	$0	$0	$0
6 OFF-SITE TRANSPORTATION/DISPOSAL											
6.1 Waste Profile	0	ls	$750.00				$0	$0	$0	$0	$0
6.2 Transport and Dispose of Soil (Non-hazard.) in Landfill	0	ton	$45.00				$0	$0	$0	$0	$0
6.3 Prepare Shipment Manifests	0	hrs			$33.23		$0	$0	$0	$0	$0
7 SITE RESTORATION											
7.1 Import Vegetative Cover Material (Topsoil	0	cy		$15.00			$0	$0	$0	$0	$0
7.2 Place/Grade Topsoil (6")	0	day			$227.20	$435.00	$0	$0	$0	$0	$0
7.3 Sod Disturbed Area	0	acre	$20,859.00				$0	$0	$0	$0	$0
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 Equipment	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 Equipment	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 Materia	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											

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING 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
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								$753	$24,448	$65	$25,265
Local Area Adjustment								84%	84%	84%	
								$632	$20,536	$54	$21,223
Overhead on Labor Cost @ 30%									$6,161		$6,161
G & A on Labor Cost @ 10%									$2,054		$2,054
G & A on Material Cost @ 10%								$63			$63
Total Direct Capital Cost								$696	$28,751	$54	$29,501
Indirects on Total Direct Labor Cost @ 75%									$21,563		$21,563
Profit on Total Direct Cost @ 10%											$2,950
Subtotal											$54,014
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$2,585
Total Field Cost											**$56,599**
Subtotal Subcontractor Cost							$32,160				$32,160
G & A on Subcontract Cost @ 10%							$3,216				$3,216
Profit on Subcontractor Cost @ 5%											$1,608
Subcontractor Cost											**$36,983**
Contingency on Total Field and Subcontractor Costs @ 10%											**$9,358**
Engineering on Total Field and Subcontractor Costs @ 5%											**$4,679**
TOTAL Capital COST											**$107,620**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$632	$20,536	$54	$21,223
Overhead on Labor Cost @ 30%									$6,161		$6,161
G & A on Labor Cost @ 10%									$2,054		$2,054
G & A on Material Cost @ 10%								$63			$63
Total Direct Capital Cost								$696	$28,751	$54	$29,501
Indirects on Total Direct Labor Cost @ 75%									$21,563		$21,563
Profit on Total Direct Cost @ 10%											$2,950
Subtotal											$54,014
Health & Safety Monitoring @ 3%		(Includes Subcontractor cost)									$2,585
Total Field Cost											**$56,599**
Subtotal Subcontractor Cost							$32,160				$32,160
G & A on Subcontract Cost @ 10%							$3,216				$3,216
Profit on Subcontractor Cost @ 5%											$1,608
Subcontractor Cost											**$36,983**
Contingency on Total Field and Subcontractor Costs @ 10%											**$9,358**
Engineering on Total Field and Subcontractor Costs @ 5%											**$4,679**
TOTAL Capital COST											**$107,620**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 3: IN SITU SOIL VENTING AND LUCs
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 (TRPH)	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 3: 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
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 3: IN SITU SOIL VENTING 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	$107,620			$107,620	1.000	$107,620
1		$39,539	$2,839	$42,379	0.943	$39,980
2		$39,539	$2,839	$42,379	0.890	$37,717
3		$39,539	$2,839	$42,379	0.840	$35,582
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	**$270,399**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost				Extended Cost				
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	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 Procurement	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 (TRPH)	20	ea	$200.00	$10.00	$23.52		$4,000	$200	$470	$0	$4,670
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/Layout	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.)	3700	cy			$0.68	$1.71	$0	$0	$2,516	$6,327	$8,843
5.2 Standby, Crawler Mounted 2.0 CY Hydraulic Excavator	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 Excavation	40	day			$188.16	$100.00	$0	$0	$7,526	$4,000	$11,526
5.6 Collect/Analyze Confirmatory Samples	10	ea	$200.00	$10.00	$23.52		$2,000	$100	$235	$0	$2,335
5.7 Import (Offsite) Place, Compact Clean Fill Material	2500	cy		$7.82	$0.85	$1.81	$0	$19,550	$2,125	$4,525	$26,200
5.8 Backfill with Clean Excavated Material	1500	cy		$0.28	$2.02	$0.76	$0	$420	$3,030	$1,140	$4,590
5.9 UST Removal	0	ea		$340.72	$485.04	$1,638.12	$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 Landfill	3700	ton	$45.00				$166,500	$0	$0	$0	$166,500
6.3 Prepare Shipment Manifests	600	hrs			$33.23		$0	$0	$19,938	$0	$19,938
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	0.77	acre	$20,859.00				$16,061	$0	$0	$0	$16,061
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								$28,561	$66,338	$34,647	$129,546

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NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 4: EXCAVATION OF SURFACE & SUBSURFACE SOIL (EXCEEDING PRGs), OFFSITE DISPOSAL, AND LUCs
CAPITAL COSTS

Cost Item	Quantity	Unit	Unit Cost Subcontract	Material	Labor	Equipment	Extended Cost Subcontract	Material	Labor	Equipment	Subtotal
Local Area Adjustment								84%	84%	84%	
								$23,991	$55,724	$29,103	$108,818
Overhead on Labor Cost @ 30%									$16,717		$16,717
G & A on Labor Cost @ 10%									$5,572		$5,572
G & A on Material Cost @ 10%								$2,399			$2,399
Total Direct Capital Cost								$26,390	$78,013	$29,103	$133,507
Indirects on Total Direct Labor Cost @ 75%									$58,510		$58,510
Profit on Total Direct Cost @ 10%											$13,351
Subtotal											$205,368
Health & Safety Monitoring @ 3%	(Includes Subcontractor cost)										$13,000
Total Field Cost											**$218,368**
Subtotal Subcontractor Cost							$227,965				$227,965
G & A on Subcontract Cost @ 10%							$22,797				$22,797
Profit on Subcontractor Cost @ 5%											$11,398
Subcontractor Cost											**$262,160**
Contingency on Total Field and Subcontractor Costs @ 10%											**$48,053**
Engineering on Total Field and Subcontractor Costs @ 5%											**$24,026**
TOTAL Capital COST											**$552,607**

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
SITE 30
SOIL ALTERNATIVE 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 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 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%.