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FINAL REMEDIAL INVESTIGATION FOR SITE 41 NAS WHITING FIELD FL
6/22/2009
TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 2
06/22/09

Remedial Investigation for Site 41 Former Pesticide Storage Building 1485C

Naval Air Station Whiting Field
Milton, Florida
USEPA ID No. FL2170023244
Operable Unit - 27

Contract Task Order 0079

June 2009

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST
NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

Rev. 2
06/22/09

REMEDIAL INVESTIGATION
FOR SITE 41
FORMER PESTICIDE STORAGE AREA BUILDING 1485C

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
USEPA ID NO. FL2170023244
OPERABLE UNIT - 27

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
NAS Jacksonville
Jacksonville, Florida 32212-0030

Submitted by:
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Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0079

June 2009

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NAVFAC
Naval Facilities Engineering Command

PROFESSIONAL REVIEW CERTIFICATION

Remedial Investigation Report
Site 41, Former Pesticide Storage Building 1485C
Naval Air Station Whiting Field, Milton, Florida

This Remedial Investigation Report was prepared under the direct supervision of the undersigned geologist using geologic and hydrogeologic principles standard to the profession at the time the report was prepared. If existing conditions differ from those described, the undersigned geologist will be notified to evaluate the effects of additional information on the assessment described in this report. This report was developed specifically for the referenced site and should not be construed to apply to any other site.

Larry Smith, P.G.
Florida License No. 0001619
Expiration Date: July 31, 2010

FOREWORD

To meet its mission objectives, the United States Navy (Navy) performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the United States Department of Defense (DOD) initiated various programs to investigate and remediate conditions related to past releases of hazardous materials at its facilities.

One of these programs is the Installation Restoration (IR) Program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act (RCRA), and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and federal facilities. CERCLA and SARA form the basis for what is commonly known as the Superfund Program.

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

The IR program consists of Preliminary Assessment (PA) and Site Inspection (SI), Remedial Investigation (RI) and Feasibility Study (FS), and Remedial Design (RD) and Remedial Action at sites where chemicals were allegedly spilled or disposed of. The PA and SI identify the presence of pollutants. The nature and extent of contamination, as well as the selected remedial solutions, are determined during the Remedial Investigation and Feasibility Study (RI/FS). The RD and Remedial Action are performed to complete the implementation of the solution.

The Naval Facilities Engineering Command Southeast (NAVFAC SE) manages, and the United States Environmental Protection Agency (USEPA) and the Florida Department of Environmental Protection (FDEP) [formerly the Florida Department of Environmental Regulation (FDER)] oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with state and federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Mr. Tread Kissam, at (904) 542-6826.

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ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
ARARs	Applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	Bioaccumulation Factor
B(a)A	benzo-(a)-anthracene
B(a)P	benzo-(a)-pyrene
B(b)F	benzo(b)fluoranthene
BERA	Baseline Ecological Risk Assessment
BHC	Hexachlorocyclohexane
B(k)F	benzo(k)fluoranthene
bls	below land surface
BOS	Base Operating Services
BRAC	Base Realignment and Closure
Cal EPA	California Environmental Protection Agency
CCME	Canadian Council of Ministers of the Environment
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm^2	square centimeters
COC	Chemicals of Concern
COPC	Chemicals of Potential Concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
C_{sat}	soil saturation concentrations
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
CTL	Clean-up Target Level
D(a,h)A	dibenzo(a,h)anthracene
DBSM	Data Base Management System
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DE1	Florida Direct Exposure Limit for Residential Use
DE2	Florida Direct Exposure Limit for Industrial Use
DOD	Department of Defense

DON	Department of the Navy
DPT	Direct Push Technology
EC	Environmental Canada
Eco-SSLs	Ecological Soil Screening Levels
EEQ	Ecological Effects Quotient
Eh	Redox Potential
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESV	Ecological Screening Values
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulations
FID	Flame Ionization Detector
FL-PRO	Florida Petroleum Range Organics
FR	Federal Register
FS	Feasibility Study
GCTL	Groundwater Clean-up Target Level
GIR	General Information Report
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HRS	Hazard Ranking System
ILCR	Incremental Lifetime Cancer Risk
IP	indeno(1,2,3-cd)pyrene
IR	Installation Restoration
IRA	Interim Removal Action
IRIS	Integrated Risk Information System
kg	kilogram
LCS	Laboratory Control Sample
LE	Leachability
LOAEL	Lowest Observed Adverse Effect Level
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg/day	milligrams per kilograms per day
mg/L	milligrams per liter
MRLs	Minimum Risk Levels

MS	Matrix Spike
MSD	Matrix Spike Duplicate
NACIP	Naval Assessment and Control of Installation Pollutants
NAS	Naval Air Station
Navy	United States Navy
NAVFAC SE	Naval Facilities Engineering Command Southeast
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
OPPTS	Office of Prevention, Pesticides, and Toxic Substances
ORNL	Oak Ridge National Laboratory
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
OVA	Organic Vapor Analyzer
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PDWS	Primary Drinking Water Standard
PEF	Particulate Emission Factor
PPRTV	Provisional Peer Reviewed Toxicity Values
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
PRGI	Preliminary Remediation Goals for Industrial
PRGR	Preliminary Remediation Goals for Residential
PSC	Potential Source of Contamination
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAG	Risk Assessment Guidance for Superfund
RBCs	Risk-Based Concentrations
RBCAP	Risk-Based Corrective Action Process
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfD	Reference Dose

RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RME	Reasonable Maximum Exposure
RMO	Risk Management Option
SARA	Superfund Amendments and Reauthorization Act
SCTLs	Soil Cleanup Target Levels
SDG	sample delivery group
SDWS	Secondary Drinking Water Standard
SERA	Screening-level ecological risk assessment
SI	Site Inspection
SMDPs	Scientific/Management Decision Points
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SSLs	Soil Screening Levels
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCDD	2,3,7,8- tetrachlorodibenzo-p-dioxin
TCL	Target Compound List
TEC	Threshold Effects Concentration
TEF	Toxicity Equivalency Factors
TRPH	Total Recoverable Petroleum Hydrocarbon
TRW	Technical Review Workgroup
TRV	Toxicity Reference Values
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper Confidence Limit
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VF	Volatilization Factor
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc., (TtNUS) under contract to the Department of the Navy is submitting this Remedial Investigation (RI) Report for Site 41 (former Pesticide Storage Building 1485C) at Naval Air Station (NAS) Whiting Field (USEPA ID No. FL2170023244) located north of Milton, Florida. This RI Report was prepared on behalf of the Navy at NAS Whiting Field under contract number N62467-94-D-0888 and was based on the results of a field investigation conducted according to the Remedial Investigation and Feasibility Study (RI/FS) Work Plan for Sites 5, 7, 29, 35, 38, 39, 40, and Potential Source of Contamination (PSC) 1485C (TtNUS, 2000).

The purpose of this RI Report is to document field investigation activities associated with the Remedial Investigation (RI) of the soil for Site 41 and to report the results from the soil investigation. This RI Report also presents conclusions for Site 41 based on the findings. Site 41 was initially designated PSC 1485C; therefore, many of the initial sample identification numbers and earlier references reflect the original site nomenclature. The potential impact to groundwater from Site 41 soil leaching will be addressed in the Site 40 Basewide Groundwater RI Report.

The former Building 1485C was used during an undetermined period for storage of ground maintenance equipment and limited amounts of pesticide compounds. The building caught fire in the late 1980's and was completely destroyed. Following the fire, cleanup activities at the site included the removal of all building materials and the building slab foundation. The depth of the removal excavation and the disposal history of the excavated materials are unknown.

No previous investigations were conducted at this site prior to the initiation of the RI activities. A records search was performed at the start of the RI, but no historical records related to this site were available. Interviews were conducted with installation personnel familiar with site activities, and this information was used to determine the initial location of the former building. During sample collection and assessment activities, a historical aerial photograph was found that provided a more accurate location of the former building.

The RI fieldwork included the following tasks:

- Surface soil sampling and analysis
- Advancement of soil borings and collection of subsurface soil samples using direct-push technology (DPT) or hand augers
- Field measurement of physical and chemical properties of soil samples.

The samples were collected using an iterative process to focus subsequent sampling events. The results of previous analyses were evaluated to determine the best locations for additional sampling and to determine the most appropriate analyses to be performed.

Initial surface and subsurface soil samples (collected in 2000) were analyzed for Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semivolatile Organic Compounds (SVOCs), TCL Pesticides/ Polychlorinated Biphenyls (PCBs), and Target Analyte List (TAL) inorganics. These samples were also processed for Synthetic Precipitation Leaching Procedure (SPLP) analyses to evaluate the potential for site contaminants to leach into groundwater.

Based on the results of the initial samples, target analytes were limited to indicator chemicals such as benzo(a)pyrene [B(a)P], dieldrin, and others during some subsequent sampling events to most effectively make use of available resources.

Soil sample analytical results were compared to the following:

- FDEP Soil Cleanup Target Levels (SCTLs) for Florida Direct Exposure Limit for Residential (DE1) use [DE1 in the analytical data tables (primary criteria)],
- FDEP SCTLs for Florida Direct Exposure Limit for Industrial/Commercial (DE2) use [DE2 in the analytical data tables (primary criteria)],
- FDEP SCTLs for leachability (LE) based on groundwater criteria (primary criteria),
- NAS Whiting Field background screening values for inorganics only (secondary criteria),
- USEPA Region 9 Superfund Preliminary Remediation Goals for Residential (PRGR) and Preliminanry Remediation Goals for Industrial (PRGI) Use (secondary criteria), and
- USEPA Region 4 Risk Assessment Guidance for Superfunds (RAGs) Ecological Screening Values (ESVs) for soil (secondary criteria) to determine if contaminants in the soil samples exceeded regulatory criteria.

The analytical results from the SPLP analyses were compared to FDEP Groundwater Cleanup Target Levels (GCTLs) (primary criteria), USEPA Primary Drinking Water Standards (PDWS) (primary criteria), and USEPA Secondary Drinking Water Standards (SDWS) (secondary criteria) to determine if contaminants in the leachate from the samples exceeded regulatory criteria.

Conclusions

The following conclusions are based on the results of the RI investigation at Site 41:

- Surface and subsurface soils at Site 41 are contaminated (contain analytes at concentrations exceeding at least one primary criterion) with SVOCs [primarily Polynuclear Aromatic

Hydrocarbon (PAHs)], pesticides, and to a lesser degree, metals and cyanide. The lateral and vertical extent of the contaminated soils has not been fully defined.

1.0 INTRODUCTION

TtNUS, under contract to the Navy, is submitting this RI Report for Operable Unit (OU) -27 Site 41 at NAS Whiting Field (USEPA ID# FL2170023244) located north of Milton, Florida. This RI Report was prepared on behalf of the Navy under contract No. N62467-94-D-0888. The RI Report was developed based on the results of a field investigation conducted according to the RI/FS Work Plan for Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C (TtNUS, 2000).

1.1 PURPOSE OF REPORT

The purpose of this RI Report is to document field investigation activities associated with the RI of the soil for Site 41 and to report the results from the soil investigation. The potential impact of Site 41 soil leaching into groundwater will be addressed in the Site 40 Basewide Groundwater RI Report.

1.2 REGULATORY SETTING

The Navy Installation Restoration (IR) Program was designed to identify and abate or control contaminant migration resulting from past operations at Naval Installations with the goal of expediting and improving environmental response actions while protecting human health and the environment. The IR Program is conducted in accordance with Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendment and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires federal facilities to comply with the act, both procedurally and substantively. Naval Facilities Engineering Command Southeast (NAVFAC SE) is the agency responsible for the Navy IR Program in the southeastern United States. Therefore, NAVFAC SE has the responsibility of processing NAS Whiting Field through the Preliminary Assessment (PA), Site Inspection (SI), RI/FS, and remedial response selection in compliance with the guidelines of the National Oil and Hazardous Substances Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300]. Section 105(a)(8)(A) of SARA required the United States Environmental Protection Agency (USEPA) to develop criteria to set priorities for remedial action based on relative risk to public health and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 [55 Federal Register (FR) Number 241:51532-51667], to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk.

The HRS score for NAS Whiting Field was generated in 1993. The score was sufficient to place NAS Whiting Field on the National Priorities List (NPL). Therefore, in January 1994, USEPA placed NAS

Whiting Field on a list of sites proposed for inclusion on the NPL (40 CFR 300: FR 18 January 1994). On 31 May 1994, NAS Whiting Field was placed on the NPL effective 30 June 1994 (40 CFR300; FR 21 May 1994). Consequently, the RI/FS for NAS Whiting Field must follow the requirements of the NCP, as amended by SARA, and the guidance for conducting an RI/FS under CERCLA (USEPA, 1988).

Per CERCLA Section 121(d), the Navy will follow all applicable or relevant and appropriate requirements (ARARs) of the State of Florida for all IR Program activities at NAS Whiting Field.

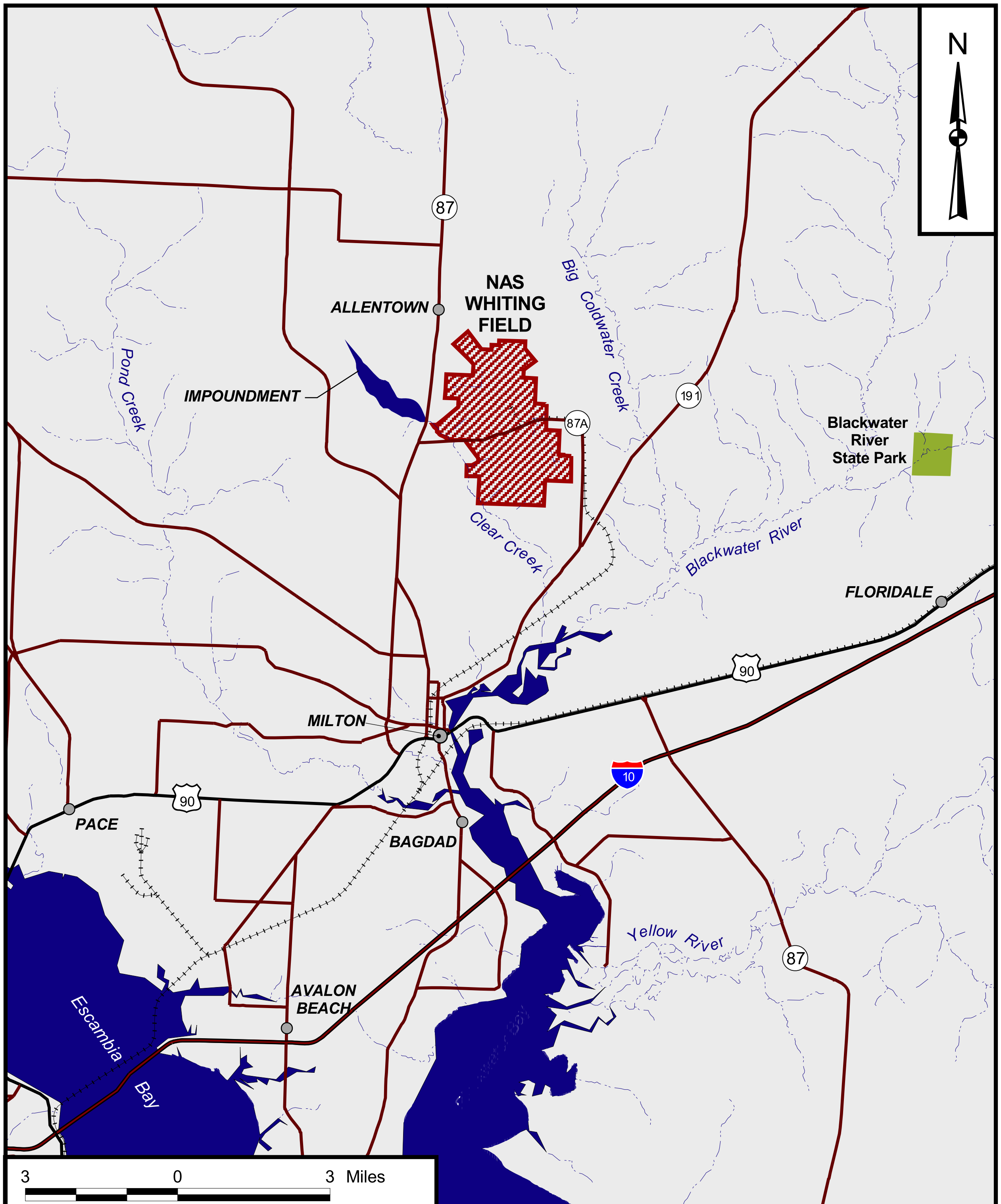
1.3 FACILITY LOCATION AND DESCRIPTION

NAS Whiting Field (Figure 1-1) is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola. Mobile, Alabama, is approximately 70 miles west of NAS Whiting Field; and Tallahassee, the capital of Florida, is 174 miles to the east. The installation was constructed in the early 1940s and has served as a naval aviation training facility since then. NAS Whiting Field presently consists of two airfields (North and South Fields), separated by an industrial area, and provides the support facilities for flight and academic training. Figure 1-2 presents the installation layout and locations of the investigation sites at NAS Whiting Field. A summary of the IR Sites and a description of the geology, groundwater hydrology, and historic operations at the facility are presented in the NAS Whiting Field General Information Report (GIR) [ABB Environmental Services, Inc. (ABB-ES), 1998].

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested areas to the south and southwest, and forests along the remaining boundaries. Located within an upland area, elevations at NAS Whiting Field range from 50 to 190 feet above sea level. The facility is bounded by low-lying receiving waters: Clear Creek to the west and south and Big Coldwater Creek to the east. Both creeks are tributaries of the Blackwater River. The Blackwater River discharges to the estuarine waters of the East Bay of the Escambia Bay Coastal System.

1.4 REPORT ORGANIZATION

This RI Report is organized into eight chapters (Chapters 1.0 to 8.0) plus a final section listing references used in preparing this report. Chapter 1.0 presents the purpose, regulatory setting, and the facility description for the Site 41 RI at NAS Whiting Field. Chapter 2.0 summarizes the site description and history and previous investigations. Chapter 3.0 presents the investigation methodology for conducting the assessment. Chapter 4.0 presents the site-specific data quality assessment. Chapter 5.0 discusses the investigation results. Chapter 6.0 provides a human health risk assessment (HHRA). Chapter 7.0 provides an ecological risk assessment (ERA). Chapter 8.0 provides a summary of the conclusions. The



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COST/SCHEDULE-AREA		
SCALE AS NOTED		

NAVFAC

FACILITY LOCATION MAP
REMEDIAL INVESTIGATION REPORT
SITE 41
NAS WHITING FIELD
MILTON, FLORIDA

CONTRACT NUMBER 0052	
APPROVED BY L.SMITH	DATE 1/30/08
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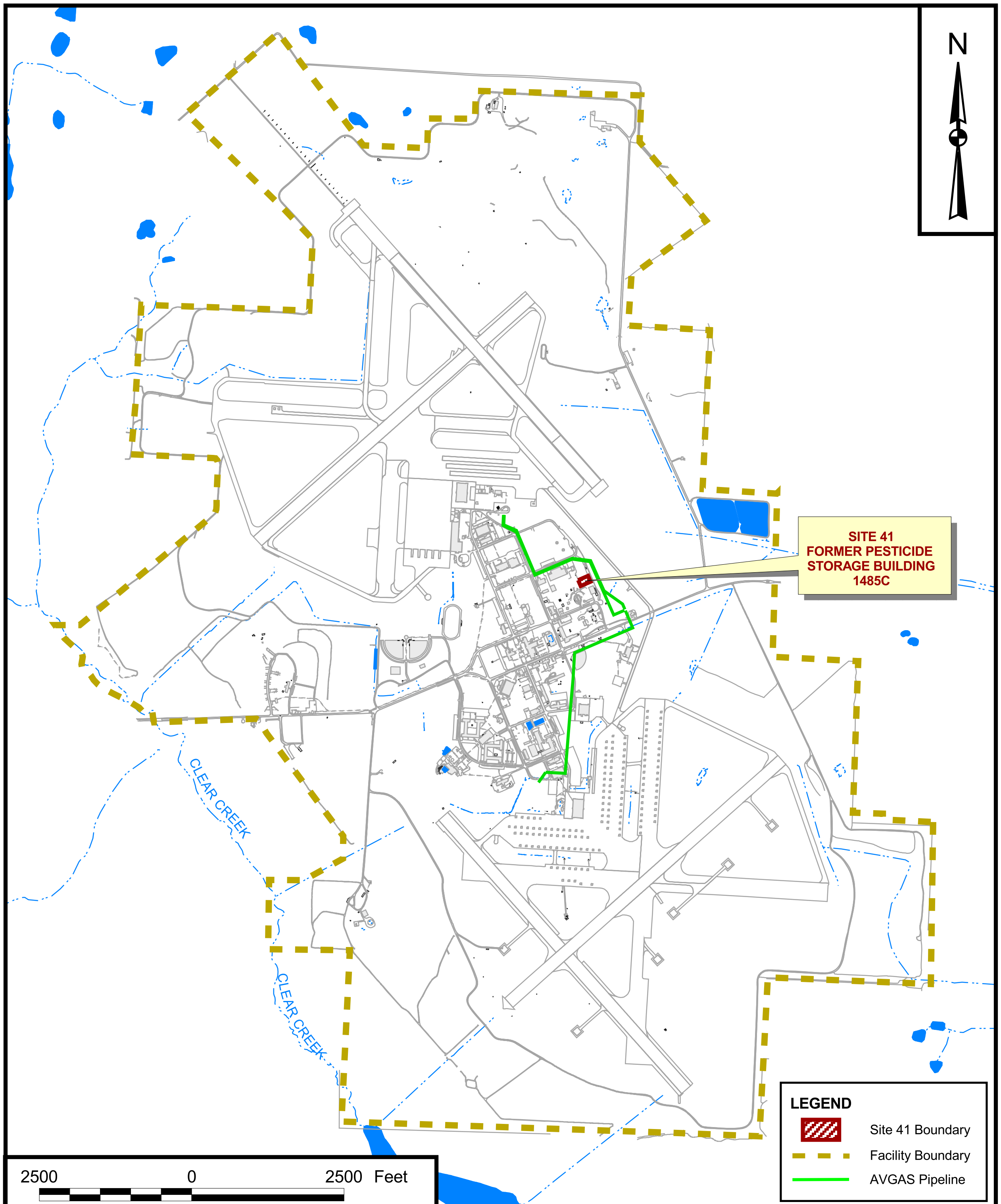

DRAWN BY S. PAXTON DATE 3/06/08	NAVFAC	SITE LOCATION MAP	CONTRACT NUMBER 0052
CHECKED BY L. SMITH DATE 3/06/08		REMEDIAL INVESTIGATION REPORT	APPROVED BY L.SMITH DATE 1/30/08
COST/SCHEDULE-AREA		SITE 41 NAS WHITING FIELD	APPROVED BY — DATE —
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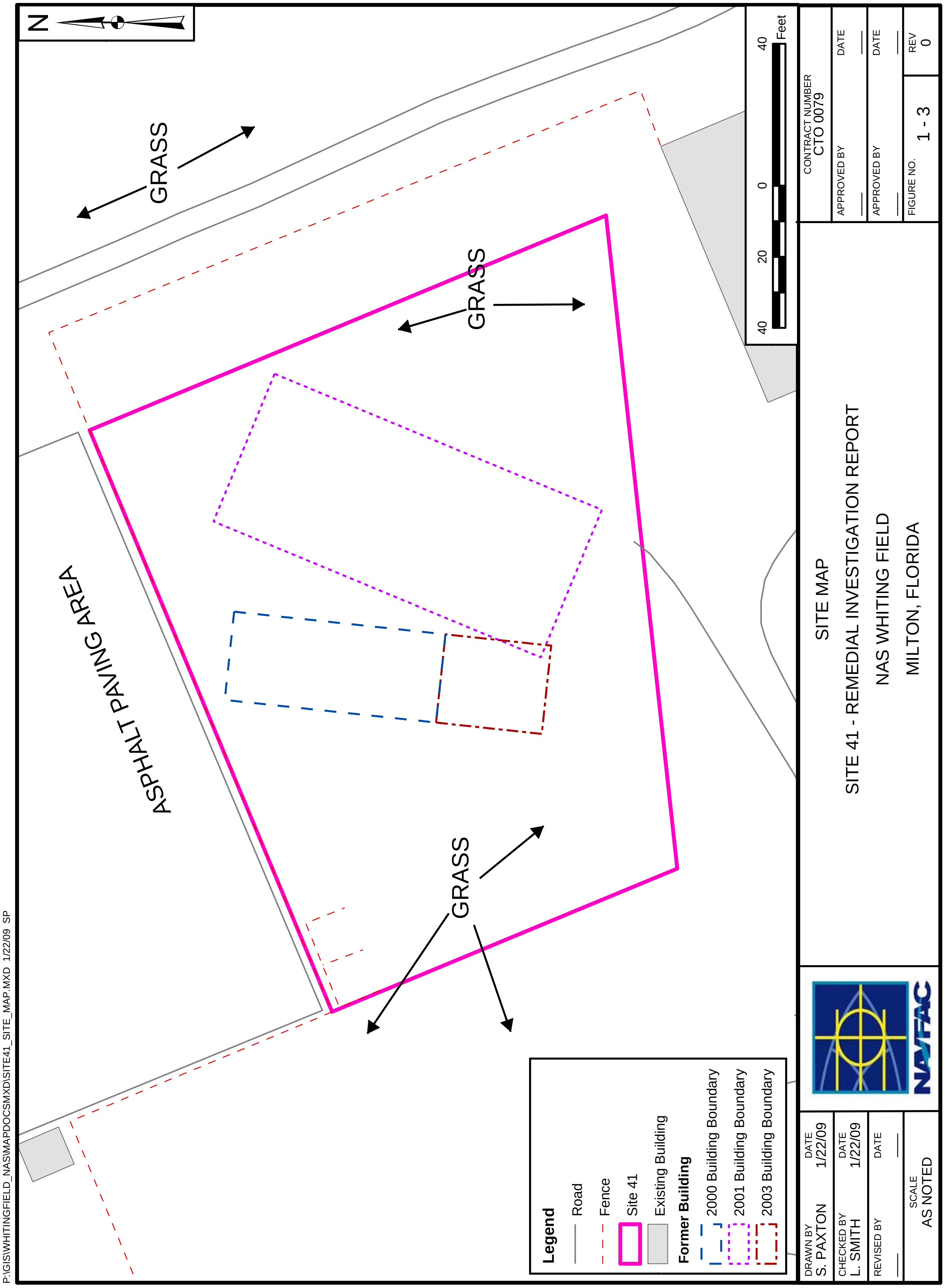
N
GRASS
GRASS
GRASS
ASPHALT PAVING AREA
40 20 0 40
Feet
Legend
Road
Fence
Site 41
Existing Building
Former Building
2000 Building Boundary
2001 Building Boundary
2003 Building Boundary
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DRAWN BY S. PAXTON
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SCALE AS NOTED
SITE MAP
SITE 41 - REMEDIAL INVESTIGATION REPORT
NAS WHITING FIELD
MILTON, FLORIDA
CONTRACT NUMBER CTO 0079
APPROVED BY
DATE
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DATE
FIGURE NO. 1 - 3
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NAVFAC

Reference Section includes the references used in preparing this report. Appendix A contains the soil boring logs, Appendix B contains referenced material concerning naturally occurring inorganics in soil, Appendix C provides the validated analytical results, Appendix D provides Human Health risk information, Appendix E provides species receptor profiles, and Appendix F provides the response to comments.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

Site 41 (Figure 1-2) was initially designated PSC 1485C; therefore, many of the initial sample numbers and earlier references reflect the original site nomenclature. Site 41 is the site of the former Pesticide Storage Building 1485C. The building was located within the Base Operating Services (BOS) Compound northwest of the eastern termination of Yorktown Street and was used for storage of ground maintenance equipment and limited amounts of pesticide compounds.

2.1.1 <u>Geologic Setting</u>

The subsurface materials to a depth of 20 feet at Site 41 include three layers. The first layer [0 to 7 feet below land surface (bls)] is a clayey sand. The second layer (7 to 15 feet bls) is a sandy clay. The third layer (15 to 20 feet bls) is a clayey sand. The soil is characterized as Troupe loamy sand [United States Department of Agriculture (USDA), 1980].

2.2 SITE HISTORY

The former Building 1485C was used during an undetermined period for storage of ground maintenance equipment and limited amounts of pesticide compounds. The building caught fire in the late 1980’s and was completely destroyed. Following the fire, cleanup activities at the site included the removal of all building materials and the concrete slab flooring. The depth of the removal excavation and the disposal history of the excavated materials are unknown.

2.3 PREVIOUS INVESTIGATIONS

In March 1996, Brown & Root Environmental Services, Inc. collected a single surface soil sample (0 to 1 foot sample depth) at the site. The sample was collected to support the Navy’s relative risk ranking for the site. The soil sample was analyzed for TCL, VOCs, TCL, SVOCs, TCL, PCBs, and TAL inorganics. No organic compounds or inorganic analytes were detected above regulatory limits in the soil sample. There have been no other investigations conducted at this site prior to the RI.

Records located at the Public Works Department at NAS Whiting Field were searched to determine if historical documents were available for Site 41. No historical documents for this site were found. An interview was conducted with a representative of the on-base facilities maintenance contractor. This interview coupled, with a site walkover, was used to develop the initial estimated location of the former Pesticide Storage Building 1485C. Based on the estimated building location, sampling locations were selected and the investigation progressed with one round of sampling completed. Subsequent to this initial sampling effort, TtNUS became aware of aerial photographs from the early 1960's showing the building relative to surrounding features. Based on this information, the footprint of the former building was more accurately located (east of the initial location), and additional samples were collected.

3.0 INVESTIGATION

The work performed for the Site 41 investigation was focused primarily on detecting, confirming, and defining the lateral and vertical extents of soil contamination. With no previous investigation data available, an exploratory sampling grid was designed based on sampling location information provided in the RI/FS Work Plan (TtNUS, 2000) maps. The initial sample plan was designed to collect samples from locations where spills were considered likely to occur proximal to the edge of the concrete building foundation and near potential door ways (Figure 3-1). In the initial stages of the investigation of AOC 1485C the character of the contamination at the Site was not known. The Work Plan directed the investigators to screen samples using FDEP Underground Storage Tank (UST) screening protocols.

During the initial sampling round in 2000, an on-site worker with historic knowledge of the location of Building 1485C indicated to the sampling team the estimated location and orientation of the former building was reasonably accurate. Conversely, during the summer of 2001, a second on-site worker, again claiming personal knowledge of the location of former Building 1485C, indicated that the building was larger than the initially estimated footprint and was of open frame construction with no walls. Based on this information, the sampling area was extended approximately 20 feet to the south-southwest (Figure 3-1). On 15 August 2001, surface soil samples (0 to 1 foot bls) were collected from locations SS18, SS19, and SS20 to evaluate this additional area (Figure 3-1).

Aerial photographs (circa 1961) were located in October 2003 showing the relative location of Building 1485C was east of the estimated locations (Figure 3-1). Plotting the aerial photograph information of the building's location showed previous sampling was biased to the west side of the now accurately located former Building 1485C. Therefore, additional data were needed to identify the area of possible soil contamination. Several iterative field investigations took place to delineate concentrations of contaminants in the soil exceeding regulatory or risk-based screening criteria. These estimated and actual locations as well as sample locations are shown on Figure 3-1.

3.1 FIELD INVESTIGATION ACTIVITIES

The field investigation included the following activities:

- Collection of surface soil samples.
- Advancement of soil borings and collection of subsurface soil samples using DPT or hand augers.
- Field measurement of physical and chemical properties of soil samples.

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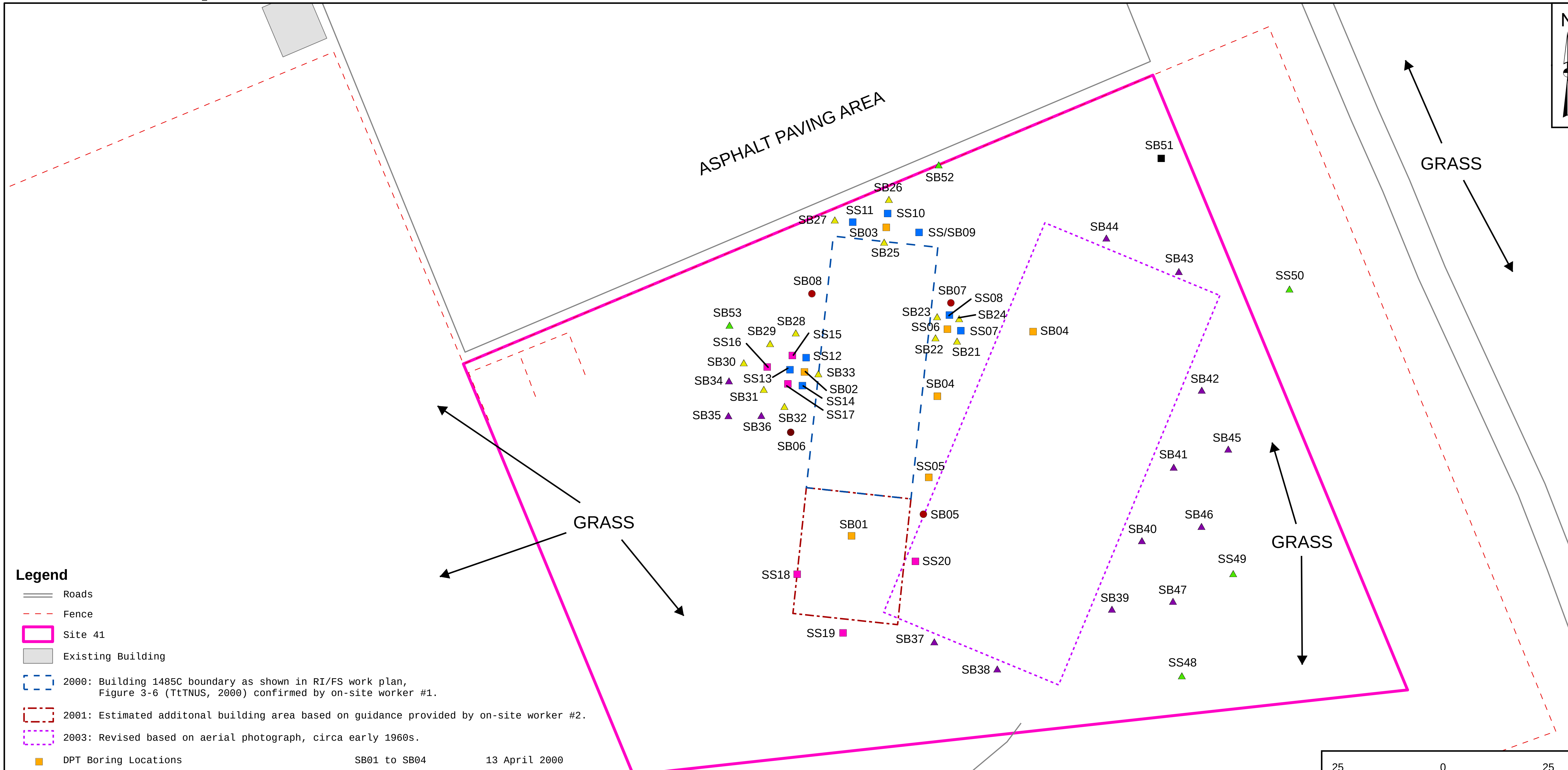

Legend

Roads			
Fence			
Site 41			
Existing Building			
2000: Building 1485C boundary as shown in RI/FS work plan, Figure 3-6 (TtTNUS, 2000) confirmed by on-site worker #1.			
2001: Estimated additonal building area based on guidance provided by on-site worker #2.			
2003: Revised based on aerial photograph, circa early 1960s.			
DPT Boring Locations	SB01 to SB04	13 April 2000	
Surface Soil Sample Locations	SS/SB01 to 04 and SS05 to 06	24 May 2000	
DPT Boring Locations	SB05 to SB08	5 June 2000	
Surface Soil Sample Locations	SS07 to SS14	17 May 2001	
Surface Soil Sample Locations	SS15 to SS20	15 August 2001	
Surface and Subsurface Soil Sample Locations	SB21 to SB33	16 October 2003	
Surface and Subsurface Soil Sample Locations	SB34 to SB47	10-11 November 2003	
Surface and Subsurface Soil Sample Locations	SB48 to SB53	31 August 2004	

DRAWN BY	DATE			CONTRACT NO.	
K. MOORE	4/9/07	NAVFAC	BUILDING 1485C ESTIMATED LOCATIONS AND SOIL SAMPLE LOCATION MAP SITE 41 - REMEDIAL INVESTIGATION REPORT NAS WHITING FIELD MILTON, FLORIDA	CTO 0079	
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L. SMITH	1/22/09			--	--
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SCALE				FIGURE NO.	REV.
AS NOTED				3-1	0

As described in Section 3.1.1 of the Work Plan, all field investigation activities were performed in general accordance with the FDEP Rule 62-770 Florida Administrative Code (F.A.C.) or the USEPA Region 4 EISOPQAM (USEPA, 2001).

The soil samples, including the environmental and Quality Control (QC) samples, were collected and analyzed at an off-site, fixed-based laboratory using USEPA SW-846 methodology for analysis of some or all of the following: TCL VOCs, TCL SVOCs, TAL inorganics, cyanide, and SPLP. The following USEPA SW-846 methods were specifically used: 8260B (TCL VOCs), 8270C (TCL SVOCs), 8310 (PAHs; a subset of the TCL SVOCs), 8081A (TCL Pesticides), 8082 (PCBs), 6010B (TAL inorganics), 9010 (cyanide), and 1312 (SPLP). The surface soil samples were also analyzed using FDEP Florida Petroleum Range Organics (FL-PRO) methodology for analysis of Total Recoverable Petroleum Hydrocarbons (TRPH).

Sample nomenclature is derived as follows: (WHF) is the NAS Whiting Field prefix, the numeral 41 is the Site ID, (SS) designates surface soil sample locations, and (SB) designates subsurface soil sample locations. The final numeral indicates the location and sequence of collection.

3.2 SURFACE SOIL ASSESSMENT

The surface soil assessment was accomplished by hand auger sampling. The surface soil samples were collected to evaluate the lateral extent of contamination at potential source areas. The samples were recovered from a depth of 0 to 12 inches bls. Hand augering was accomplished using a 4-inch diameter bucket auger.

3.3 SUBSURFACE SOIL ASSESSMENT

The subsurface soil assessment was accomplished by DPT and hand auger sampling. The subsurface samples were collected to evaluate the vertical and lateral extent of contamination in the potential source areas.

All DPT soil borings were advanced to a depth of 20 feet bls. An organic vapor analyzer (OVA) with a flame ionization detector (FID) was used to scan the soil cores, and subsurface soil samples were selected for laboratory analysis based on FID readings, changes in lithology, or at the discretion of the site geologist. Hand augering was accomplished using a 4-inch stainless steel bucket auger with 3 feet extension rods. Typically, subsurface soils were obtained no deeper than 6 feet bls by hand augering.

Soil vapor headspace analyses were performed according to the method prescribed in FDEP Rule 62-770.200 (2) of the F.A.C. Subsurface soil samples were analyzed for total organic vapors using an

OVA equipped with an FID. Charcoal filters were used to determine the contribution of methane (a naturally occurring gas) to the total organic vapor concentration. The results of the headspace analyses were used to guide the investigation and focus sampling points to areas of concern.

3.4 SAMPLE COLLECTION AND ANALYSIS

The former location of Building 1485C was initially estimated by consultation with facility personnel and comparison to available maps [see Figure 3-6 in the RI/FS Work Plan (TtNUS, 2000)]. Based on this best available information, four DPT borings (SB01 through SB04) were advanced to a depth of 20 feet on 13 April 2000, at locations projected to be near the boundaries of the former structure (Figure 3-1). The logs for these borings are provided in Appendix A. Subsurface samples were collected at 5-foot intervals and analyzed on-site with an FID. These subsurface soil samples did not exhibit a significantly elevated OVA response, staining, or other indications that laboratory analyses were warranted. Therefore, no samples were sent for off-site laboratory analysis.

On 24 May 2000, six surface soil samples (0 to 1 foot bls) were collected near the originally indicated boundaries of the former structure. Sample locations 1 through 4 were co-located with the DPT sample locations of 13 April 2000 as SB01 through SB04. Locations SS05 and SS06 are located on the southeast side of the structure where doorways were described as being present. These surface soil samples were collected using stainless steel hand augers and sent to a laboratory for analysis of TCL VOCs, SVOCs, pesticides/PCBs, TRPH, and TAL inorganics plus cyanide. In addition, these samples were processed for SPLP analysis of metals, pesticides, SVOCs (samples SS02, SS03, and SS06 only), and TRPH. Figure 3-1 shows the locations of these six samples.

Monitoring well WHF-1485C-MW-01S was installed in the southern portion of Site 41 (Figure 3-1) on 1 June 2000. No soil samples were collected during the drilling and installation of this well. Results of groundwater sampling from this well will be addressed in the Site 40 Basewide Groundwater RI Report.

On 5 June 2000, four additional subsurface soil samples were collected via DPT from the four originally indicated corners of the former structure. Samples were collected from the 3 to 5 foot interval in borings SB06 and SB07, and the 8 to 10 foot interval in borings SB05 and SB08. Samples were analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TRPH, and TAL inorganics plus cyanide. These samples were processed for SPLP analysis of metals and pesticides. Figure 3-1 shows the locations of the monitoring well and these four DPT borings.

Subsequent soil sampling activities (both surface and subsurface) were conducted using an iterative process of evaluating the analytical data and collecting additional data either laterally or vertically where previous results exceeded either FDEP, USEPA Region 9 Superfund Preliminary Remediation Goals for

Residential (PRGRs), USEPA Region 9 Superfund Preliminary Remediation Goals for Industrial (PRGIs), or USEPA Region 4 Risk Assessment Guidance Ecological Screening Values (RAGs) criteria. Both FDEP and USEPA criteria were exceeded in soil samples. This approach was used to evaluate the lateral and vertical extent of soil contamination at the site rather than collecting a large number of samples (many of which may have been outside the limits of contamination) during one event.

Initial soil analytical results were positive only for B(a)P and pesticides; therefore, future analysis was limited to B(a)P and pesticides for the next group of samples (collected in 2001). These analytes were used as indicator compounds for soil contamination at the site. Eight surface soil samples (0 to 1 foot bls) were collected on May 17, 2001 (SS07 through SS14) near points where SVOCs or pesticides were detected previously (Figure 3-1).

On 15 August 2001, surface soil samples (0 to 1 foot bls) were collected from locations SS18, SS19, and SS20 to evaluate this additional area (Figure 3-1). Three surface soil samples were also collected on this date near SS02 to further evaluate SVOC and pesticide contamination found at this location during the May 2000 sampling event. The analysis for these six samples was limited to B(a)P.

Additional surface and subsurface soil samples were collected on 16 October 2003 from the area around the initial site. B(a)P was used again as an indicator chemical, and samples were analyzed for this compound only. Thirteen surface soil samples (0 to 1 foot at locations SB21 through SB33) were collected (Figure 3-1). Sixteen subsurface soil samples were also collected during this sampling event. Samples were collected from the 1 to 2 foot interval from all locations (SB09 and SB21 through SB33). In addition, samples were collected from the 2 to 3 foot interval at locations SB31 and SB33 (Figure 3-1).

The revised 2003 building location showed previous sampling was biased to the west of the now accurately located former Building 1485C (Figure 3-1). Subsequent sampling on 10 and 11 November 2003 emphasized locations south, east, and north of the former structure. Locations sampled during this event included SB34 through SB47. At each of these locations a surface soil (0 to 1 foot) and two subsurface soil (1 to 2 and 2 to 3 feet bls) samples were collected. All 33 of these samples were analyzed for TCL VOCs, SVOCs, pesticides/PCBs, TRPH, and TAL inorganics plus cyanide.

In addition, samples were collected during this event to define the extent of SVOC contamination previously detected above FDEP, USEPA PRGRs, USEPA PRGIs, and USEPA RAGs primary screening criteria in surface (multiple samples) and subsurface (SB31) soil samples near the west-central edge of the initial estimated location of the building. A subsurface sample from the 3 to 4 foot depth interval was collected at SB31 to evaluate the vertical extent of contamination at this location. At locations SB34, SB35, and SB36 a surface soil (0 to 1 foot) and two subsurface soil (1 to 2 and 2 to 3 feet bls) samples were collected. All of these samples were analyzed for B(a)P only.

On 31 August 2004, additional samples were collected east, west, and north of the former structure. Sampling locations were selected to further evaluate the horizontal and vertical extent of SVOC and/or pesticide/PCB soil contamination detected during previous sampling events. All samples collected during this event were analyzed for the SVOCs B(a)P and dibenzo(a,h)anthracene [D(a,h)A], and the pesticides aldrin, dieldrin, and heptachlor. These compounds were chosen as indicator compounds based on previous sampling results. Three subsurface soil samples were collected at locations SS31 and SB43 (3 to 4, 4 to 5, and 5 to 6 feet bls at each location). Also during this sampling event, soil samples were collected at locations SS48 through SS53 (Figure 3-1). A surface soil (0 to 1 foot bls) and two subsurface soil (1 to 2 and 2 to 3 feet bls) samples were collected at each location and analyzed for the five compounds indicated above.

4.0 DATA QUALITY ASSESSMENT

This chapter describes the analytical program for the RI at Site 41 and how the data that were generated during the investigation were managed and validated.

4.1 ANALYTICAL PROGRAM

Environmental and QC samples collected at Site 41 under the RI/FS Work Plan for Sites 5, 7 29, 35, 38, 39, 40 and PSC 1485C (TtNUS, 2000) were analyzed using field screening and off-site laboratory analytical methods. Environmental sampling locations are presented in Chapter 3 of this report, and validated sample results are presented in Chapter 5 and Appendix C. QC data for Site 41 were submitted along with environmental data in sample delivery groups (SDGs).

Environmental samples (surface and subsurface soil) were collected and analyzed by an off-site laboratory using USEPA SW-846 methodology for the analysis of one or more of the following: TCL VOCs, TCL SVOCs, TAL Metals, TCL Pesticides/PCBs, TRPH, Cyanide, and PAHs. The analytical program is described in more detail in Chapter 3.0 and the RI/FS Work Plan (TtNUS, 2000).

Analytical results obtained for all environmental samples during the RI sampling events were submitted in fully validatable (i.e., Contract Laboratory Program [CLP]-compliant) analytical packages for the TCL VOCs, TCL SVOCs, TCL Pesticides/PCBs, TAL Metals, TRPH, Cyanide, and/or PAHs.

4.2 DATA MANAGEMENT

The purpose of this task was the tracking and management of environmental and QC data collected during the field investigation from the time the data were obtained through data analysis and evaluation. Coordination and management of environmental and QC sample analysis by the contracted laboratory was also part of this task. Field activities generated data including sample locations and measurements of field parameters. The data management process follows the flow of data collected in the field and generated by the analytical laboratory through data validation, evaluation, and decision making. Management of data collected during field activities ensures accessibility of data to support environmental data analysis and the evaluation of remedial action alternatives.

Samples were tracked from field collection activities to the analytical laboratory following standard chain-of-custody procedures. Sample information recorded on the chain-of-custody form was transferred (electronically or manually) into the sample-tracking portion of the database management system (DBMS), thereby enabling the samples to be tracked through final disposition.

Data quality indicators included the precision, accuracy, representativeness, comparability, and completeness parameters. These parameters were used within the data validation process to evaluate data quality. The limits used for laboratory analytical data in this RI were those established by the CLP as identified in the referenced guidelines in Section 4.3.

Analytical results, applicable Quality Assurance (QA)/QC data, validation qualifiers, chain-of-custody information, and any other applicable information were incorporated into the DBMS. All data were verified after uploading to ensure completeness and accuracy.

Data verification included the following tasks:

- TtNUS reviewed and signed the chain-of-custody form to verify that all samples listed were included in the shipment to the laboratory and the sample information was accurate. The forms were signed by the sampler and a copy was retained for the project file, the TtNUS Project Manager, and the data validators.
- Verification that all proposed samples were collected.
- Verification that information recorded in the log sheets was accurate and complete.
- Verification that sample locations were correct and in accordance with the proposed locations.
- Verification that field QC samples were collected as required.
- The laboratory sample custodian reviewed the sample shipment for completeness, integrity, and signed accepting the shipment. The data validators checked that the chain-of-custody form was signed/dated by TtNUS relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.
- All analytical data packages were verified internally for completeness by the laboratory performing the work. The Laboratory QAM signed the case narrative for each data package.
- Each data package was verified for completeness by TtNUS data validators. Any missing information was requested from the laboratory and validation was suspended until missing data was received.
- The electronic data was verified against the chain-of-custody and hard copy data package for accuracy and completeness. Laboratory analytical results were verified and compared to the electronic analytical results for accuracy. Sample results were evaluated for laboratory contamination and were qualified for false positives using the laboratory method/preparation blank summaries. Positive results reported between the method detection limit and the reporting

limit were qualified as estimated. Extraneous laboratory qualifiers were removed from the validation qualifier.

4.3 DATA VALIDATION

The QA/QC efforts for laboratory analyses include collection and submittal of QC samples and the assessment and validation of data from the subcontracted laboratory. Analytical data were subjected to limited independent data validation in accordance with the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (OLM04.0, USEPA 1999a).
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (ILM04.2, USEPA 1999b).
- *Navy Installation Restoration Chemical Data Quality Manual* (NFESC 1999).

Organic analytical data were validated based on, but not limited to, the following parameters:

- Data completeness
- Holding time compliance
- Gas chromatograph/mass spectrometer (GC/MS) tuning and system performance
- Initial and continuing calibration results
- Laboratory and field QC blank results
- Surrogate spike recoveries
- Internal standard recoveries
- Matrix Spike (MS) and Matrix Spike Duplicate (MSD) results
- Laboratory Control Sample (LCS) and Laboratory Control Spike Duplicate (LCSD) results
- Field duplicate sample analyses
- Compound identification
- Compound quantitation
- Detection limits
- Comparison of laboratory and field blanks to sample results
- Comparison of laboratory and field duplicate results

Inorganic analytical data were validated based on, but not limited to, the following parameters:

- Data completeness
- Holding time compliance
- Initial and continuing calibration verification results

- Laboratory and field QC blank results
- Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) results
- MS/MSD or MS/Matrix Duplicate (MD) results
- LCS/LCSD results
- ICP Serial Dilution results
- Field duplicate sample analyses
- Compound quantitation
- Detection limits
- Comparison of laboratory and field blanks to sample results
- Comparison of laboratory and field duplicate results

The limits for these were set and contained either in the NAS Whiting Field Quality Assurance Project Plan (QAPP), the FDEP-approved Laboratory QA Plan, or the methodology. Included in the data validation process was an assessment of the precision, accuracy, representativeness, comparability, and completeness (PARCC) criteria.

4.4 DATA USABILITY ASSESSMENT

The usability of the data directly affects whether project objectives can be achieved. The following characteristics were evaluated. The results of these evaluations are included in this project report. The characteristics were not evaluated for multiple concentration levels as the evaluator determined that this was not necessary. To the extent required by the type of data being reviewed, the assessors consulted with other technically competent individuals to render sound technical assessments of these data characteristics:

Precision

- The Project Chemist acting on behalf of the project team determined that precision goals for field duplicates and laboratory duplicates were met. This was accomplished by comparing duplicate results to precision goals identified in the RI/FS Work Plan. This also included a comparison of field and laboratory precision with the expectation that field duplicate results would be no less precise than laboratory duplicate results. If the goals were not met, or data were flagged as estimated (J qualifier), limitations on the use of the data were described in this project report.

Accuracy

-The Project Chemist acting on behalf of the project team determined that the accuracy/bias goals were met for project data. This was accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in the RI/FS Work Plan. This assessment included an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, matrix spike, and laboratory control samples. If the goals were not met, limitations on the use of the data were described in this project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data were described in this project report.

Representativeness

- A Project Scientist identified by the TtNUS Project Manager and acting on behalf of the project team determined that the data are adequately representative of intended populations, both spatially and temporally. This was accomplished by verifying that samples were collected and processed for analysis in accordance with the RI/FS Work Plan, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report described the representativeness of the data for each matrix and analytical fraction. This did not require quantitative comparisons because professional judgment of the Project Scientist indicates that a quantitative analysis was not required.

Completeness

- For each matrix that was scheduled to be sampled, the Field Operations Leader acting on behalf of the project team prepared a table listing planned samples/analyses to collected samples/analyses. No deviations from the scheduled sample collection or analyses were identified. Therefore, the TtNUS Project Manager did not need to consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Comparability

- The Project Chemist acting on behalf of the project team determined that the data generated under this project were sufficiently comparable to any historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This was accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This did not require quantitative comparisons because professional judgment of the Project Chemist indicated that such quantitative analysis was not required.

Sensitivity

- The Project Chemist acting on behalf of the project team determined that project sensitivity goals listed in the RI/FS Work Plan were achieved. The overall sensitivity and Practical Quantitation Limits (PQLs) from multiple data sets for each matrix and analysis were compared. If any sensitivity goals were not achieved, the limitations on the data were described in the Human Health Risk Assessment in Section 6.0. The Project Chemist enlisted the help of the Project Risk Assessor to evaluate all deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

- The TtNUS Project Manager and designated team members evaluated whether project assumptions were valid. This was a qualitative evaluation but may have been supported by quantitative evaluations. The type of evaluation depended on the assumption being tested.

After completion of the data validation, the data and data quality were reviewed to determine that sufficient data of acceptable quality were available for decision making (risk assessment). In addition to the evaluations described above, a series of inspections and statistical analyses were performed to estimate these characteristics. The statistical evaluations included simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. The project team members identified by the TtNUS Project Manager assessed whether the data collectively supported the attainment of project objectives. They considered whether any missing or rejected data may have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data were evaluated to determine whether missing or rejected data needed to be compensated by other data. Although rejected data will generally not be used, there may be reason to use them in a weight of evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values were represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) were not averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples were used to represent the concentration at a particular sampled location.

The TtNUS Project Manager, TtNUS Project Chemist, TtNUS Field Operations Leader, and TtNUS Project Scientist were responsible for conducting the listed data usability assessments. The data usability assessments could have been reviewed, if necessary, with the Navy RPM, the EPA RPM, and the FDEP RPM in face-to-face meetings or teleconferences depending on the extent of identified deficiencies. Since no significant deficiencies were identified, the data usability assessment was simply documented in the project report and shall be reviewed during the normal document review cycle.

The data has been presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation supports any non-compliant estimated or rejected data results. This project report identifies and describes the data usability limitations and any suggested re-sampling or other corrective actions, if necessary.

5.0 INVESTIGATION RESULTS

This chapter presents the results from the Site 41 investigation. Surface and subsurface soil samples were collected in a series of sampling events in support of the investigation described in the RI/FS Work Plan for Sites 5, 7 29, 35, 38, 39, 40 and PSC 1485C (TtNUS, 2000). Additional information regarding NAS Whiting Field is presented in the GIR (ABB-ES, 1998).

For various administrative reasons issuance of this RI Report was delayed until 2008. Therefore, the report was modified to provide content consistent with the original intent (defined above), but with current regulatory criteria as follows:

- Evaluate the extent of soil contamination that exceeds applicable FDEP SCTLs (FDEP, 2005).
- Define the extent of contamination that exceeds various “risk benchmarks” defined by both FDEP and USEPA. These criteria include where applicable, USEPA Region 9 Superfund PRGR and PRGI (USEPA, 2004), and USEPA Region 4 RAGs ESVs for soil (USEPA, 2001).

The environmental samples are described in the order of 1) surface soil and 2) subsurface soil. Chapter 3.0 provides information regarding the sample collection methodology and sequence and the sample analyses.

B(a)P Toxic Equivalency Factors

According to FDEP guidance (FDEP, 2005), detected concentrations of benzo(a)anthracene [B(a)A], benzo(b)fluoranthene [B(b)F], benzo(k)fluoranthene [B(k)F], chrysene, D(a,h)A, and indeno(1,2,3-cd)pyrene (IP) can be summed and converted to B(a)P Toxic Equivalency Factors (TEFs). The B(a)P equivalent concentration of these compounds were summed to provide a B(a)P equivalent value (Table 5-1). The TEF concentration is then compared to the DE1 and DE2 criteria for B(a)P. The TEF is shown in the detection Table 5-1 and described in Section 5.1.1.

Naturally Occurring Inorganics

Aluminum, arsenic, iron, manganese, and vanadium were detected frequently in both surface and subsurface samples analyzed for TAL inorganics. In some cases these analytes were found at concentrations exceeding primary or secondary FDEP criteria. However, these inorganics have been determined to be naturally occurring when at slightly elevated levels and there is no known facility activity that would have caused elevated concentrations (TtNUS, 2005). Based on a review of observed arsenic

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SS01	WHF-1485C-SS02	WHF-1485C-SS03	WHF-1485C-SS04	WHF-1485C-SS05	WHF-1485C-SS06
Sample No.	Regulatory Criteria	1485CD00101	1485CD00201	1485CD00301	1485CD00401	1485CD00501	1485CD00601
Collect Date		5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	--	--	0.0271[J]	--	--	--
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	--	--	--	--	--	--
Fluoranthene	3200/59000/1200/2300/22000/**0.1**	--	**0.348**	**0.357**	--	--	**0.76**
Phenanthrene	2200/36000/250/NC/NC/**0.1**	--	**0.106[J]**	**0.165[J]**	--	--	**0.22[J]**
Pyrene	2400/45000/880/2300/29000/**0.1**	--	**0.221[J]**	**0.235[J]**	--	--	**0.495**
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	--	0.17[J]	0.255[J]	--	--	0.349
Benzo(a)pyrene equivalent	**0.1**/0.7/8/NC/NC/NC	NS	**0.20772**	**0.24886**	NS	NS	**0.40508**
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	--	0.108[J]/0.0108	0.106[J]/0.0106	--	--	0.282[J]/0.0282
Benzo(a)pyrene	NC/NC/8/**0.062/0.21/0.1**	--	**0.159[J]**/0.159	**0.185[J]**/0.185	--	--	**0.3[J]**/0.3
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	--	0.169[J]/0.0169	0.238[J]/0.0238	--	--	0.352/0.0352
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	--	0.123[J]/0.00123	0.126[J]/0.00126	--	--	0.266[J]/0.00266
Chrysene[9]	NC/NC/77/62/210/1[10]	--	0.189[J]/0.000189	0.201[J]/0.000201	--	--	0.422[J]/0.000422
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	--	0.196[J]/0.0196	0.28[J]/0.028	--	--	0.386[J]/0.0386
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	--	--	--	--	--	--
4,4'-DDE	2.9/15/18/1.7/7/0.0025	--	--	--	--	--	--
4,4'-DDT	2.9/15/11/1.7/7/**0.0025**	--	--	--	**0.0052[J]**	--	--
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	--	--	--	--	--	--
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	--	--	--	--	--	--
Dieldrin	0.06/0.3/**0.002**/**0.03**/0.11/**0.0005**	**0.0034[J]**	**0.0031[J]**	--	**0.0126**	**0.0345**	**0.0041[J]**
Endrin	25/510/1/18/180/0.001	--	--	--	--	--	--
Endrin Ketone	NC/NC/NC/NC/0.1[13]	--	--	--	--	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	--	--	--	--	--	--
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	13	17.2	29.2	55.4	21.7	27.4

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SS07	WHF-1485C-SS08	WHF-1485C-SS09	WHF-1485C-SS10	WHF-1485C-SS11	WHF-1485C-SS12
Sample No.	Regulatory Criteria	1485CSS0701	1485CSS0801	1485CSS0901	1485CSS1001	1485CSS1101	1485CSS1201
Collect Date		5/17/2001	5/17/2001	5/17/2001	5/17/2001	5/17/2001	5/17/2001
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	**0.1**/0.7/8/**0.062**/0.21/**0.1**	**0.0693[J]**	--	--	**0.122[J]**	**0.119[J]**	--
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SS13	Duplicate of WHF-1485C-SS13	WHF-1485C-SS14	WHF-1485C-SS15	WHF-1485C-SS16	WHF-1485C-SS17
Sample No.	Regulatory Criteria	1485CSS1301	1485CSS1301-D	1485CSS1401	1485CSS1501	1485CSS1601	1485CSS1701
Collect Date		5/17/2001	5/17/2001	5/17/2001	8/15/2001	8/15/2001	8/15/2001
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	**0.1/0.7**/8/**0.062/0.21/0.1**	**0.197^{J}**	--	**0.0774^{J}**	**0.196^{J}**	**0.358^{J}**	**0.14^{J}**
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SS18	WHF-1485C-SS19	WHF-1485C-SS20	WHF-1485C-SB21	WHF-1485C-SB22	WHF-1485C-SB23
Sample No.	Regulatory Criteria	1485CSS1801	1485CSS1901	1485CSS2001	WHF-1485C-SS-2101	WHF-1485C-SS-2201	WHF-1485C-SS-2301
Collect Date		8/15/2001	8/15/2001	8/15/2001	10/16/2003	10/16/2003	10/16/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	0.1/0.7/8/0.062/0.21/0.1	--	--	--	0.019[J]	0.024[J]	0.0082[J]
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SB24	WHF-1485C-SB25	WHF-1485C-SB26	WHF-1485C-SB27	WHF-1485C-SB28	WHF-1485C-SB29
Sample No.	Regulatory Criteria	WHF-1485C-SS-2401	WHF-1485C-SS-2501	WHF-1485C-SS-2601	WHF-1485C-SS-2701	WHF-1485C-SS-2801	WHF-1485C-SS-2901
Collect Date		10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	**0.1**/0.7/8/**0.062**/**0.21/0.1**	0.03[J]	0.034[J]	**0.11[J]**	0.076[J]	0.029[J]	**0.24[J]**
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
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[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** (underlined) indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SB30	WHF-1485C-SB31	WHF-1485C-SB32	WHF-1485C-SB33	WHF-1485C-SB34	WHF-1485C-SB35
Sample No.	Regulatory Criteria	WHF-1485C-SS-3001	WHF-1485C-SS-3101	WHF-1485C-SS-3201	WHF-1485C-SS-3301	WHF-1485C-SS-3401	WHF-1485C-SS-3501
Collect Date		10/16/2003	10/16/2003	10/16/2003	10/16/2003	11/11/2003	11/11/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	**0.1/0.7/8/0.062/0.21/0.1**	**0.29[J]**	**9[J]**	**0.88[J]**	0.057[J]	0.034[J]	0.036[J]
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 7 OF 9

Sample Location		WHF-1485C-SB36	WHF-1485C-SB37	WHF-1485C-SB38	WHF-1485C-SB39	WHF-1485C-SB40	WHF-1485C-SB41
Sample No.	Regulatory Criteria	WHF-1485C-SS-3601	WHF-1485C-3701	WHF-1485C-3801	WHF-1485C-3901	WHF-1485C-4001	WHF-1485C-4101A
Collect Date		11/11/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	--	--	--	--	--
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	--	--	--	--	0.014^J
Fluoranthene	3200/59000/1200/2300/22000/**0.1**	NA	0.052^J	0.041^J	0.068	0.097	**0.80**
Phenanthrene	2200/36000/250/NC/NC/**0.1**	NA	0.016	0.0088	0.016	0.024	**0.2**
Pyrene	2400/45000/880/2300/29000/**0.1**	NA	0.053^J	0.032^J	0.065	0.079	**0.61**
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	0.031^J	0.021^J	0.034^J	0.045^J	0.30^J
Benzo(a)pyrene equivalent	**0.1**/0.7/8/NC/NC/NC	NS	0.05763	0.03315	0.06899	0.080934	**0.57343**
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	0.02^J/0.002	0.011/0.0011	0.026/0.0026	0.031/0.0031	0.26/0.026
Benzo(a)pyrene	0.1/0.7/8/**0.062**/**0.21**/**0.1**	0.018^J	0.036^J/0.036	0.022/0.022	0.044/0.044	0.053/0.053	**0.38**/0.38
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	0.038/0.0038	0.022/0.0022	0.047/0.0047	0.055/0.0055	0.39/0.039
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	0.02/0.0002	0.013^J/0.00013	0.025/0.00025	0.029/0.00029	0.21/0.0021
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	0.029/0.000029	0.018/0.000018	0.038/0.000038	0.044/0.000044	0.33/0.00033
Dibenz(a,h)anthracene[9]	NC/NC/0.7/**0.062**/0.21/1[10]	NA	0.012^J/0.012	0.0057^J/0.0057	0.013^J/0.013	0.014^J/0.014	**0.091^J**/0.091
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	0.036/0.0036	0.02/0.002	0.044/0.0044	0.05/0.005	0.35/0.035
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	--	--	0.0017^J	--	--
4,4'-DDE	2.9/15/18/1.7/7/**0.0025**	NA	**0.0028**	0.0023	**0.023**	--	**0.0036**
4,4'-DDT	2.9/15/11/1.7/7/**0.0025**	NA	0.0021	0.0024	**0.0049**	--	--
Aldrin	0.06/0.3/0.2/0.029/0.10/**0.0025**	NA	--	--	0.00043^J	--	**0.0025**
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	0.0035	NS	0.015	1.17	0,004
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	0.0018^J	--	0.015	**0.61**	0.0018^J
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	0.0017^J	--	--	**0.56**	0.0022^J
Dieldrin	**0.06**/**0.3**/**0.002**/**0.03**/**0.11**/**0.0005**	NA	**0.019**	**0.0013^J**	**0.036**	**0.34^J**	**0.015^J**
Endrin	25/510/1/18/180/0.001	NA	--	--	0.0004^J	--	--
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	--	--	--	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	--	--	0.0028^J	--	0.00086^J
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	9^J	10^J	12	34	75

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
^{J} Indicates the presence of a chemical at an estimated concentration.

TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-1485C-SB42	WHF-1485C-SB43	WHF-1485C-SB44	WHF-1485C-SB45	WHF-1485C-SB46	WHF-1485C-SB47
Sample No.	Regulatory Criteria	WHF-1485C-4201A	WHF-1485C-4301	WHF-1485C-4401	WHF-1485C-4501	WHF-1485C-4601	WHF-1485C-4701
Collect Date		11/10/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	--	--	--	0.029	0.016[J]	--
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	--	--	--	0.0012[J]	0.00096[J]	--
Fluoranthene	3200/59000/1200/2300/22000/**0.1**	0.063	**0.24**	**0.31**	**0.13**	**0.11**	**0.32**
Phenanthrene	2200/36000/250/NC/NC/0.1	0.014	0.052	--	0.027	0.029	0.058
Pyrene	2400/45000/880/2300/29000/**0.1**	0.057[J]	**0.27**	**0.39**	**0.10**	0.094[J]	**0.29**
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	0.023[J]	0.11[J]	0.16[J]	0.056[J]	0.041[J]	0.22[J]
Benzo(a)pyrene equivalent	**0.1**/0.7/8/NC/NC/NC	0.04291	**0.26036**	**0.41803**	**0.11513**	0.08398	**0.46796**
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	0.019/0.0019	0.17[J]/0.017	0.23/0.023	0.043/0.0043	0.041/0.0041	0.22/0.022
Benzo(a)pyrene	NC/NC/8/**0.062**/**0.21**/**0.1**	0.028/0.028	**0.18**/0.18	**0.28**/0.28	**0.073**/0.073	0.058/0.058	**0.33**/0.33
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	0.029/0.0029	0.24/0.024	0.31/0.031	0.07/0.007	0.06/0.006	0.3/0.03
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	0.018/0.00018	0.12/0.0012	0.18/0.0018	0.047/0.00047	0.032/0.00032	0.17/0.0017
Chrysene[9]	NC/NC/77/62/210/1[10]	0.029/0.000029	0.16/0.00016	0.23/0.00023	0.062/0.000062	0.056/0.000056	0.26/0.00026
Dibenz(a,h)anthracene[9]	NC/NC/0.7/**0.062**/0.21/1[10]	0.0073[J]/0.0073	0.027[J]/0.027	**0.066[J]**/0.066	0.023[J]/0.023	0.011[J]/0.011	0.059[J]/0.059
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	0.026/0.0026	0.11/0.011	0.16/0.016	0.073/0.0073	0.045/0.0045	0.25/0.025
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/**0.0025**	--	**0.11**	--	0.00072[J]	**0.011**	0.00082[J]
4,4'-DDE	2.9/15/18/1.7/7/**0.0025**	--	**0.13**	**0.041**	0.001[J]	**0.013**	**0.0029[J]**
4,4'-DDT	2.9/15/11/1.7/7/**0.0025**	0.0019[J]	**0.33**	**0.087**	--	0.0018[J]	--
Aldrin	0.06/0.3/0.2/0.029/0.10/**0.0025**	**0.0058[J]**	--	0.0019[J]	0.0017[J]	0.0019[J]	0.00095[J]
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	0.149	0.3	0.0117	0.00215	0.0224	0.0025
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	0.069	**0.15**	0.0067[J]	0.0012[J]	0.013	0.0025[J]
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	0.08	**0.15**	0.005[J]	0.00095[J]	0.0094[J]	--
Dieldrin	**0.06**/**0.3**/**0.002**/**0.03**/**0.11**/**0.0005**	**0.019**	**0.30**	**0.06**	**0.0048**	**0.013[J]**	**0.02**
Endrin	25/510/1/18/180/**0.001**	--	**0.018[J]**	--	--	--	--
Endrin Ketone	NC/NC/NC/NC/0.1[13]	--	0.004[J]	--	--	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	0.0099[J]	--	--	--	--	--
Total Recoverable Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	75	130	150	32	190	27

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
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[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
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Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
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TABLE 5-1

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-41-SS-4801	WHF-41-SS-4901	WHF-41-SS-5001	WHF-41-SS-5101	WHF-41-SS-5201	WHF-41-SS-5301
Sample No.	Regulatory Criteria	WHF-41-SS-48-1	WHF-41-SS-49-1	WHF-41-SS-50-1	WHF-41-SS-51-1	WHF-41-SS-52-1	WHF-41-SS-53-1
Collect Date		8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]						
Volatiles[7] (mg/kg)							
Acetone	11000/68000/25/14000/54000/NC	NA	NA	NA	NA	NA	NA
Semivolatile[8] (mg/kg)							
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NC/NC/0.1	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NC/NC/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	**0.1**/0.7/8/**0.062**/**0.21**/**0.1**	0.0024[J]	0.032	0.0063[J]	**0.16[J]**	**0.30**	0.0061[J]
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/**0.062**/0.21/1[10]	--	0.01	0.0027[J]	0.056[J]	**0.10**	0.0025[J]
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)							
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA
Dieldrin	**0.06**/0.3/**0.002**/**0.03**/**0.11**/**0.0005**	--	**0.0458**	**0.00466[J]**	**0.182**	**0.0135[J]**	--
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA
Endrin Ketone	NC/NC/NC/NC/0.1[13]	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA
Total Recoverable							
Petroleum Hydrocarbons[14] (mg/kg)	460/2700/340/NC/NC/NC	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
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[7] SW-846 8260B, [8] SW-846 8270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] FDEP FL-PRO
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NC = no regulatory criterion available NS = no sum
[J] Indicates the presence of a chemical at an estimated concentration.

values in surface and subsurface soils across NAS Whiting Field and surrounding outlying fields slightly elevated arsenic values have also been determined to be naturally occurring when no facility activity has been identified as a potential cause of the elevated concentrations (FDEP, 2001). These referenced reports are found in Appendix B.

In the data tables associated with this chapter, concentrations of these analytes that exceed either primary or secondary criteria are indicated as such in the tables. However, these five naturally occurring inorganic analytes are not indicated as exceedances of primary or secondary criteria (because they are considered naturally occurring) on the sample results maps in this chapter or in the text for this chapter.

The complete analytical results for the investigation are provided in Appendix C.

5.1 SURFACE SOIL INVESTIGATION RESULTS

From May 24, 2000 to August 31, 2004, 53 surface soil samples were collected from 0 to 1 foot bls and analyzed for various parameters. Laboratory analytical results were compared to FDEP SCTLs for Residential Use [DE1 in the analytical data tables (primary criteria)], FDEP SCTLs for Commercial/Industrial Use [DE2 in the analytical data tables (primary criteria)], FDEP SCTLs for LE based on groundwater criteria (primary criteria), NAS Whiting Field background screening values for inorganics only (secondary criteria), USEPA Region 9 PRGRs and PRGIs (secondary criteria), and USEPA Region 4 RAG (secondary criteria) to determine if contaminants in the surface soil samples exceeded regulatory criteria (FDEP, 2005; USEPA, 2004; and USEPA, 2002).

Selected samples were also prepared for SPLP analysis. The SPLP analytical results were compared to FDEP GCTLs (primary criteria), USEPA PDWSs (primary criteria), and USEPA SDWSs (secondary criteria) to determine if contaminants in leachate exceeded regulatory criteria (FDEP, 2005 and USEPA, 2006).

In the analytical results tables, concentrations exceeding regulatory criteria are indicated by bold type. Regulatory criteria that have been exceeded are shown with bold and underlined type.

5.1.1 Organics

As indicated in Chapter 3.0 and in Table 5-1, the initial six samples collected were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TRPH. Many subsequent samples were analyzed only for the SVOC B(a)P. B(a)P is used as an indicator analyte which when detected would imply other related SVOCs are present and would likely also exceed regualtory criteria and require remediation. In 2003, 11 additional samples (SB37 to SB47) were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TRPH. In 2004, 6 samples (SS48 to SS53) were sampled for B(a)P, D(a,h)A, aldrin, and dieldrin.

VOCs

Acetone was the only VOC detected in surface soil samples; however, concentrations did not exceed any primary or secondary criteria (Table 5-1). Since acetone is considered a common laboratory contaminant, the low concentrations detected are likely due to laboratory contamination.

SVOCs

Seven surface soil samples contained B(a)P equivalent concentrations exceeding the FDEP DE1 exposure limit (Table 5-1 and Figure 5-1). Two surface soil samples contained B(a)P concentrations exceeding FDEP DE2 exposure limits. Eighteen surface soil samples contained B(a)P in exceedance of PRGR, PGRI, or RAGs criteria. D(a,h)A was detected in three surface soil samples (SB41, SB44, and SB52) exceeding PRGR.

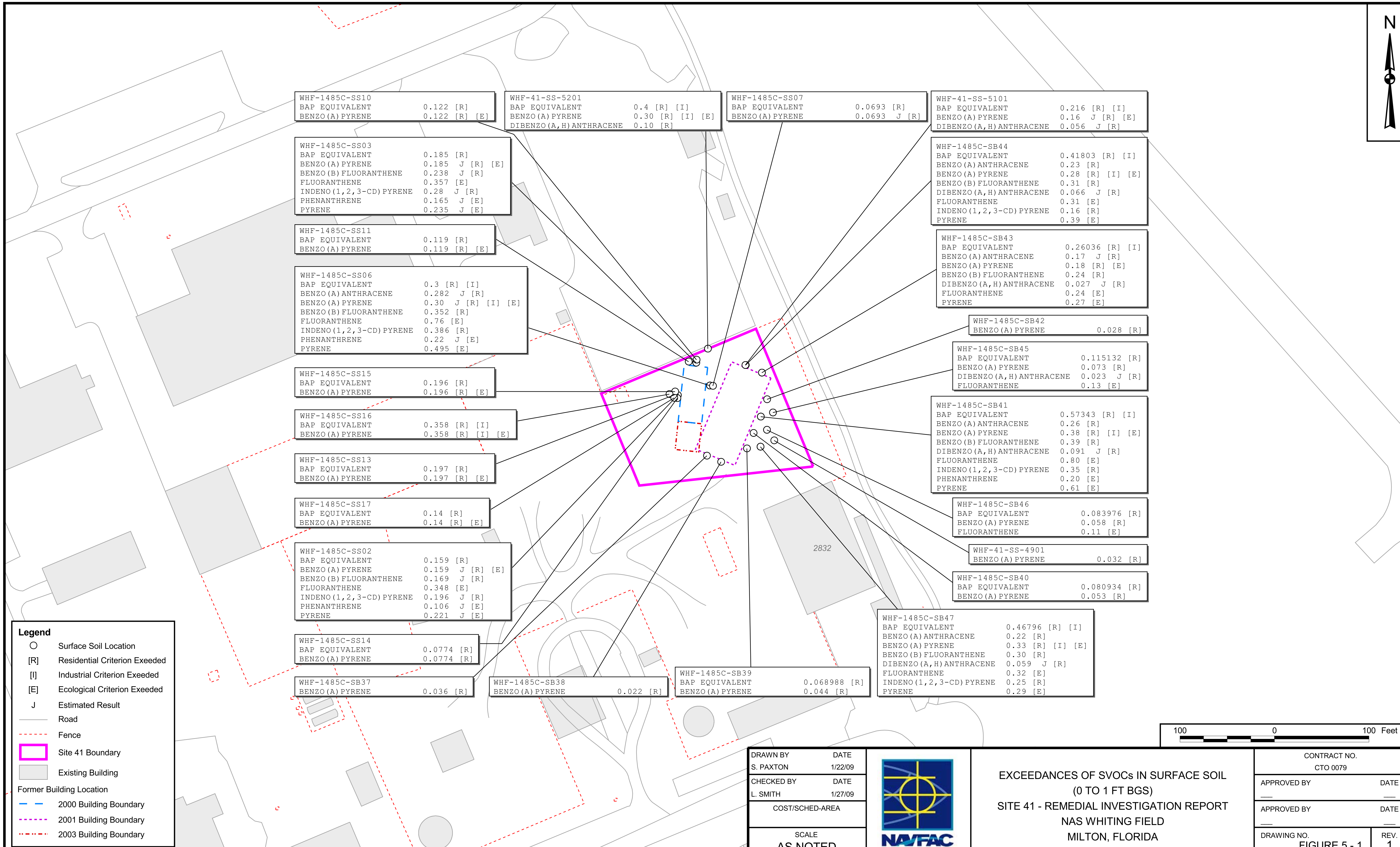
The detection limits for several of the PAHs were elevated in some samples above the SCTLs as provided in Chapter 62-777 F.A.C.. As a result of the elevated detection limits, PAH contaminant levels may exceed the SCTLs even though non-detects were reported. At the time of analysis, the best achievable detection limit using this method was higher than the SCTL; therefore, the ability to meet the SCTLs was not possible. Because several of the PAHs were reported with elevated non-detects, it is possible that the concentrations exceed the SCTL. The affected compounds and samples are:

- B(a)A in the sample from location SS04
- B(a)P in samples from locations SS01, SS04 and SS05
- B(b)F in the sample from location SS04
- D(a,h)A in the samples from locations SS01 through SS06
- Indeno(1,2,3-cd)pyrene (IP) in the sample from location SS04

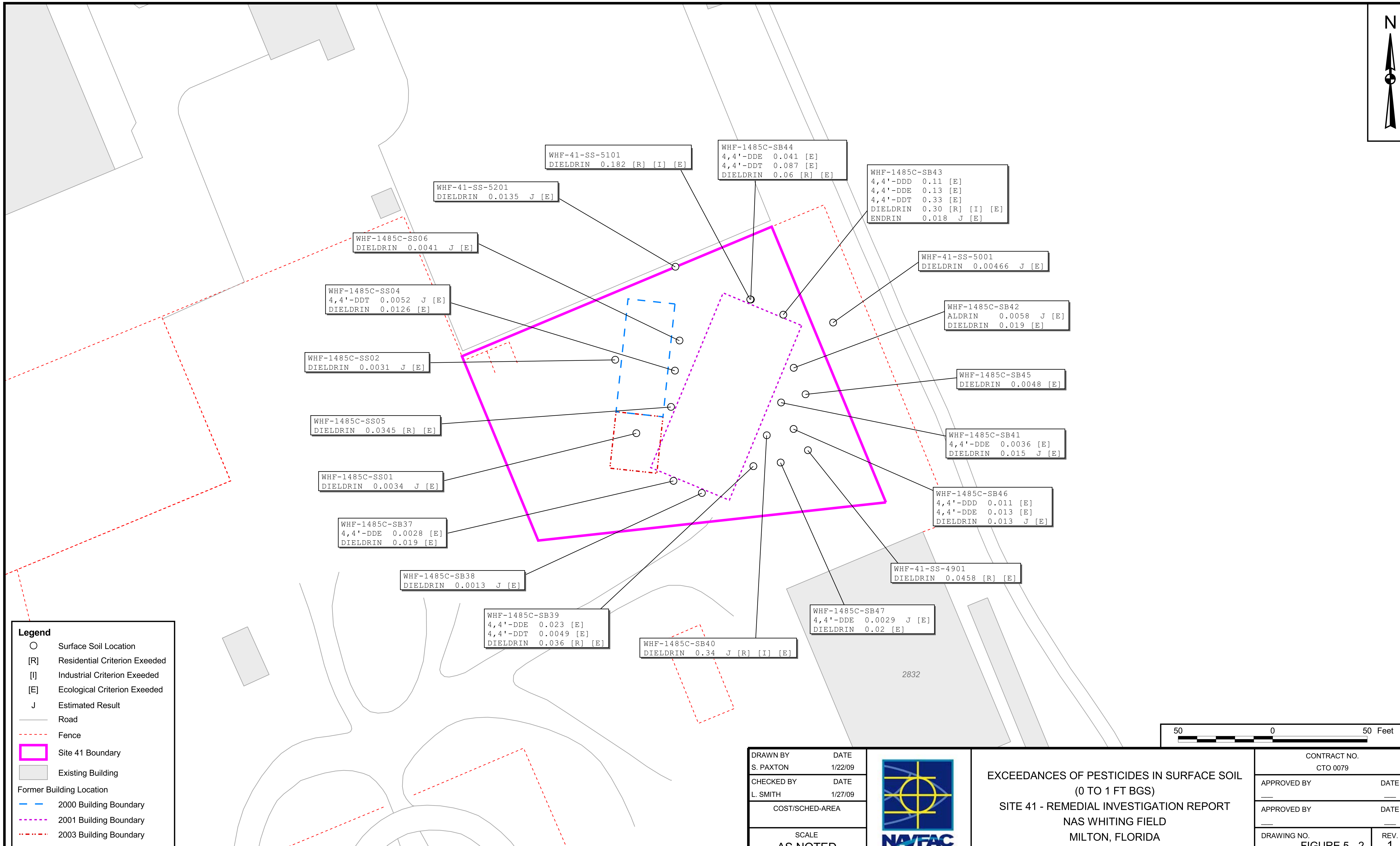
Pesticides/PCBs

Widespread pesticide contamination was found in surface soils at Site 41. Dieldrin was detected at concentrations exceeding DE1 in four samples SS40, SS43, SS44, and SS51. DE2 was excedded in two samples: SB40 and SB43. At least one primary criterion (PRGR, PGR1, or RAG) was exceeded in 20 of 22 samples analyzed for pesticides (Table 5-1 and Figure 5-2). No pesticides other than dieldrin were found at levels above primary or secondary criteria. No PCBs were detected in the 17 samples analyzed for these compounds. The detection limits for aldrin and dieldrin were elevated above the SCTLs as provided in Chapter 62-777 F.A.C. for at least one sample. As a result of the elevated detection limits, concentrations of these compounds may exceed the SCTLs. At the time of analysis, the best achievable

P:\GIS\WHITINGFIELD_NAS\MAPDOCS\APR\SITE41_TAG_MAPS.APR SURFACE SOIL SVOC TAG LAYOUT 1/27/09 SP



P:\GIS\WHITINGFIELD_NAS\MAPDOCS\APR\SITE41_TAG_MAPS.APR SURFACE SOIL PESTICIDE TAG LAYOUT 1/27/09 SP



detection limit using this method was higher than the SCTL; therefore, the ability to meet the SCTLs was not possible. Because these compounds were reported with elevated non-detects, and practical quanitation limits (PQLs) were not available at the time of analysis, it is possible that concentrations may exceed the SCTLs. The affected compounds and samples are:

- Aldrin in the sample from location SB40
- Dieldrin in the samples from locations SS03, SS48, and SS53

Therefore, prior to future action additional equivalent soil samples should be collected and reanalyzed to determine if concentrations in the soil samples from this area exceed FDEP SCTLs, USEPA PRGR, USEPA PRGI, or RAGs criteria.

TRPH

TRPH concentrations did not exceed primary criteria in any of the 16 samples analyzed for this group of compounds.

5.1.2 Inorganics

As indicated in Chapter 3.0 and in Table 5-2, 17 of the surface soil samples were analyzed for TAL metals plus cyanide.

Nineteen of the TAL metals were detected in at least one surface soil sample at Site 41 (Table 5-2). Aluminum, arsenic, barium, calcium, chromium, copper, lead, magnesium, manganese, nickel, potassium, zinc, and cyanide exceeded the background screening values in at least one soil sample. Aluminum, chromium, iron, lead, manganese, vanadium, and zinc, exceeded the USEPA RAG secondary values in at least one soil sample. Arsenic, exceeded the USEPA PRGR and PRGI secondary values in multiple soil samples. See the discussion of arsenic in the first section of Chapter 5.0.

Antimony, cadmium, cobalt, mercury, and sodium were detected in mulitple samples, but none of the concentrations exceeded primary criteria. Cyanide was detected in three of the samples, but none of the concentrations exceeded primary criteria.

5.1.3 SPLP Results

The samples collected at locations SS01 through SS06 were prepared using the SPLP methods to evaluate the potential impact from site soils to groundwater. All six samples were analyzed for TCL pesticides, TAL metals, and TRPH. The samples from SS02, SS03, and SS05 were also analyzed for TCL SVOCs (Table 5-3).

TABLE 5-2

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 3

Sample Location		WHF-1485C-SS01	WHF-1485C-SS02	WHF-1485C-SS03	WHF-1485C-SS04	WHF-1485C-SS05	WHF-1485C-SS06
Sample No.		1485CD00101	1485CD00201	1485CD00301	1485CD00401	1485CD00501	1485CD00601
Collect Date		5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)						
TAL Metals[8] (mg/kg)							
Aluminum	80000/*/***/15848/76000/100000/**50**	**7590**	**9110**	**7630**	**7290**	**8730**	**7140**
Antimony	27/370/5.4/8/31/410/3.5	--	--	--	--	--	--
Arsenic	2.1/12/***/3.2/0.39/1.6/10	--	--	--	--	--	--
Barium	120**/130000/1600/**23.2**/5400/67000/165	18.1	15.2	18.9	19.1	14	**32.7**
Cadmium	82/1700/7.5/0.58/37/450/1.6	--	--	--	--	--	--
Calcium	NA/NA/NA/**396**/NA/NA/NA	**1710**	**1220**	**1520**	**1860**	**778**	**1290**
Chromium	210/470/38/**11**/210/450/**0.4**	**7.9**	**10.4**	**7.4**	**10.4**	**9**	**11.8**
Cobalt	1700/420000/***/3/900/1900/20	1.8	0.91	0.93	0.95	0.99	0.89
Copper	150**/89000/***/**9.4**/3100/41000/40	4.2	5.1	4.8	9.4	**15.4**	5.7
Iron	53000/*/***/8832/23000/100000/**200**	**3610**	**7060**	**4130**	**4170**	**5140**	**3360**
Lead	400/1400/***/**11.4**/400/800/**50**	6.4	7.9	9.7	**145**	8.6	12.8
Magnesium	NA/NA/NA/**268**/NA/NA/NA	**736**	**284**	**496**	**444**	208	**315**
Manganese	3500/43000/***/392/1800/19000/**100**	94.6	**109**	**126**	95.4	98.5	**158**
Mercury	3/17/2.1/0.12/23/310/0.1	--	0.01	0.02	0.02	--	--
Nickel	340**/35000/130/**7.2**/1600/20000/30	**8**	--	--	--	--	4.1
Potassium	NA/NA/NA/**177**/NA/NA/NA	**268**	174	147	160	**183**	154
Sodium	NA/NA/NA/406/NA/NA/NA	322	367	347	368	337	299
Vanadium	67**/10000/980/21.8/78/1000/**2.0**	**10.5**	**14.5**	**10.8**	**13.3**	**12.7**	**10.9**
Zinc	26000/630000/***/**15.4**/23000/100000/50	11.6	**16.7**	**16.4**	**68.1**	**17.2**	14.6
Cyanide[9] (mg/kg)	34**/11000/0.8/0.28/1200/12000/0.9	--	0.6[J]	--	--	--	0.76[J]

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7]EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NA = not analyzed -- = not detected [J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-2

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 2 OF 3

Sample Location		WHF-1485C-SB37	WHF-1485C-SB38	WHF-1485C-SB39	WHF-1485C-SB40	WHF-1485C-SB41	WHF-1485C-SB42
Sample No.		WHF-1485C-3701	WHF-1485C-3801	WHF-1485C-3901	WHF-1485C-4001	WHF-1485C-4101	WHF-1485C-4201
Collect Date		11/10/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)						
TAL Metals[8] (mg/kg)							
Aluminum	80000/*/***/15848/76000/100000/**50**	**7930**	**9740**	**9670**	**9100**	**5720**	**5510**
Antimony	27/370/5.4/8/31/410/3.5	0.52	--	--	0.26	--	--
Arsenic	2.1/12/***/3.2/**0.39**/**1.6**/10	**1.7**	**1.6**	**2**	**1.8**	**1.3**	**1.2**
Barium	120**/130000/1600/**23.2**/5400/67000/165	11.9	13.3	14.1	**62.2**	12.3	8.9
Cadmium	82/1700/7.5/0.58/37/450/1.6	0.22	--	0.047	0.075	--	0.061
Calcium	NA/NA/NA/396/NA/NA/NA	690	1510	1230	1480	2080	992
Chromium	210/470/38/**11**/210/450/**0.4**	**75**^{J}	**8.9**^{J}	**9.4**^{J}	**12.1**^{J}	**4.9**^{J}	**6**^{J}
Cobalt	1700/420000/***/3/900/1900/20	0.57	--	--	--	--	--
Copper	150**/89000/***/9.4/3100/41000/40	7	3.4	4.3	5.8	2.4	5
Iron	53000/*/***/8832/23000/100000/**200**	**4850**	**4980**	**5950**	**5310**	**3450**	**3100**
Lead	400/1400/***/**11.4**/400/800/**50**	**345**	8.2	**21.2**	**34**	5.2	**18.4**
Magnesium	NA/NA/NA/**268**/NA/NA/NA	179	**290**	159	**357**	**552**	158
Manganese	3500/43000/***/392/1800/19000/100	57.5	93	70.3	52.5	33.8	40.1
Mercury	3/17/2.1/0.12/23/310/0.1	--	--	--	--	--	--
Nickel	340**/35000/130/7.2/1600/20000/30	2.1	1.9	1.8	2.1	1.8	1.6
Potassium	NA/NA/NA/**177**/NA/NA/NA	70.9	55.4	80.5	**199**	**177**	**196**
Sodium	NA/NA/NA/406/NA/NA/NA	--	--	--	--	--	--
Vanadium	67**/10000/980/21.8/78/1000/**2.0**	**11.7**	**14.9**	**20**	**13.9**	**8.8**	**8.1**
Zinc	26000/630000/***/**15.4**/23000/100000/**50**	**89.3**^{J}	12.2^J	15.1^J	**21.9**^{J}	9.1^J	**22.7**^{J}
Cyanide[9] (mg/kg)	34**/11000/08/**0.28**/1200/12000/0.9	**0.31**	--	--	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NA = not analyzed -- = not detected ^{J} Indicates the presence of a chemical at an estimated concentration.

TABLE 5-2

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 3 OF 3

Sample Location		WHF-1485C-SB43	WHF-1485C-SB44	WHF-1485C-SB45	WHF-1485C-SB46	WHF-1485C-SB47
Sample No.		WHF-1485C-4301	WHF-1485C-4401	WHF-1485C-4501	WHF-1485C-4601	WHF-1485C-4701
Collect Date		11/10/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)					
TAL Metals[8] (mg/kg)						
Aluminum	80000/*/***/15848/76000/100000/**50**	**9970**	**6370**	**6090**	**7510**	**9560**
Antimony	27/370/5.4/8/31/410/3.5	0.94	0.87	--	--	--
Arsenic	**2.1**/12/***/3.2/**0.39**/**1.6**/10	**5.4**	**3.2**	**1.3**	**1.5**	**1.7**
Barium	120**/130000/1600/**23.2**/5400/67000/165	**37.7**	16.7	10.6	9.8	13.7
Cadmium	82/1700/7.5/0.58/37/450/1.6	0.77	0.2	--	--	--
Calcium	NA/NA/NA/**396**/NA/NA/NA	**793**	**787**	**519**	**397**	**1020**
Chromium	210/470/38/**11**/210/450/**0.4**	**23.3**^{J}	**9.6**^{J}	**5.1**^{J}	**6**^{J}	**8**^{J}
Cobalt	1700/420000/***/3/900/1900/20	0.93	--	0.63	--	--
Copper	150**/89000/***/**9.4**/3100/41000/40	**11.3**	8.6	3.2	3.6	9
Iron	53000/*/***/8832/23000/100000/**200**	**6510**	**3690**	**3630**	**4470**	**5520**
Lead	400/1400/***/**11.4**/400/800/**50**	**137**^{J}	**54.4**^{J}	4.6^J	9.6^J	11^J
Magnesium	NA/NA/NA/**268**/NA/NA/NA	167	134	157	147	**324**
Manganese	3500/43000/***/392/1800/19000/**100**	**135**^{J}	85.4^J	68.9^J	31.4^J	56.3^J
Mercury	3/17/2.1/0.12/23/310/0.1	0.023^J	0.019^J	0.021^J	--	0.015^J
Nickel	340**/35000/130/7.2/1600/20000/30	3	1.8	2	2.1	2.3
Potassium	NA/NA/NA/**177**/NA/NA/NA	**251**	109	141	**205**	128
Sodium	NA/NA/NA/406/NA/NA/NA	--	--	--	--	--
Vanadium	67**/10000/980/21.8/78/1000/**2.0**	**16.6**	**9**	**9**	**11**	**13.8**
Zinc	26000/630000/***/**15.4**/23000/100000/**50**	**139**^{J}	**49.7**^{J}	9.1^J	9.9^J	**27.7**^{J}
Cyanide[9] (mg/kg)	34**/11000/08/0.28/1200/12000/0.9	--	--	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7]EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
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P:\GIS\WHITINGFIELD_NAS\MAPDOCS\APR\SITE41_TAG_MAPS.APR SURFACE SOIL METALS TAG LAYOUT 1/28/09 SP

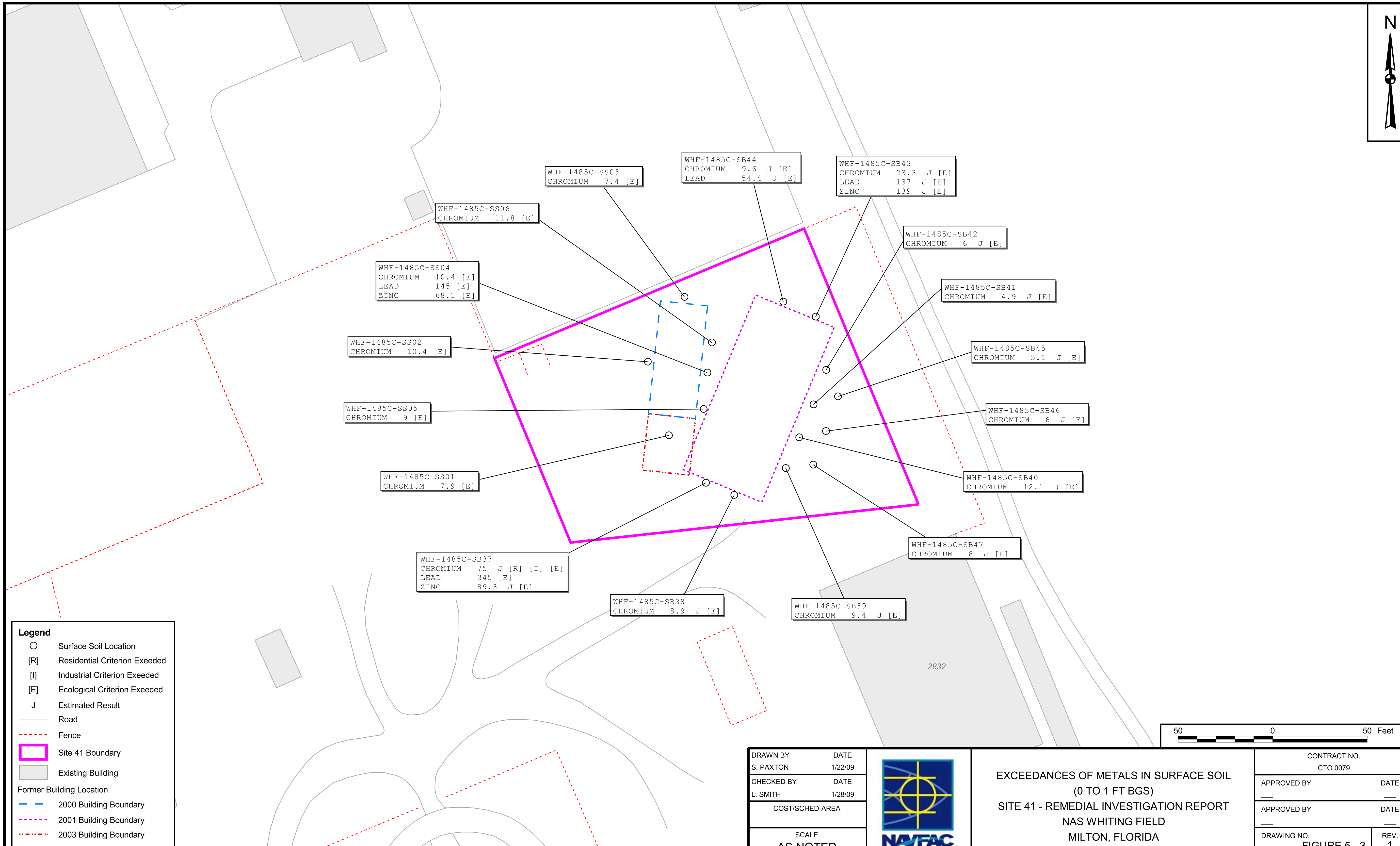

TABLE 5-3

SUMMARY OF ANALYTES DETECTED IN SURFACE SOIL LEACHATE - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA

Sample Location		WHF-1485C-SS01	WHF-1485C-SS02	WHF-1485C-SS03	WHF-1485C-SS04	WHF-1485C-SS05	WHF-1485C-SS06
Sample No.	Regulatory Criteria	1485CD00101	1485CD00201	1485CD00301	1485CD00401	1485CD00501	1485CD00601
Collect Date		5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000	5/24/2000
Sample Depth (bls)		0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
	Groundwater Criteria[1]/Primary[2]/ Secondary[3]						
Volatile[4] (ug/L)							
Ethylbenzene	30/700/NA	NA	NA	NA	NA	NA	NA
Toluene	40/1000/NA	NA	NA	NA	NA	NA	NA
Xylenes	20/10000/NA	NA	NA	NA	NA	NA	NA
Semivolatile[5] (ug/L)							
2-Methylnaphthalene	28/NA/NA	NA	--	--	NA	NA	--
Fluoranthene	280/NA/NA	NA	--	--	NA	NA	--
Naphthalene	14/NA/NA	NA	--	--	NA	NA	--
Phenanthrene	210/NA/NA	NA	--	--	NA	NA	--
Pyrene	210/NA/NA	NA	--	--	NA	NA	--
Pesticides/PCBs[6] (ug/L)							
no detects							
Total Recoverable Petroleum Hydrocarbons[7] (ug/L)	5000/NA/NA	--	NA	NA	--	--	--
Metals[4] (ug/L)							
Aluminum	**200**/NA/**50-200**	**72800**	**53800**	**13000**	**23800**	**54600**	**64500**
Barium	2000/2000/NA	53	33	14	31	38	78
Calcium	NA/NA/NA	5200	7500	2400	9000	6200	8100
Chromium	100/100/NA	46	37	--	20	37	42
Copper	1000/NA/1000	17	13	--	16	28	18
Iron	**300**/NA/**300**	**34800**	**31400**	**6600**	**11100**	**28900**	**26400**
Lead	**15**/NA/NA	**23**	--	--	**190**	**31**	**37**
Magnesium	NA/NA/NA	1800	1200	810	1300	1600	2000
Manganese	**50**/NA/**50**	**220**	**210**	**110**	**130**	**250**	**550**
Mercury	2/2/NA	--	--	--	--	--	--
Nickel	100/NA/NA	--	--	--	--	--	21
Potassium	NA/NA/NA	2900[J]	3300[J]	--	--	2300[J]	4100[J]
Sodium	160000/NA/NA	5700	5100	8400	9800	11300	8000
Vanadium	**49**/NA/NA	**94**	**80**	19	40	**76**	**84**
Zinc	5000/NA/5000	53[J]	47[J]	--	120[J]	64[J]	66[J]

[1] Groundwater Clean-up Criteria as provided in Chapter 62-777, F.A.C. 17April 2005
[2] EPA 40 CFR Primary Drinking Water Standards
[3] EPA 40 CFR Secondary Drinking Water Standards
[4] SW-846 8260B, [5] SW-846 8270C, [6] SW-846 8081A/8082, [7] FL-PRO, [8] SW-846 6010B and 7470A/7471
Bold indicates an exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NA = not analyzed -- = not detected
[J] Indicates the presence of a chemical at an estimated concentration.

No SVOCs or pesticides were detected in any of the samples. Fourteen metals were detected in at least one sample. The concentrations of lead exceeded the primary criteria in the samples from SS01, SS04, SS05, and SS06.

5.2 SUBSURFACE SOIL INVESTIGATION RESULTS

From June 5, 2000 to August 31, 2004, 67 subsurface soil samples were collected from 53 locations. Initial sampling events were guided by the Work Plan, in later events sampling locations were iterative. Samples were collected from 0 to 10 feet bls, and they were analyzed for various parameters. Initially, FID screening results were used to determine if samples were contaminated. Samples were not collected below 10 feet bls because FID screening indicated the soil at 10 feet bls was not impacted. Laboratory analytical results were compared to FDEP SCTLs for Residential Use (DE1) in the analytical data tables (primary criteria), FDEP SCTLs for Commercial/Industrial use (DE2) in the analytical data tables (primary criteria), FDEP SCTLs for LE based on groundwater criteria (primary criteria), NAS Whiting Field background screening values for inorganics only (secondary criteria), USEPA Region 9 PRGRs and PRGIs (secondary criteria), and USEPA Region 4 RAGs (secondary criteria) to determine if contaminants in the subsurface soil samples exceeded regulatory criteria.

Selected samples were also prepared for SPLP analysis to determine if contaminants were leaching to groundwater. The analytical results were compared to FDEP GCTLs (primary criteria), USEPA PDWS (primary criteria), and USEPA SDWSs (secondary criteria).

On the analytical results tables, concentrations exceeding regulatory criteria are indicated by bold type. Regulatory criteria that have been exceeded are shown with bold and underlined type.

5.2.1 Organics

As indicated in Chapter 3.0 and in Table 5-4, 23 of the subsurface soil samples were analyzed for B(a)P only as this compound is considered an indicator compound for this site. Eighteen of the samples were analyzed for D(a,h)A, aldrin, dieldrin, and heptachlor, in addition to B(a)P. The remaining 26 samples collected after the area of investigation were widened to include the new building location area were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, and TRPH.

VOCs

All 26 samples were analyzed for VOCs but only detected in subsurface soil samples in three instances, at locations SB45 and SB46. Acetone and 2-butanone were the only VOCs detected at the two subsurface soil sample locations, SB45 and SB46. Concentrations did not exceed any primary or

TABLE 5-4

**ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 10**

Sample Location		WHF-1485C-SB05	WHF-1485C-SB06	WHF-1485C-SB07	WHF-1485C-SB08	WHF-1485C-SB09	WHF-1485C-SB21	WHF-1485C-SB22
Sample No.	Regulatory Criteria	1485CD00510	1485CD00605	1485CD00705	1485CD00810	WHF-1485C-SS-0902	WHF-1485C-SS-2102	WHF-1485C-SS-2202
Collect Date		6/5/2000	6/5/2000	6/5/2000	6/5/2000	10/16/2003	10/16/2003	10/16/2003
Sample Depth (bls)		8-10'	3-5'	3-5'	8-10'	1-2'	1-2'	1-2'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	--	--	--	--	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	--	--	--	--	NA	NA	NA
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	--	--	--	--	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	--	--	--	--	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	--	--	--	--	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	--	--	--	--	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	--	--	--	--	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	--	--	--	--	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	--	--	--	--	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	--	--	--	--	NA	NA	NA
Benzo(a)pyrene equivalent[9]	0.1/0.7/8/NC/NC/NC	NS	NS	NS	NS	NS	0.008	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	--	--	--	--	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	--	--	--	--	--	0.008/0.008	--
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	--	--	--	--	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	--	--	--	--	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	--	--	--	--	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	--	--	--	--	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	--	--	--	--	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)								
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	--	--	--	--	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	--	--	--	--	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	--	--	--	--	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	--	--	--	--	NA	NA	NA
Gama-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	--	--	--	--	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	--	--	--	--	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	--	--	--	--	NA	NA	NA
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	--	--	--	--	NA	NA	NA
Endrin	25/510/1/18/180/0.001	--	--	--	--	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	--	--	--	--	NA	NA	NA
Total Recoverable								
Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	--	--	--	--	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

**ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 2 OF 10**

Sample Location		WHF-1485C-SB23	WHF-1485C-SB24	WHF-1485C-SB25	WHF-1485C-SB26	WHF-1485C-SB27	WHF-1485C-SB28	WHF-1485C-SB29
Sample No.	Regulatory Criteria	WHF-1485C-SS-2302	WHF-1485C-SS-2402	WHF-1485C-SS-2502	WHF-1485C-SS-2602	WHF-1485C-SS-2702	WHF-1485C-SS-2802	WHF-1485C-SS-2902
Collect Date		10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003	10/16/2003
Sample Depth (bls)		1-2'	1-2'	1-2'	1-2'	1-2'	1-2'	1-2'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	NA	NA	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	NA	NA	NA	NA	NA	NA	NA
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent[9]	0.1/0.7/8/NC/NC/NC	NS	NS	NS	0.0054	0.0057	0.0026	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	--	--	--	0.0054[J]/0.0054	0.0057[J]/0.0057	0.0026[J]/0.0026	--
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)								
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA	NA
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Total Recoverable Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	NA	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 3 OF 10

Sample Location		WHF-1485C-SB30	WHF-1485C-SB31	WHF-1485C-SB31	WHF-1485C-SB31	WHF-1485C-SB31	WHF-1485C-SB31	WHF-1485C-SB31
Sample No.	Regulatory Criteria	WHF-1485C-SS-3002	WHF-1485C-SB-3102	WHF-1485C-SB-3103	WHF-1485C-3104	WHF-41-SS-31-4	WHF-41-SS-31-5	WHF-41-SS-31-6
Collect Date		10/16/2003	10/16/2003	10/16/2003	11/11/2003	8/31/2004	8/31/2004	8/31/2004
Sample Depth (bls)		1-2'	1-2'	2-3'	3-4'	3-4'	4-5'	5-6'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]							
<u>Volatiles[7] (mg/kg)</u>								
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	NA	NA	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	NA	NA	NA	NA	NA	NA	NA
<u>Semivolatiles[8] (mg/kg)</u>								
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent[9]	**<u>0.1</u>**/0.7/8/NC/NC/NC	0.011	**0.4**	**0.26**	0.02	0.0152	0.0128	0.0021
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/**<u>0.062</u>**/**<u>0.21</u>**/**<u>0.1</u>**	0.011/0.011	**0.4**/0.4	**0.26**/0.26	0.02/0.02	0.011/0.011	0.0094[J]/0.0094	0.0021[J]/0.0021
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	0.0042[J]/0.0042	0.0034[J]/0.0034	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
<u>Pesticides/PCBs[11] (mg/kg)</u>						PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	--	--	--
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Total Recoverable								
<u>Petroleum Hydrocarbons[15] (mg/kg)</u>	460/2700/340/NA/NA/NA	NA	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **<u>Bold</u>** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 4 OF 10

Sample Location		WHF-1485C-SB32	WHF-1485C-SB33	WHF-1485C-SB33	WHF-1485C-SB34	WHF-1485C-SB34	WHF-1485C-SB35	WHF-1485C-SB35
Sample No.	Regulatory Criteria	WHF-148SC-SS-3202	WHF-148SC-SS-3302	WHF-148SC-SS-3303	WHF-1485C-3402	WHF-1485C-3403	WHF-1485C-3502	WHF-1485C-3503
Collect Date		10/16/2003	10/16/2003	10/16/2003	11/11/2003	11/11/2003	10/11/2003	10/11/2003
Sample Depth (bls)		1-2'	1-2'	2-3'	1-2'	2-3'	1-2'	2-3'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6]							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	NA	NA	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	NA	NA	NA	NA	NA	NA	NA
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent[9]	**0.1**/0.7/8/NC/NC/NC	0.02	0.092	0.018	0.071	0.044	**0.19**	**0.11**
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/**0.062**/0.21/**0.1**	0.02/0.02	**0.092**/0.092	0.018/0.018	**0.071**/0.071	0.044/0.044	**0.19**/0.19	**0.11**/0.11
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)								
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	NA	NA	NA	NA	NA
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	NA	NA	NA	NA	NA	NA	NA
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Total Recoverable								
Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	NA	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 5 OF 10

Sample Location		WHF-1485C-SB36	WHF-1485C-SB36	WHF-1485C-SB37	WHF-1485C-SB37	WHF-1485C-SB-38	WHF-1485C-SB38	WHF-1485C-SB39
Sample No.	Regulatory Criteria	WHF-1485C-3602	WHF-1485C-3603	WHF-1485C-3702	WHF-1485C-3703	WHF-1485C-3802	WHF-1485C-3803	WHF-1485C-3902
Collect Date		11/11/2003	11/11/2003	10/11/2003	10/11/2003	10/11/2003	10/11/2003	10/11/2003
Sample Depth (bls)		1-2'	2-3'	1-2'	2-3'	1-2'	2-3'	1-2'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	--	--	--	--	--
Acetone	11000/68000/25/14000/54000/NA	NA	NA	--	--	--	--	--
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	--	--	--	--	--
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	--	--	--	--	--
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	0.0022[J]	0.0051[J]	0.021	--	0.0032[J]
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	--	--	--	--	--
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	--	0.0016[J]	0.004[J]	--	--
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	0.0017[J]	0.0036[J]	0.02	--	0.0031[J]
Carbazole	49/240/0.2/24/86/NA	NA	NA	--	--	--	--	--
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	0.0017[J]	0.0055[J]	0.0059[J]	--	0.0023[J]
Benzo(a)pyrene equivalent[9]	0.1/0.7/8/NC/NC/NC	0.026	0.032	0.00037	0.0029281	0.01243	NS	0.002812
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	--	--	0.0088/0.00088	--	--
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	0.026/0.026	0.032/0.032	--	0.0022[J]/0.0022	0.008/0.008	--	0.0023[J]/0.0023
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	0.0021[J]/0.0021	0.0032[J]/0.00032	0.011/0.0011	--	0.0029[J]/0.00029
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	--	0.0015[J]/0.000015	0.0057[J]/0.000057	--	--
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	--	0.0031[J]/0.0000031	0.013/0.000013	--	0.002[J]/0.000002
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	NA	NA	--	--	0.0017[J]/0.0017	--	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	0.0016[J]/0.00016	0.0039[J]/0.00039	0.0068[J]/0.00068	--	0.0022[J]/0.00022
Pesticides/PCBs[11] (mg/kg)								
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	--	--	--	--	--
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	0.0002[J]	--	--	--	0.0003[J]
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	--	--	--	--	
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	NA	NA	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	--	--	--	--	--
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	--	--	--	--	--
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	--	--	--	--	--
Dieldrin	0.06/0.3/**0.002**/0.03/0.11/**0.0005**	NA	NA	**0.0025**	--	--	--	--
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	--	--	--	--	
Endrin	25/510/1/18/180/0.001	NA	NA	--	--	--	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	--	--	--	--	--
Total Recoverable Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	NA	NA	--	--	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 6 OF 10

Sample Location		WHF-1485C-SB39	WHF-1485C-SB40	WHF-1485C-SB40	WHF-1485C-SB41	WHF-1485C-SB41	WHF-1485C-SB-42	WHF-1485C-SB-42
Sample No.	Regulatory Criteria	WHF-1485C-3903	WHF-1485C-4002	WHF-1485C-4003	WHF-1485C-4102A	WHF-1485C-4103A	WHF-1485C-SB4202A	WHF-1485C-SB4203A
Collect Date		10/11/2003	10/11/2003	10/11/2003	10/11/2003	10/11/2003	11/11/2003	11/11/2003
Sample Depth (bls)		2-3'	1-2'	2-3'	1-2'	2-3'	1-2'	2-3'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	--	--	--	--	--	--	--
Acetone	11000/68000/25/14000/54000/NA	--	--	--	--	--	--	--
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	--	--	--	--	--	--	--
Anthracene	21000/300000/2500/22000/100000/0.1	--	--	--	--	--	--	--
Fluoranthene	3200/59000/1200/2300/22000/0.1	0.0016J	0.0055J	0.066	0.034J	--	--	--
Fluorene	2600/33000/160/2700/26000/1[10]	--	--	--	0.0019J	--	--	--
Phenanthrene	2200/36000/250/NA/NA/0.1	--	0.0038J	0.014	0.0079	--	--	--
Pyrene	2400/45000/880/2300/29000/0.1	--	0.0036J	0.061	0.027	--	--	--
Carbazole	49/240/0.2/24/86/NA	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	0.0019J	0.0045J	0.032J	0.019J	--	--	--
Benzo(a)pyrene equivalent[9]	0.1/**0.7**/8/NC/NC/NC	0.00046	0.0032622	**0.073277**	0.032937	NS	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	--	0.0023J/0.00023	0.028/0.0028	0.013J/0.0013	--	--	--
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	--	0.0025J/0.0025	0.049/0.049	0.02/0.02	--	--	--
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	0.0028J/0.00028	0.0022J/0.00022	0.043/0.0043	0.024/0.0024	--	--	--
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	--	--	0.024/0.00024	0.012/0.00012	--	--	--
Chrysene[9]	NC/NC/77/62/210/1[10]	--	0.002J/0.000002	0.037/0.000037	0.017/0.000017	--	--	--
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	--	--	0.013J/0.013	0.007J/0.007	--	--	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	0.0018J/0.00018	0.0031J/0.00031	0.039/0.0039	0.021/0.0021	--	--	--
Pesticides/PCBs[11] (mg/kg)								
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	--	--	--	--	--		--
4,4'-DDE	2.9/15/18/1.7/7/0.0025	--	--	--	--	--		--
4,4'-DDT	2.9/15/11/1.7/7/0.0025	--	--	--	--	--	--	--
Aldrin	0.06/0.3/0.2/**0.029**/0.10/**0.0025**	--	--	--	**0.049**	--	0.0003J	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	0.0008	0.88	0.005	0.0111	0.0045
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/**0.1**[13]	--	--	0.0008J	**0.42**	0.0016J	0.0048J	0.002J
Gama-chlordane	NC/NC/9.6/1.6/6.5/**0.1**[13]	--	--	--	**0.46**	0.0034J	0.0063J	0.0025J
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	--	--	--	--	--	--	--
Dieldrin	**0.06**/0.3/**0.002**/**0.03**/**0.11**/**0.0005**	--	--	--	**0.15**	**0.0026**	**0.0016J**	0.0004J
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]							0.0006J
Endrin	25/510/1/18/180/**0.001**	--	--	--	**0.0068J**	--	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	--	--	--	--	--	0.0005J	0.0003J
Total Recoverable								
Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	--	--	14	7.4J	9.6J	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
J Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

**ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 7 OF 10**

Sample Location		WHF-1485C-SB43	WHF-1485C-SB43	WHF-1485C-SB43	WHF-1485C-SB43	WHF-1485C-SB43	WHF-1485C-SB44	WHF-1485C-SB44
Sample No.	Regulatory Criteria	WHF-1485C-4302	WHF-1485C-4303	WHF-41-SS-43-4	WHF-41-SS-43-5	WHF-41-SS-43-6	WHF-1485C-4402	WHF-1485C-4403
Collect Date		11/11/2003	11/11/2003	8/31/2004	8/31/2004	8/31/2004	11/11/2003	11/11/2003
Sample Depth (bls)		1-2'	2-3'	3-4'	4-5'	5-6'	1-2'	2-3'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	--	--	NA	NA	NA	--	--
Acetone	11000/68000/25/14000/54000/NA	--	--	NA	NA	NA	--	--
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/**0.008**/23/82/NA	**0.17[J]**	--	NA	NA	NA	--	--
Anthracene	21000/300000/2500/22000/100000/0.1	0.052[J]	--	NA	NA	NA	--	--
Fluoranthene	3200/59000/1200/2300/22000**0.1**	**3.1**	**0.34**	NA	NA	NA	0.002[J]	0.0078
Fluorene	2600/33000/160/2700/26000/1[10]	--	--	NA	NA	NA	--	--
Phenanthrene	2200/36000/250/NA/NA**0.1**	**0.32[J]**	--	NA	NA	NA	--	0.0016[J]
Pyrene	2400/45000/880/2300/29000**0.1**	**3.7**	**0.44**	NA	NA	NA	0.0018[J]	0.008
Carbazole	49/240/**0.2**/24/86/NA	**0.33[J]**	--	NA	NA	NA	--	--
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	1.2[J]	0.21[J]	NA	NA	NA	0.0057[J]	0.0041[J]
Benzo(a)pyrene equivalent[9]	**0.1**/0.7/8/NC/NC/NC		**0.51511**	NS	0.0032	0.0064	0.00217	0.008053
Benzo(a)anthracene[9]	NC/NC/**0.8**/**0.62**/**2.1**/1[10]	**2.5**	0.27[J]/0.027	NA	NA	NA	--	0.0049[J]/0.00049
Benzo(a)pyrene	NC/NC/8/**0.062**/**0.21**/**0.1**	**2**	**0.36**/0.36	--	0.0032[J]/0.0032	0.004[J]/0.004	0.0018[J]/0.0018	0.0063[J]/0.0063
Benzo(b)fluoranthene[9]	NC/NC/**2.4**/**0.62**/**2.1**/1[10]	**3.1**	0.53/0.053	NA	NA	NA	0.0035[J]/0.00035	0.0082[J]/0.00082
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	1.7	0.28/0.0028	NA	NA	NA	0.002[J]/0.00002	0.0038[J]/0.000038
Chrysene[9]	NC/NC/77/62/210/1[10]	3.6	0.31/0.00031	NA	NA	NA	--	0.005[J]/0.000005
Dibenz(a,h)anthracene[9]	NC/NC/0.7/**0.062**/**0.21**/1[10]	**0.30[J]**	0.052[J]/0.052	--	--	0.0024[J]/0.0024	--	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/**0.62**/2.1/1[10]	**0.98**	0.2/0.02	NA	NA	NA	--	0.004[J]/0.0004
Pesticides/PCBs[11] (mg/kg)				PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed		
4,4'-DDD	4.2/22/5.5/2.4/10**0.0025**	**1.1[J]**	**0.65[J]**	NA	NA	NA	--	--
4,4'-DDE	2.9/15/18/1.7/7**0.0025**	**1**	**1**	NA	NA	NA	0.0006[J]	0.0006[J]
4,4'-DDT	**2.9**/15/11/**1.7**/7/**0.0025**	**5.7**	**5.5**	NA	NA	NA	0.0007[J]	0.0009[J]
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	1.3	1.16	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/**0.1**[13]	**0.51[J]**	**0.58[J]**	NA	NA	NA	--	--
Gama-chlordane	NC/NC/9.6/1.6/6.5/**0.1**[13]	**0.79**	**0.58[J]**	NA	NA	NA	--	--
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	--	--	NA	NA	NA	--	--
Dieldrin	**0.06**/**0.3**/**0.002**/**0.03**/**0.11**/**0.0005**	**0.67[J]**	**0.94[J]**	**0.0148[J]**	**0.0156**	**0.154**	**0.0005[J]**	**0.0005[J]**
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	--	--	NA	NA	NA	--	--
Endrin	25/510/1/18/180/0.001	--	--	NA	NA	NA	--	--
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	--	--	NA	NA	NA	--	--
Total Recoverable								
Petroleum Hydrocarbons[15] (mg/kg)	**460**/2700/**340**/NA/NA/NA	**630**	**920**	NA	NA	NA	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41

PAGE 8 OF 10

Sample Location		WHF-1485C-SB45	WHF-1485C-SB45	WHF-1485C-SB46	WHF-1485C-SB46	WHF-1485C-SB47	WHF-1485C-SB47	WHF-41-SS-4801
Sample No.	Regulatory Criteria	WHF-1485C-4502	WHF-1485C-4503	WHF-1485C-4602	WHF-1485C-4603	WHF-1485C-4702	WHF-1485C-4703	WHF-41-SS-48-2
Collect Date		11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003	8/31/2004
Sample Depth (bls)		1-2'	2-3'	1-2'	2-3'	1-2'	2-3'	1-2'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	0.0041[J]	0.0019[J]	0.0023[J]	--	--	--	NA
Acetone	11000/68000/25/14000/54000/NA	0.025	0.029	0.016[J]	--	--	--	NA
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	--	--	--	--	--	--	NA
Anthracene	21000/300000/2500/22000/100000/0.1	--	--	--	--	--	--	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	0.025[J]	--	--	0.0042[J]	0.015	--	NA
Fluorene	2600/33000/160/2700/26000/1[10]	0.0042[J]	--	--	--	--	--	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	0.0058[J]	--	0.0024[J]	--	0.0079	--	NA
Pyrene	2400/45000/880/2300/29000/0.1	0.018	--	--	0.0044[J]	0.015	--	NA
Carbazole	49/240/0.2/24/86/NA	--	--	--	--	--	--	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	0.013[J]	--	--	0.0055[J]	0.0085[J]	--	NA
Benzo(a)pyrene equivalent	0.1/0.7/8/NC/NC/NC	0.024155	NS	0.0024	0.0088547	0.0154968	NS	0.0228
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	0.0074[J]/0.00074	--	--	0.002[J]/0.0002	0.0081/0.00081	--	NA
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	0.015/0.015	--	--	0.0072[J]/0.0072	0.011/0.011	--	0.017/0.017
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	0.018/0.0018	--	--	0.0086/0.00086	0.011/0.0011	--	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	0.01/0.0001	--	--	0.004[J]/0.00004	0.0049[J]/0.000049	--	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	0.015/0.000015	--	--	0.0047[J]/0.0000047	0.0078/0.0000078	--	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	0.0049[J]/0.0049	--	0.0024[J]/0.0024	--	0.0018[J]/0.0018	--	0.0058[J]/0.0058
Indeno(1,2,3-cd)pyrene[9]	NC/NC/0.62/2.1/1[10]	0.016[J]/0.0016	--	--	0.0055[J]/0.00055	0.0073[J]/0.00073	--	NA
Pesticides/PCBs[11] (mg/kg)								PCBs Not Analyzed
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	0.0011[J]	--	0.0003[J]	--	0.0004[J]	--	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	0.0012[J]	--	0.0005[J]	0.0003[J]	0.0015[J]	--	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	--	--	--	--	0.0009[J]	--	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	0.0008[J]	--	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	0.0005	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	0.0005[J]	--	--	--	0.0007[J]	--	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	--	--	--	--	--	--	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	--	--	0.0002[J]	--	--	--	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11**0.0005**	**0.001[J]**	--	--	--	--	--	--
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	--	--	--	--	--	--	NA
Endrin	25/510/1/18/180/0.001	--	--	--	--	--	--	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	--	--	--	--	--	--	NA
Total Recoverable Petroleum Hydrocarbons[15]	460/2700/340/NA/NA/NA	13	5.5	7.5	5.7	5.2	--	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** (underlined) indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

**ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 9 OF 10**

Sample Location		WHF-41-SS-4801	WHF-41-SS-4901	WHF-41-SS-4901	WHF-41-SS-5001	WHF-41-SS-5001	WHF-41-SS-5101	WHF-41-SS-5101
Sample No.	Regulatory Criteria	WHF-41-SS-48-3	WHF-41-SS-49-2	WHF-41-SS-49-3	WHF-41-SS-50-2	WHF-41-SS-50-3	WHF-41-SS-51-2	WHF-41-SS-51-3
Collect Date		8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004	8/31/2004
Sample Depth (bls)		2-3'	1-2'	2-3'	1-2'	2-3'	1-2'	2-3'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)							
Volatiles[7] (mg/kg)								
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	NA	NA	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	NA	NA	NA	NA	NA	NA	NA
Semivolatiles[8] (mg/kg)								
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	NA	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene equivalent[9]	0.1/0.7/8/NC/NC/NC	NS	0.0018	NS	0.0025	NS	0.0295	0.0018
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	--	0.0018[J]/0.0018	--	0.0025[J]/0.0025	--	0.022/0.022	0.0018[J]/0.0018
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	--	--	--	--	--	0.0075[J]/0.0075	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)		PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.06/0.3/**0.002**/0.03/0.11/**0.0005**	--	--	--	--	--	**0.0077[J]**	--
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA	NA	NA	NA
Total Recoverable								
Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	NA	NA	NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-4

ANALYTICAL SUMMARY FOR ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
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Sample Location		WHF-41-SS-5201	WHF-41-SS-5201	WHF-41-SS-5301	WHF-41-SS-5301
Sample No.	Regulatory Criteria	WHF-41-SS-52-2	WHF-41-SS-52-3	WHF-41-SS-53-2	WHF-41-SS-53-3
Collect Date		8/31/2004	8/31/2004	8/31/2004	8/31/2004
Sample Depth (bls)		1-2'	2-3'	1-2'	2-3'
	DE1[1]/DE2[2]/LE[3]/PRGR[4]/ PRGI[5]/RAG[6] (mg/kg)				
Volatiles[7] (mg/kg)					
2-Butanone	16000/110000/17/22000/110000/NA	NA	NA	NA	NA
Acetone	11000/68000/25/14000/54000/NA	NA	NA	NA	NA
Semivolatiles[8] (mg/kg)					
4-Nitroaniline	17/96/0.008/23/82/NA	NA	NA	NA	NA
Anthracene	21000/300000/2500/22000/100000/0.1	NA	NA	NA	NA
Fluoranthene	3200/59000/1200/2300/22000/0.1	NA	NA	NA	NA
Fluorene	2600/33000/160/2700/26000/1[10]	NA	NA	NA	NA
Phenanthrene	2200/36000/250/NA/NA/0.1	NA	NA	NA	NA
Pyrene	2400/45000/880/2300/29000/0.1	NA	NA	NA	NA
Carbazole	49/240/0.2/24/86/NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	2500/52000/32000/NA/NA/1[10]	NA	NA	NA	NA
Benzo(a)pyrene equivalent[9]	0.1/0.7/8/NC/NC/NC	0.0014	0.0186	NS	NS
Benzo(a)anthracene[9]	NC/NC/0.8/0.62/2.1/1[10]	NA	NA	NA	NA
Benzo(a)pyrene	NC/NC/8/0.062/0.21/0.1	0.0014[J]/0.0014	0.014/0.014	--	--
Benzo(b)fluoranthene[9]	NC/NC/2.4/0.62/2.1/1[10]	NA	NA	NA	NA
Benzo(k)fluoranthene[9]	NC/NC/24/6.2/21/1[10]	NA	NA	NA	NA
Chrysene[9]	NC/NC/77/62/210/1[10]	NA	NA	NA	NA
Dibenz(a,h)anthracene[9]	NC/NC/0.7/0.062/0.21/1[10]	--	0.0046[J]/0.0046	--	--
Indeno(1,2,3-cd)pyrene[9]	NC/NC/6.6/0.62/2.1/1[10]	NA	NA	NA	NA
Pesticides/PCBs[11] (mg/kg)		PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed	PCBs Not Analyzed
4,4'-DDD	4.2/22/5.5/2.4/10/0.0025	NA	NA	NA	NA
4,4'-DDE	2.9/15/18/1.7/7/0.0025	NA	NA	NA	NA
4,4'-DDT	2.9/15/11/1.7/7/0.0025	NA	NA	NA	NA
Aldrin	0.06/0.3/0.2/0.029/0.10/0.0025	--	--	--	--
Total Chlordane(s)[12]	2.8/14/NC/NC/NC/NC	NS	NS	NS	NS
Alpha-chlordane[12]	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA
Gama-chlordane	NC/NC/9.6/1.6/6.5/0.1[13]	NA	NA	NA	NA
Beta-BHC	0.5/2.4/0.001/0.32/1.3/0.001	NA	NA	NA	NA
Dieldrin	0.06/0.3/0.002/0.03/0.11/0.0005	--	--	--	--
Endosulfan II[14]	450/7600/3.8/370/3700/0.1[13]	NA	NA	NA	NA
Endrin	25/510/1/18/180/0.001	NA	NA	NA	NA
Heptahlor Epoxide	0.1/0.5/0.6/0.053/0.19/0.1[13]	NA	NA	NA	NA
Total Recoverable					
Petroleum Hydrocarbons[15] (mg/kg)	460/2700/340/NA/NA/NA	NA	NA	NA	NA

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4/5] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[6] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[7] SW-846 8260B, [8] SW-8468270C
[9] Concentrations converted to benzo(a)pyrene equivalents according to FAC and EPA Toxic Equivalency Factors.
[10] For PAHs without RAG criteria, RAG Total PAHs value used.
[11] SW-846 8081A/8082
[12] DE1, DE2, and LE values are for Total Chlordane.
[13] For pesticides without RAG criteria, RAG Total Pesticides value used.
[14] Values for Endosulfan used for Endosulfan II
[15] FDEP FL-PRO
Bold indicates the exceedance of FL SCTLs. **Bold** indicates which regulatory limit has been exceeded.
-- = not detected NA = not analyzed NS = no sum NC = no regulatory criterion available
[J] Indicates the presence of a chemical at an estimated concentration.

secondary criteria as presented on Table 5-4. Both of these compounds are common laboratory contaminants.

SVOCs

With the exception of B(a)P, 26 subsurface soil samples were analyzed for SVOCs, and SVOCs were detected in 16 of the 26 samples. The majority of these 16 SVOC dectections were below FDEP and USEPA criteria.

Exceptions were: B(a)P exceeded the USEPA PRGR, PRGI, and RAGs in sample SB31 at the 1 to 2 and 2 to 3 foot interval. B(a)P exceeded the USEPA PRGR and RAGs in samples SB33, SB34, SB35 at either or both the 1 to 2 and 2 to 3 foot interval. B(a)P exceeded the USEPA PRGR in sample SB40 at the 2 to 3 foot interval. 4-Nitroanline, carbazole, B(a)A, and B(b)F exceeded the FDEP LE criteria only in sample SB43 at the 1 to 2 foot interval. Fluoranthene, phenanthrene, and pyrene eceeded the RAGs criteria in sample SB43 at the 1 to 2 and 2 to 3 foot interval. B(a)A, B(a)P, B(b)F, D(a,h)A, and IP exceeded the USEPA PRGR in sample SB43 at the 1 to 2 foot interval. B(a)A, B(a)P, B(b)F, and D(a,h)A, exceeded the PRGI in sample SB43 at the 1 to 2 foot interval. B(a)P exceeded the RAGs in soil samples collected from SB43 at the 1 to 2 and 2 to 3 foot interval. None of these compounds were detected in any other samples from this site. No other SVOCs, with the exception of B(a)P exceedances adressed below, were detected at concentrations above primary or secondary criteria.

Five of the 44 subsurface soil samples contained B(a)P at concentrations exceeding at least one primary criterion (Table 5-4 and Figure 5-4). Following FDEP guidance (FDEP, 2005), detected concentrations of B(a)A, B(b)F, B(k)F, chrysene, D(a,h)A, and IP were converted to B(a)P TEFs. The B(a)P equivalent concentration of these compounds were summed to produce a B(a)P equivalent (Table 5-3). These concentrations were then compared to the DE1 and DE2 criteria for B(a)P.

The detection limits for some of the SVOCs were elevated in some samples above the SCTLs as provided in Chapter 62-777 F.A.C.. As a result of the elevated detection limits, SVOC contaminant levels may exceed the SCTLs even though non-detects were reported. At the time of analysis, the best achievable detection limit using this method was higher than the SCTL; therefore, the ability to meet the SCTLs was not possible. Because some of the SVOCs were reported with elevated non-detects, it is possible that the concentrations exceed the SCTL. The affected compounds and samples are:

- 4-nitroaniline in 25 samples (all samples analyzed for SVOCs except the 1 to 2 foot sample at location SB43)
- B(a)P in samples from locations SB05 through SB08

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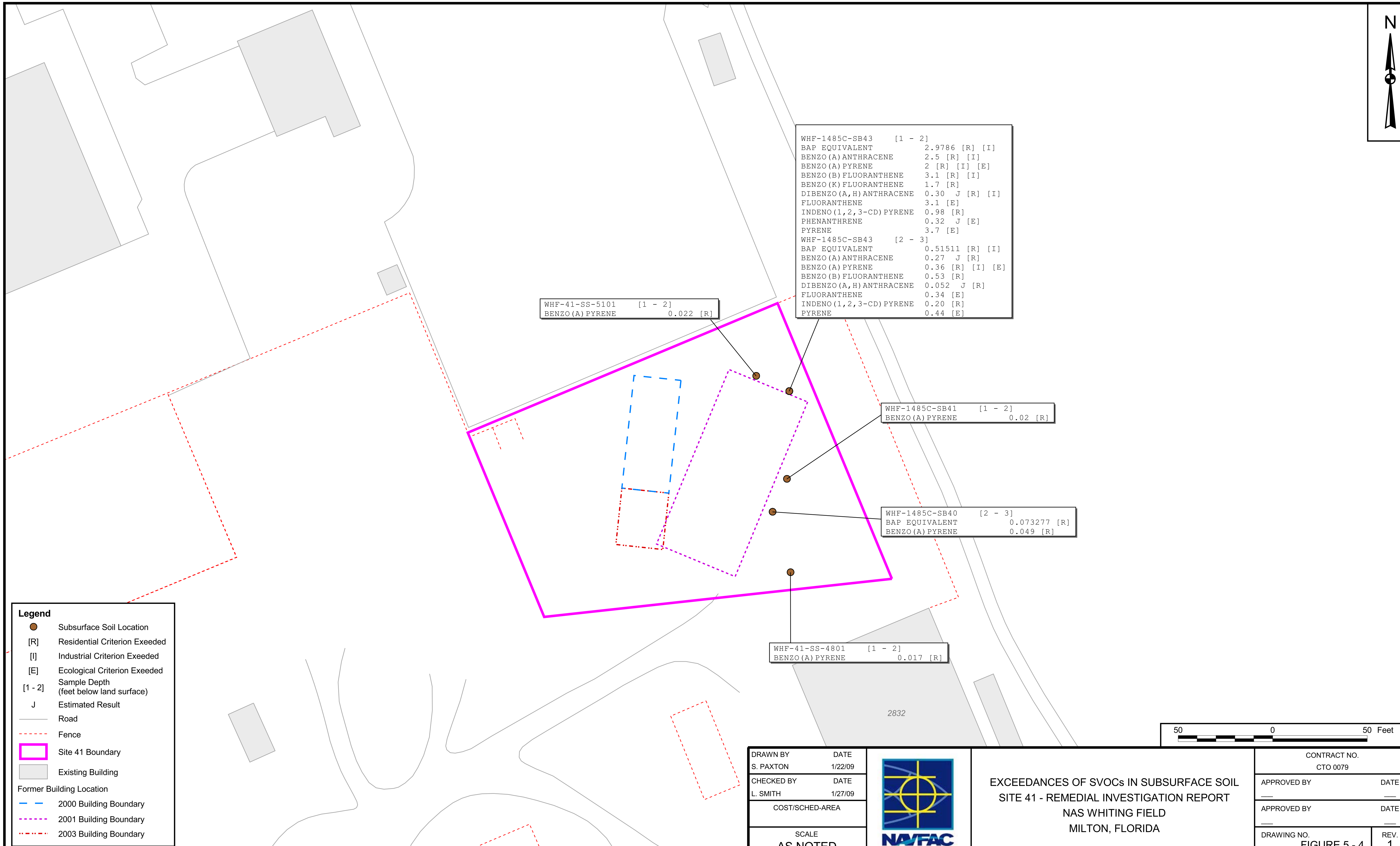

DRAWN BY S. PAXTON	DATE 1/22/09	NAVFAC	EXCEEDANCES OF SVOCs IN SUBSURFACE SOIL SITE 41 - REMEDIAL INVESTIGATION REPORT NAS WHITING FIELD MILTON, FLORIDA	CONTRACT NO. CTO 0079
CHECKED BY L. SMITH	DATE 1/27/09			APPROVED BY — DATE —
COST/SCHED-AREA				APPROVED BY — DATE —
SCALE AS NOTED				DRAWING NO. FIGURE 5 - 4 / REV. 1

- Carbazole in 25 samples (all samples analyzed for SVOCs except the 1 to 2 foot sample at location SB43)

Pesticides/PCBs

Subsurface soils were analyzed for TCL pesticides/PCBs at 16 locations across the site from 2000 to 2003. Pesticides detected in these subsurface soils samples were 4,4-dichlorodiphenyldichlorethane (DDD), 4,4-dichlorodiphenyldichloroethylene (DDE), 4,4-dichlorodiphenyltrichloroethane (DDT), aldrin, beta-Hexachlorocyclohexane (BHC), chlordane, alpha and gama, dieldrin, endosulfan II, endrin, and heptachlor epoxide. Only 4,4-DDT and dieldrin exceeded FDEP DE1 criteria at SB41, and SB43 at the 1 to 2 foot bls interval. Dieldrin also exceeded FDEP DE2 criteria at the SB43 at the 1 to 2 and 2 to 3 foot bls interval. Dieldrin was not analyzed for in the deeper samples from this location. The 1 to 2 foot samples from locations SB37 SB41 and SB42, and the 1 to 2, 2 to 3, 3 to 4, 4 to 5, and 5 to 6 foot samples from location SB43 contained dieldrin at concentrations exceeding at least one primary criterion (Table 5-3 and Figure 5-5). Dieldrin was detected at concentrations exceeding the FDEP LE and the USEPA RAGs in soil sample SB37 at the 1 to 2 foot interval. No other pesticides were found at levels exceeding criteria in the subsurface soil samples. Because no PCBs were detected in the initial 47 surface and subsurface soil samples. after 11 November 2003. PCBs were not included in the analyte list submitted to the laboratory.

The detection limits for aldrin, beta-BHC, dieldrin, and heptachlor epoxide were elevated above the SCTLs as provided in Chapter 62-777 F.A.C. for at least one sample. As a result of the elevated detection limits, concentrations of these compounds may exceed the SCTLs even though non-detects were reported. At the time of analysis, the best achievable detection limit using this method was higher than the SCTL; therefore, the ability to meet the SCTLs was not possible. The affected compounds and samples are:

- Aldrin in the two samples from location SB43
- Beta-BHC in all samples reported as non-detect
- Dieldrin in the samples from locations SB08, SB31, SS48, SS49, SS50, SS51, SS52, and SS53

TRPH

TRPH was detected at concentrations exceeding primary criteria in the 1 to 2 foot and the 2 to 3 foot sample from location SB43.

5.2.2 Inorganics

As indicated in Chapter 3.0 and in Table 5-5, 26 of the subsurface soil samples were analyzed for TAL metals plus cyanide.

P:\GIS\WHITINGFIELD_NAS\MAPDOCS\APR\SITE41_TAG_MAPS.APR SUBSURFACE SOIL PESTICIDE TAG LAYOUT 1/27/09 SP

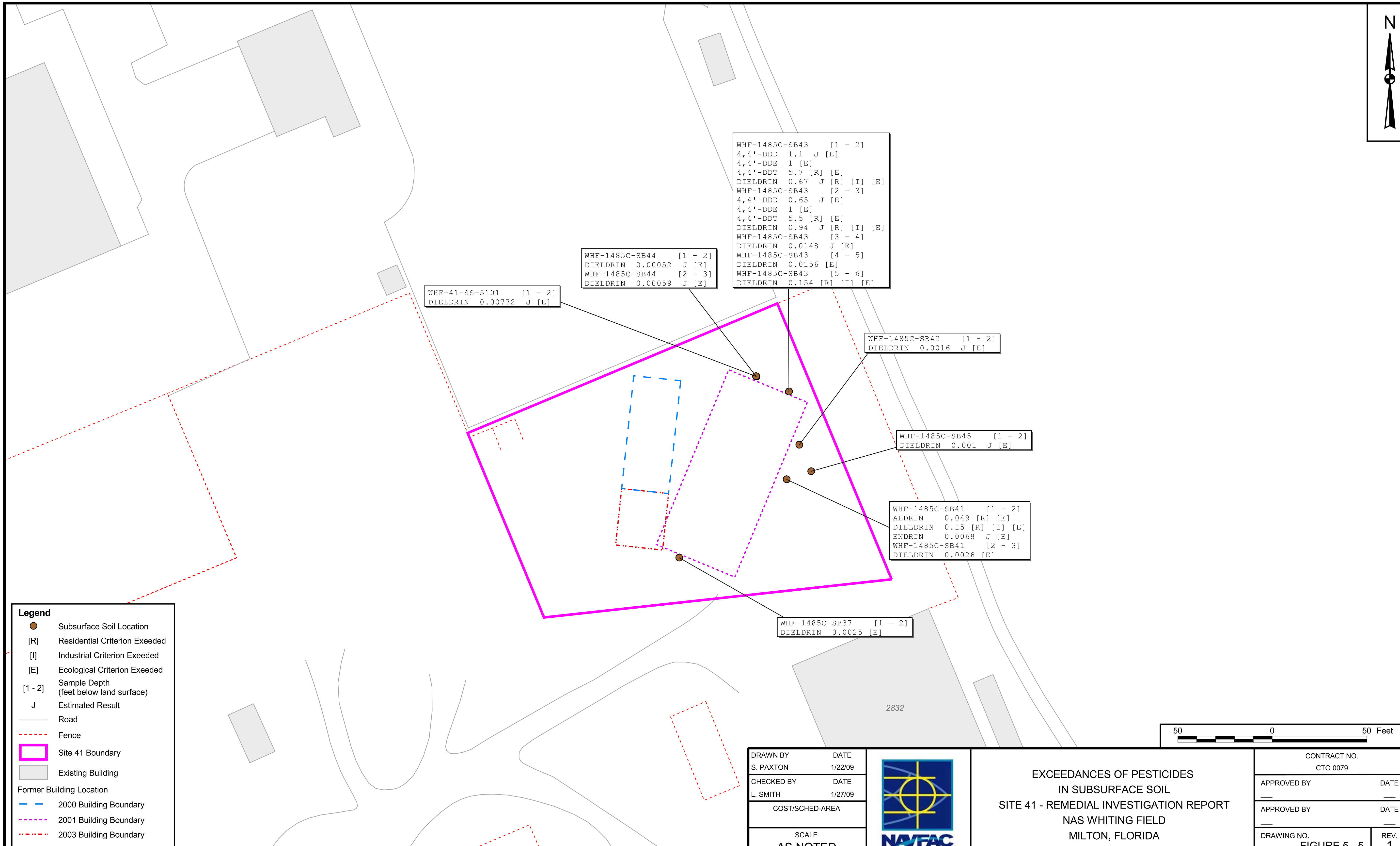

TABLE 5-5

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 1 OF 4

Sample Location		WHF-1485C-SB05	WHF-1485C-SB06	WHF-1485C-SB07	WHF-1485C-SB08	WHF-1485C-SB37	WHF-1485C-SB38	WHF-1485C-SB39
Sample No.	Regulatory Criteria	1485CD00510	1485CD00605	1485CD00705	1485CD00810	WHF-1485C-3702	WHF-1485C-3802	WHF-1485C-3902
Collect Date		6/5/2000	6/5/2000	6/5/2000	6/5/2000	11/10/2003	11/10/2003	11/10/2003
Sample Depth (bls)		8-10'	3-5'	3-5'	8-10'	1-2'	1-2'	1-2'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)							
TAL Metals[8] (mg/kg)								
Aluminum	80000/*/***/**15848**/76000/100000/**50**	**33900**	**15500**	**34200**	**37400**	**6120**	**5480**	**8550**
Antimony	27/370/5.4/31/410/3.5	--	--	--	--	--	--	--
Arsenic	**2.1**/12/***/**3.2**/**0.39**/**1.6**/10	**5.6**	**1**	**1.7**	**3.6**	**1.1**	**0.98**	**1.2**
Barium	120**/130000/1600/23.2/5400/67000/165	4.6	9.9	22.2	7.2	10.8	9.8	11.4
Cadmium	82/1700/7.5/0.58/37/450/1.6	--	--	--	--	--	--	--
Calcium	NC/NC/NC/**396**/NC/NC/NC	**445**	116	376	132	355	**409**	6.13
Chromium	210/470/38/**11**/210/450/**0.4**	**27.6**	**12.4**	**26.7**	**37.3**	**5.1**[J]	**4.4**[J]	**6.7**[J]
Cobalt	1700/420000/***/3/900/1900/20	--	--	--	--	--	--	--
Copper	150**/89000/***/**9.4**/3100/41000/40	7.5	5.6	**10.3**	9.3	2.8	2.1	3.1
Iron	53000/*/***/**8832**/**23000**/100000/**200**	**21800**	**8270**	**14300**	**26700**	**3040**	**2530**	**3650**
Lead	400/1400/***/11.4/400/800/50	1.1[J]	2.4	4.3[J]	1.8[J]	5	2.3	2.8
Magnesium	NC/NC/NC/268/NC/NC/NC	31.2	116	192	43.7	140	118	156
Manganese	3500/43000/***/392/1800/19000/100	1.8[J]	14	10.3	4.7[J]	25.6	36.6	36.3
Mercury	3/17/2.1/0.12/23/310/0.1	--	--	--	--	--	--	--
Nickel	340**/35000/130/7.2/1600/20000/30	--	1.7	2.8[J]	0.92[J]	1.8	1.8	2.8
Potassium	NC/NC/NC/**177**/NC/NC/NC	--	160	**289**	--	88.9	47.1	112
Selenium	440/11000/5.2/**0.46**/390/5100/**0.81**	--	--	**4.8**[J]	--	--	--	--
Sodium	NC/NC/NC/406/NC/NC/NC	97.4[J]	95.7	99.5[J]	115[J]	--	--	--
Vanadium	**67****/10000/980/**21.8**/78/1000/**2.0**	**47.2**	**19.9**	**41.3**	**68.1**	**8.3**	**7.3**	**10.8**
Zinc	26000/630000/***/15.4/23000/100000/50	4.3	8.1	10.7	4.5	13.2[J]	6.4[J]	10[J]
Cyanide[9] (mg/kg)	34**/11000/**0.8**/**0.28**/1200/12000/**0.9**	--	--	--	**1.8**[J]	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NC = no regulatory criterion available
-- = not detected
[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-5

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 2 OF 4

Sample Location		WHF-1485C-SB40	WHF-1485C-SB41	WHF-1485C-SB42	WHF-1485C-SB43	WHF-1485C-SB44	WHF-1485C-SB45	WHF-1485C-SB46
Sample No.	Regulatory Criteria	WHF-1485C-4002	WHF-1485C-4102	WHF-1485C-4202	WHF-1485C-4302	WHF-1485C-4402	WHF-1485C-4502	WHF-1485C-4602
Collect Date		11/10/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003
Sample Depth (bls)		1-2'	1-2'	1-2'	1-2'	1-2'	1-2'	1-2'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)							
TAL Metals[8] (mg/kg)								
Aluminum	80000/*/***/**15848**/76000/100000/**50**	**11800**	**6670**	**11100**	**22000**	**9870**	**10500**	**10900**
Antimony	27/370/5.4/31/410/3.5	--	--	--	0.55	0.82	--	--
Arsenic	**2.1**/**12**/***/**3.2**/**0.39**/**1.6**/**10**	**1.7**	**1.2**	**1.3**	**15.2**	**2.2**	**1.5**	**1.3**
Barium	120**/130000/1600/**23.2**/5400/67000/165	11.7	9.7	12	**48.1**	17.1	15.6	12
Cadmium	82/1700/7.5/**0.58**/37/450/**1.6**	--	--	--	**2.2**	--	--	--
Calcium	NC/NC/NC/**396**/NC/NC/NC	380	**461**	**482**	**1430**	**493**	**481**	94.8
Chromium	210/470/38/**11**/210/450/**0.4**	**9.1**[J]	**6.6**[J]	**8.6**[J]	**34.3**[J]	**8.5**[J]	**8.5**[J]	**8.5**[J]
Cobalt	1700/420000/***/3/900/1900/20	--	--	--	2.4	--	--	--
Copper	150**/89000/***/**9.4**/3100/41000/40	3.4	3	3.9	**26**	4.5	3.5	3.6
Iron	53000/*/***/**8832**/23000/100000/**200**	**5510**	**3490**	**5470**	**14800**	**4440**	**4770**	**4800**
Lead	400/1400/***/**11.4**/400/800/**50**	2.8	**16**	3.8	**273**[J]	7.1[J]	10.4[J]	3.6[J]
Magnesium	NC/NC/NC/**268**/NC/NC/NC	148	114	156	**313**	168	161	122
Manganese	3500/43000/***/**392**/1800/19000/**100**	22.8	36.5	36.4	**410**[J]	52.3[J]	35[J]	8[J]
Mercury	3/17/2.1/0.12/23/310/0.1	--	--	--	0.059[J]	0.015[J]	0.022[J]	0.045[J]
Nickel	340**/35000/130/7.2/1600/20000/30	2.1	1.7	2.1	6.1	2.3	2.7	2.2
Potassium	NC/NC/NC/**177**/NC/NC/NC	126	126	**221**	**306**	75.8	128	**186**
Selenium	440/11000/5.2/0.46/390/5100/0.81	--	--	--	--	--	--	--
Sodium	NC/NC/NC/406/NC/NC/NC	--	--	--	--	--	--	--
Vanadium	67**/10000/980/**21.8**/78/1000/**2.0**	**15**	**9.3**	**13.5**	**37.7**	**12.7**	**13.8**	**13.8**
Zinc	26000/630000/***/**15.4**/23000/100000/**50**	4.7[J]	11[J]	8.8[J]	**246**[J]	8.9[J]	7.8[J]	4.5[J]
Cyanide[9] (mg/kg)	34**/11000/0.8/**0.28**/1200/12000/0.9	--	--	--	--	**0.31**	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7]EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NC = no regulatory criterion available
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TABLE 5-5

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 3 OF 4

Sample Location		WHF-1485C-SB47	WHF-1485C-SB37	WHF-1485C-SB38	WHF-1485C-SB39	WHF-1485C-SB40	WHF-1485C-SB41	WHF-1485C-SB42
Sample No.	Regulatory Criteria	WHF-1485C-4702	WHF-1485C-3703	WHF-1485C-3803	WHF-1485C-3903	WHF-1485C-4003	WHF-1485C-4103	WHF-1485C-4203
Collect Date		11/11/2003	11/10/2003	11/10/2003	11/10/2003	11/10/2003	11/11/2003	11/11/2003
Sample Depth (bls)		1-2'	2-3'	2-3'	2-3'	2-3'	2-3'	2-3'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)							
TAL Metals[8] (mg/kg)								
Aluminum	80000/*/***/**15848**/76000/100000/**50**	**7970**	**7320**	**5670**	**16400**	**16100**	**13500**	**16400**
Antimony	27/370/5.4/31/410/3.5	--	--	--	--	--	--	--
Arsenic	**2.1**/12/***/**3.2**/**0.39**/**1.6**/10	**1.1**	**1.3**	**0.99**	**2.9**	**3.5**	**1.7**	**1.2**
Barium	120**/130000/1600/23.2/5400/67000/165	13.7	11.1	9.5	12.7	12.2	13.5	13.8
Cadmium	82/1700/7.5/0.58/37/450/1.6	--	--	--	--	--	--	--
Calcium	NC/NC/NC/**396**/NC/NC/NC	**632**	320	238	**423**	357	**509**	240
Chromium	210/470/38/**11**/210/450/**0.4**	**6.5[J]**	**6.6[J]**	**4.9[J]**	**14.6[J]**	**13.1[J]**	**10.6[J]**	**12.2[J]**
Cobalt	1700/420000/***/3/900/1900/20	--	--	--	--	--	--	--
Copper	150**/89000/***/9.4/3100/41000/40	3.3	2.4	1.6	3.8	3.4	4.9	3.6
Iron	53000/*/***/**8832**/23000/100000/**200**	**3400**	**3800**	**2950**	**9510**	**8470**	**6710**	**5080**
Lead	400/1400/***/11.4/400/800/50	6.1[J]	3.6	2.2	3.2	3	7.1	3.3
Magnesium	NC/NC/NC/268/NC/NC/NC	128	151	139	164	153	157	135
Manganese	3500/43000/***/392/1800/19000/100	54[J]	9.5	8	10.8	24.4	10.4	8.3
Mercury	3/17/2.1/0.12/23/310/0.1	0.028[J]	--	--	--	--	--	--
Nickel	340**/35000/130/7.2/1600/20000/30	2.1	2	1.9	2.7	2.1	2	2.3
Potassium	NC/NC/NC/**177**/NC/NC/NC	132	120	75.9	140	111	160	**267**
Selenium	440/11000/5.2/0.46/390/5100/0.81	--	--	--	--	--	--	--
Sodium	NC/NC/NC/406/NC/NC/NC	--	--	--	--	--	--	--
Vanadium	67**/10000/980/**21.8**/78/1000/**2.0**	**9.9**	**10.5**	**8.1**	**22.9**	**23**	**15.8**	**17**
Zinc	26000/630000/***/**15.4**/23000/100000/50	10.2[J]	8.5[J]	7.8[J]	**18.5[J]**	4.6[J]	7[J]	12.3[J]
Cyanide[9] (mg/kg)	34**/11000/0.8/0.28/1200/12000/0.9	--	--	--	--	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7]EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NC = no regulatory criterion available
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[J] Indicates the presence of a chemical at an estimated concentration.

TABLE 5-5

ANALYTICAL SUMMARY FOR INORGANIC ANALYTES DETECTED IN SUBSURFACE SOIL SAMPLES - SITE 41
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA
PAGE 4 OF 4

Sample Location		WHF-1485C-SB43	WHF-1485C-SB44	WHF-1485C-SB45	WHF-1485C-SB46	WHF-1485C-SB47
Sample No.	Regulatory Criteria	WHF-1485C-4303	WHF-1485C-4403	WHF-1485C-4503	WHF-1485C-4603	WHF-1485C-4703
Collect Date		11/11/2003	11/11/2003	11/11/2003	11/11/2003	11/11/2003
Sample Depth (bls)		2-3'	2-3'	2-3'	2-3'	2-3'
	DE1[1]/DE2[2]/LE[3]/BSL[4]/PRGR[5]/ PRGI[6]/RAG[7] (mg/kg)					
TAL Metals[8] (mg/kg)						
Aluminum	80000/*/***/**15848**/76000/100000/**50**	**12100**	**11200**	**16400**	**14900**	**10900**
Antimony	27/370/**5.4**/31/410/**3.5**	**10.7**	0.51	--	--	--
Arsenic	**2.1**/12/***/**3.2**/**0.39**/**1.6**/10	**6**	**1.9**	**1.7**	**1.5**	**1.4**
Barium	120**/130000/1600/**23.2**/5400/67000/165	**73.8**	13.6	13.9	14	10.9
Cadmium	82/1700/7.5/**0.58**/37/450/1.6	**0.86**	--	--	--	--
Calcium	NC/NC/NC/**396**/NC/NC/NC	**1570**	**434**	60.3	83.4	243
Chromium	210/470/38/**11**/210/450/**0.4**	**23.3[J]**	**9.1[J]**	**12.2[J]**	**11.2[J]**	**8.6[J]**
Cobalt	1700/420000/***/3/900/1900/20	1.4	--	--	--	--
Copper	150**/89000/***/**9.4**/3100/41000/40	**17.9**	4	3.6	3.7	2.6
Iron	53000/*/***/**8832**/23000/100000/**200**	**8950**	**5500**	**5430**	**5080**	**4150**
Lead	400/1400/***/**11.4**/400/800/50	**322[J]**	6.1[J]	2.9[J]	3[J]	3[J]
Magnesium	NC/NC/NC/268/NC/NC/NC	210	172	112	127	120
Manganese	3500/43000/***/392/1800/19000/**100**	**144[J]**	15.9[J]	4.2[J]	7.2[J]	6.1[J]
Mercury	3/17/2.1/0.12/23/310/0.1	0.078[J]	0.024[J]	0.015[J]	0.0075[J]	0.031[J]
Nickel	340**/35000/130/7.2/1600/20000/30	5	2.4	1.8	2.3	1.8
Potassium	NC/NC/NC/177/NC/NC/NC	135	78.8	138	154	77
Selenium	440/11000/5.2/0.46/390/5100/0.81	--	--	--	--	--
Sodium	NC/NC/NC/406/NC/NC/NC	--	--	--	--	--
Vanadium	67**/10000/980/21.8/78/1000/**2.0**	**20**	**14.4**	**18.6**	**16.5**	**13.2**
Zinc	26000/630000/***/**15.4**/23000/100000/**50**	**217[J]**	6.5[J]	6.8[J]	6.4[J]	**46.5[J]**
Cyanide[9] (mg/kg)	34**/11000/0.8/0.28/1200/12000/0.9	--	--	--	--	--

[1] Direct Exposure limit for residential area from Chapter 62-777, F.A.C. 17 April 2005
[2] Direct Exposure limit for industrial area from Chapter 62-777, F.A.C. 17 April 2005
[3] Leachability for groundwater limit from Chapter 62-777, F.A.C. 17 April 2005
[4] Background screening value from Table 3-9, General Information Report,Remedial Investigation and Feasability Study, ABB, January 1998.
[5/6] EPA Region 9 Superfund Preliminary Remediation Goals for residential/industrial.
[7] EPA Region 4 Risk Assessment Guidance Ecological Screening Values.
[8] SW-846 6010B and 7470A/7471A, [9] EPA 335.2
* Contaminant is not a health concern for this default exposure scenario.
** Direct exposure value based on acute toxicity considerations.
*** Leachability values may be derived using the SPLP Test to calculate site-specific SCTLs or may be determined using TCLP in the event oily wastes are present.
Bold indicates the exceedance of limits. **Bold** indicates which regulatory limit has been exceeded.
NC = no regulatory criterion available
-- = not detected
[J] Indicates the presence of a chemical at an estimated concentration.

Twenty of the TAL metals were detected in at least one subsurface soil sample at Site 41 (Table 5-4). Antimony was detected at a concentration exceeding the LE primary criterion in the sample from location

SB43 (Table 5-4 and Figure 5-6). No other metals were found at concentrations exceeding the primary or secondary criteria. See the discussion of arsenic and vanadium in the first section of Chapter 5.0.

Cyanide was detected in two of the samples, and the concentration in the sample from SB08 exceeded the primary criterion for leaching (Figure 5-6).

5.2.3 SPLP Results

The samples collected at locations SB05 through SB08 were prepared using the SPLP methods to evaluate the potential impact from site soils to groundwater. All four samples were analyzed for TCL pesticides and TAL metals.

No pesticides were detected in any of the samples. Calcium and mercury were both detected in the samples from locations at least one sample. No SPLP analytes were detected at concentrations that exceeded the primary criteria.

5.3 CONCLUSIONS

5.3.1 Surface Soil

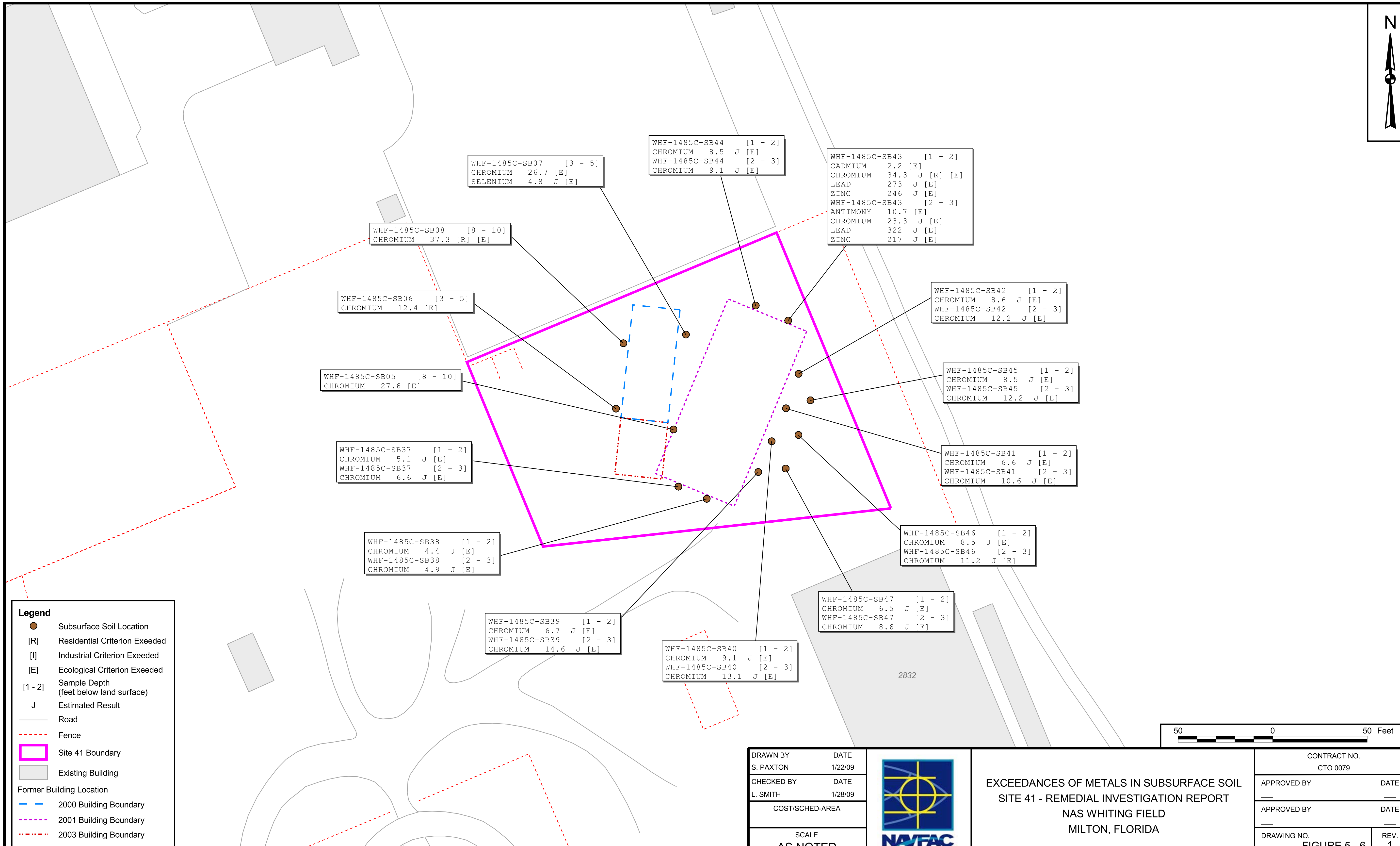
SVOCs

SVOC contamination (concentrations exceeding at least one primary criterion - exceedances) was found at Site 41. Apparent “hot spots” have been delineated near SB47 and SS06. Another apparent hot spot is at SB41. This area is delineated in the sense that it is bounded by samples without exceedances in all directions except to the west where the former building was located. For the purposes of this RI any area where there was a fixed-base laboratory detection will be considered contaminated material.

An area of surface soil SVOC contamination west of the initial estimated location of the former building is partially delineated. Multiple samples contained SVOC exceedances in this area. The nearest sample to the south of this area that was analyzed for SVOCs is more than 35 feet from SB32 (southernmost sample with detected SVOC exceedances in the area), but there are several samples to the south, southeast, and east that did not contain SVOCs at concentrations exceeding primary criteria.

A larger area north of the initial estimated location of the former building and the revised location of the building is not defined to the north, northeast, or northwest.

P:\GIS\WHITINGFIELD_NAS\MAPDOCS\APR\SITE41_TAG_MAPS.APR SUBSURFACE SOIL METALS TAG LAYOUT 1/28/09 SP



DRAWN BY S. PAXTON	DATE 1/22/09	EXCEEDANCES OF METALS IN SUBSURFACE SOIL SITE 41 - REMEDIAL INVESTIGATION REPORT NAS WHITING FIELD MILTON, FLORIDA	CONTRACT NO. CTO 0079
CHECKED BY L. SMITH	DATE 1/28/09		APPROVED BY — DATE —
COST/SCHED-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 5 - 6 / REV. 1

NAVFAC

Pesticides

A large area of surface soil pesticide exceedances has been partially delineated to the southeast and northwest. However, the boundaries of this area have not been defined to the east, northeast, or southwest.

Metals

Two areas of metals exceedances in surface soil have been partially defined. The limits of an apparent hot spot associated with SB37 have not been defined to the south or southwest.

An area of exceedances associated with SB43 and SB44 has not been defined to the northwest, north, or northeast.

SPLP Leachate

Lead from surface soil samples from locations SS01, SS04, SS05, and SS06 was the only analyte found at concentrations exceeding primary criteria in the SPLP leachate samples. See Chapter 5.0 for a discussion of aluminum, iron, manganese, and vanadium.

5.3.2 Subsurface Soil

SVOCs

An apparent hot spot at SB43 has been delineated in the sense that it is bounded by samples without exceedances in all directions except to the south where the former building was located. The sampling effort was not designed to find contamination under the former building footprint where contamination was not considered likely.

A second area associated with locations SB31 and SB35 is well defined in all directions except to the southwest of SB35.

Pesticides

The limits of an apparent hot spot associated with SB37 have not been defined to the south or southwest.

An area of exceedances associated with SB41 and SB43 has been laterally delineated in the sense that it is bounded by samples without exceedances in all directions except to the south and west where the former building was located. However, the vertical limit of contamination has not been defined at SB43 (the deepest sample at this location was the 5 to 6 foot sample, and it contained a dieldrin exceedance).

Metals

The limits of an apparent hot spot at SB43 have not been defined to the north, northeast, or east. This area has been defined to the south and southwest in the sense that it is bounded by samples without exceedances in these directions where the former building was located. See the first part of Chapter 5.0 for a discussion of arsenic and vanadium.

5.3.3 General Trends

There is minor overlapping of hotspots in surface soil as well as overlapping of hotspots in subsurface soil, including SB43 exceedances in metals, pesticide and SVOCs. Subsurface samples exceeding in SVOCs overlap in surface and subsurface soil samples at sample locations SS13, SB31, and the adjacent surrounding area.

6.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the human health risk assessment (HHRA) for soil at Site 41. The objective of the risk assessment is to determine whether detected concentrations of chemicals in soil pose significant threats to potential human receptors under current and/or future land use. The potential risks to receptors are estimated based on the assumption no further actions are taken to control contaminant releases or prevent receptor exposure.

6.1 HUMAN HEALTH RISK ASSESSMENT PROTOCOL

The following U.S. Environmental Protection Agency (USEPA), Florida Department of Environmental Protection (FDEP), and Navy guidance documents and regulations were used to develop the HHRA methodology and to evaluate potential risks for each site:

- Conducting Human Health Risk Assessments under the Environmental Restoration Program, Department of the Navy, February 2001.
- Navy Policy on the Use of Chemical Background Levels, Department of the Navy, January 2004.
- Technical Report: Development of Soil Cleanup Target Levels for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), February 2005.
- State of Florida Chapter 62-780 F.A.C., Contaminated Site Cleanup Criteria, April 2005.
- Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A), USEPA, December 1989.
- Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors, USEPA, March 1991.
- Guidance for Data Usability in Risk Assessment (Part A), USEPA, April 1992.
- Supplemental Guidance to RAGS: Calculating the Concentration Term, USEPA, May 1992.
- Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure, USEPA, May 1993.

- Soil Screening Guidance: Technical Background Document, USEPA, July 1996.

- Exposure Factors Handbook, USEPA, August 1997.

- Supplemental Guidance to RAGS: Region IV Bulletins, Human Health Risk Assessment, USEPA Region 4, May 2000.

- Role of Background in the CERCLA Cleanup Program, USEPA, April 2002.

- Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites, USEPA, December 2002a.

- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA, December 2002b.

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance, Dermal Risk Assessment), USEPA, July 2004.

The components of a HHRA are addressed in the following sections:

- Data Evaluation Protocol [including data usability assessment; chemical of potential concern (COPC)] selection)

- Exposure Assessment

- Toxicity Assessment

- Risk Characterization

- Uncertainty Analysis

The risk assessment presented in this report considers both USEPA and FDEP policies and guidelines available for conducting human health risk assessments. Quantitative risk estimates are developed for receptor exposure to surface soil and subsurface soil using the “risk-ratio” approach defined in Section 6.3.3. USEPA Region IV supports the use of this technique. Additionally, comparisons of site soil concentrations to FDEP Clean-up Target Level (CTLs) recommended in FDEP Rule 62-780 are provided

(Section 6.6). This rule presents a phased risk-based corrective action process (RBCAP) that is iterative and tailors site rehabilitation tasks to site-specific conditions and risks.

6.1.1 Data Evaluation Protocol

Data evaluation, the first component of a baseline HHRA, is a two-step, medium-specific task involving the compilation and evaluation of analytical data. The first step involves the compilation of the analytical database and an evaluation of data usability for purposes of HHRA. The second step of the data evaluation is the selection of a medium-specific list of COPCs which are used to quantitatively or qualitatively determine potential human health risks for site media. COPCs are selected primarily based on a toxicity screen (i.e., a comparison of site contaminant concentrations to conservative toxicity screening values) and a background screen (i.e., a comparison of site concentrations to background concentrations). In addition, as discussed below, factors such as frequency of detection are considered in some cases. The results of the COPC selection process are presented in Section 6.2.

6.1.1.1 Data Usability

Data collected from the field investigation were used to assess risks to potential human receptors. The data were validated according to USEPA National Validation Functional Guidelines for Organic Data Review (October 1999), the Laboratory and Data Validation Functional Guidelines for Evaluation of Inorganic Analysis (February 1994), and TtNUS Standard Operating Procedures.

All detected concentrations with "J" qualifiers are considered positive detections and were used in the risk evaluation. Data with "U" and "UJ" qualifiers and data qualified because of blank contamination were retained and evaluated as nondetects. Field measurements and data regarded as unreliable (i.e., qualified as "R" during the data validation process) were not used in the quantitative risk assessment.

6.1.1.2 Selection of Chemicals of Potential Concern for Quantitative Risk Assessment

The selection of COPCs is a qualitative screening process used to limit the number of chemicals and exposure routes quantitatively evaluated in the baseline HHRA to those site-related constituents that dominate overall potential risks. Screening, primarily by risk-based concentrations and basewide background levels, is used to focus the risk assessment on meaningful chemicals and exposure routes.

In most cases, a chemical is selected as a COPC and retained for further quantitative risk evaluation if the maximum detection in a sampled medium exceeds the selected risk-based concentration(s) (i.e., the COPC screening level) and the chemical is determined to be present at concentrations exceeding background. This second condition applies only to those chemicals for which background comparison is possible and appropriate (e.g., metals). Background data are not available for organic chemicals. Chemicals eliminated from further evaluation at this time are assumed to present minimal risks to potential human receptors.

6.1.1.2.1 COPC Screening Levels

Several types of screening concentrations were used to identify COPCs for soil at Site 41. Screening concentrations based on the following criteria were used to select COPCs for surface and subsurface soil:

- USEPA Region 9 Preliminary Remediation Goals (PRGs) for Residential Soil (USEPA Region 9, October 2004)

- Florida Soil Cleanup Target (SCTLs) for Direct Contact (FDEP, April 2005)

- Florida Soil Cleanup Target Levels (SCTLs) for Leachability Based on Groundwater Criteria (FDEP, April 2005)

Most of the Region 9 PRGs and State of Florida STCLs are based on a Hazard Quotient (HQ) of 1.0 (i.e., a no adverse non-carcinogenic effect level) or a cancer risk level of 1×10^{-6} (i.e., a one-in-one million probability of developing cancer) but are adjusted (lowered) to reflect cumulative risk issues (e.g., Region 9 PRGs are typically adjusted to reflect a HQ of 0.1).

In the risk assessment conducted according to USEPA methodology, the screening levels for both carcinogens and non-carcinogens were developed using the guidance provided in the USEPA Region 4 Human Health Risk Assessment Bulletins -- Supplement to RAGS (USEPA Region 4, May 2000). In this approach, the risk-based USEPA Region 9 screening concentrations correspond to a HQ of 0.1 (for noncarcinogens) or an ILCR of 1×10^{-6} (for carcinogens). The Region 9 PRG values for noncarcinogens were multiplied by 0.1 to account for potential cumulative effects of several chemicals affecting the same target area or producing the same adverse noncarcinogenic health effect.

The screening levels used in the risk assessment conducted according to FDEP methodology were developed using the guidance provided in Appendices D and E of the Technical Report for Chapter 62-777 (FDEP, February 2005) and are presented in Section 6.6.

Because of the different exposure scenarios for potential human receptors, COPCs are identified separately for surface and subsurface soil. Surface soil is defined as soil collected from 0 to 1 feet below ground surface (bgs) and subsurface soil is defined as soil collected from depths of 1 to 10 feet bgs.

Exposure to COPCs in subsurface soil is typically evaluated only for potential exposure during construction or excavation activities. Therefore, a construction/excavation worker is considered to be the receptor most likely exposed to COPCs in subsurface soil. However, subsurface soil could potentially be brought to the surface during future excavation projects resulting in exposure of other receptors such as future residents or workers. For this reason, potential exposure of residents and typical industrial workers to subsurface soils are also evaluated in the risk assessment.

Screening Levels for Lead

Limited criteria are available to evaluate the potential risks associated with lead. There are no strictly risk-based concentrations for this chemical because the USEPA has not derived toxicity values [i.e., cancer slope factors (CSFs), reference doses (RfDs)] for lead. However, recommended screening levels are available for lead in soil and are frequently used to indicate the need for response activities.

Guidance from both the Office of Prevention, Pesticides, and Toxic Substances (OPPTS) and the Office of Solid Waste and Emergency Response (OSWER) recommend 400 mg/kg as the lowest screening level for lead-contaminated soil in a residential setting where children are frequently present (USEPA, July 1994). OPPTS identifies 2,000 to 5,000 mg/kg as an appropriate range for areas where contact with soil by children in a residential setting is less frequent. A value of 400 mg/kg is used as the screening level for COPC selection for both surface and subsurface soil.

Guidance for the USEPA Technical Review Workgroup (TRW) for Lead indicates that “a reasonable screening level for soil lead at commercial/industrial (i.e., non-residential) sites is 800 mg/kg” for a typical non-contact intensive worker (USEPA, August 2007). This value is not used for COPC selection but may be used in the qualitative evaluation of lead. The current State of Florida commercial/industrial SCTL for lead in soil is 1,400 mg/kg (FDEP, April 2005).

Essential Nutrients and Chemicals without Toxicity Criteria

The essential nutrients calcium, magnesium, potassium, and sodium are not included in the COPC screening process. These inorganic chemicals are naturally abundant in environmental matrices and are only toxic at high doses and, because of the lack of toxicity criteria, risk-based COPC screening levels are not available for these chemicals in the Region 9 PRG table or FDEP CTL tables.

Risk-based screening levels are currently not available for several constituents detected at Site 41 (e.g., benzo(g,h,i)perylene, phenanthrene, and alpha- and gamma-chlordane). Therefore, screening levels available for surrogate chemicals are used as screening levels for these constituents, as recommended, for example, by USEPA Region 1 (USEPA, August 1999). For example, in the COPC selection for soil at

Site 41, the screening level for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene, and chlordane is use as a surrogate for alpha- and gamma-chlordane.

6.1.1.2.2 Background Screen

Detected concentrations of organics and inorganics in surface soil and subsurface soil at Site 41 were compared to background data available for these media using various statistical tests. The statistical analysis of the background dataset and the comparisons of site concentrations to background concentrations were conducted in accordance with the following Navy and USEPA guidance:

- Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA, September 2002).

- Guidance for Environmental Background Analysis, Volume I: Soil. Prepared by Battelle Memorial Institute, Earth Tech, Inc., and Newfields for the Naval Facilities Engineering Command, Washington D.C., April 2002.

In the COPC selection process for Site 41, if the results of the background comparison evaluation indicated that Site 41 chemical concentrations did not exceed background concentrations, that chemical was not selected as a COPC and was not carried through the quantitative risk assessment. However, chemicals present at concentrations exceeding toxicity screening criteria but not selected as COPCs on the basis of background comparisons evaluations are further discussed in the uncertainty analysis section. The background comparison is presented in Appendix D.3. The results of the background screens are summarized in Tables 6-1 through 6-2.

The elimination of chemicals as site-related COPCs on the basis of background comparisons follows Navy Policy on the Use of Background Chemical Levels (Department of the Navy, January 2004). This document also presents the Navy's interpretation of the USEPA guidance provided in the document titled Role of Background in the CERCLA Cleanup Program (USEPA, April 2002) and details the methodology to be used in evaluating background under the Navy's Environmental Restoration and Base Realignment and Closure (BRAC) programs. Navy policy applies to both the screening-level and baseline risk assessments and requires the following:

1. A clear and concise understanding of chemicals released from a site thus ensuring the Navy is focusing on remediating the release.

2. The use of background data in the screening-level risk assessment.

TABLE 6-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects[2]	Concentration Used for Screening[3]	Site Above Background?[4]	EPA Region 9 PRG (Residential)[5]	EPA SSL Soil to Air Residential[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
Site 41	**Volatile Organic Compounds**													
	67-64-1	Acetone	0.0271 J	0.0271 J	mg/kg	1485CD00301	1/17	0.02 - 0.052	0.0271	NA	1400 N	NA	No	BSL
	Semivolatile Organic Compounds													
	120-12-7	Anthracene	0.00096 J	0.014 J	mg/kg	WHF-1485C-4101A	3/17	0.007 - 1.4	0.014	NA	2200 N	NA	No	BSL
	56-55-3	Benzo(a)anthracene	0.011	0.282 J	mg/kg	1485CD00601	14/17	0.34 - 1.4	0.282	NA	0.62 C	NA	No	BSL
	50-32-8	**Benzo(a)pyrene**	0.0024 J	9	mg/kg	WHF-148SC-SS-3101	44/53	0.07 - 1.4	9	NA	**0.062 C**	NA	**Yes**	ASL
	205-99-2	Benzo(b)fluoranthene	0.022	0.39	mg/kg	WHF-1485C-4101A	14/17	0.34 - 1.4	0.39	NA	0.62 C	NA	No	BSL
	191-24-2	Benzo(g,h,i)perylene	0.021 J	0.349	mg/kg	1485CD00601	14/17	0.34 - 1.4	0.349	NA	230 N[8]	NA	No	BSL
	207-08-9	Benzo(k)fluoranthene	0.013 J	0.266 J	mg/kg	1485CD00601	14/17	0.34 - 1.4	0.266	NA	6.2 C	NA	No	BSL
	218-01-9	Chrysene	0.018	0.422	mg/kg	1485CD00601	14/17	0.34 - 1.4	0.422	NA	62 C	NA	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	0.0025 J	0.1	mg/kg	WHF-41-SS-52-1	16/23	0.0077 - 1.4	0.1	NA	**0.062 C**	NA	**Yes**	ASL
	206-44-0	Fluoranthene	0.041 J	0.8	mg/kg	WHF-1485C-4101A	14/17	0.34 - 1.4	0.8	NA	230 N	NA	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	0.02	0.386	mg/kg	1485CD00601	14/17	0.34 - 1.4	0.386	NA	0.62 C	NA	No	BSL
	85-01-8	Phenanthrene	0.0088	0.22 J	mg/kg	1485CD00601	13/16	0.34 - 1.4	0.22	NA	230 N[8]	NA	No	BSL
	129-00-0	Pyrene	0.032 J	0.61	mg/kg	WHF-1485C-4101A	14/17	0.34 - 1.4	0.61	NA	230 N	NA	No	BSL
		Benzo(a)pyrene Equivalents	0.00625	9	mg/kg	WHF-148SC-SS-3101	44/53	0.07 - 1.4	9	NA	**0.062 C**	NA	**Yes**	ASL
	Pesticides/PCBs													
	72-54-8	4,4'-DDD	0.00072 J	0.11	mg/kg	WHF-1485C-4301	5/17	0.0018 - 0.37	0.11	NA	2.4 C	NA	No	BSL
	72-55-9	4,4'-DDE	0.001 J	0.13	mg/kg	WHF-1485C-4301	9/15	0.014 - 0.014	0.13	NA	1.7 C	NA	No	BSL
	50-29-3	4,4'-DDT	0.0018 J	0.33	mg/kg	WHF-1485C-4301	8/17	0.0019 - 0.37	0.33	NA	1.7 C	750 C	No	BSL
	309-00-2	Aldrin	0.00043 J	0.0058 J	mg/kg	WHF-1485C-4201A	7/23	0.00175 - 0.37	0.0058	NA	0.029 C	3.4 C	No	BSL
	5103-71-9	alpha-Chlordane	0.0012 J	0.61	mg/kg	WHF-1485C-4001	10/17	0.0019 - 0.014	0.61	NA	1.6 C[9]	72 C	No	BSL
	60-57-1	**Dieldrin**	0.0013 J	0.34 J	mg/kg	WHF-1485C-4001	20/23	0.00383 - 0.0068	0.34	NA	**0.03 C**	1.1 C	**Yes**	ASL
	72-20-8	Endrin	0.0004 J	0.018 J	mg/kg	WHF-1485C-4301	2/16	0.0018 - 0.37	0.018	NA	1.8 N	NA	No	BSL
	53494-70-5	Endrin Ketone	0.004 J	0.004 J	mg/kg	WHF-1485C-4301	1/16	0.0018 - 0.37	0.004	NA	1.8 N	NA	No	BSL
	5103-74-2	gamma-Chlordane	0.00095 J	0.56	mg/kg	WHF-1485C-4001	8/15	0.0019 - 0.014	0.56	NA	1.6 C[9]	72 C	No	BSL
	1024-57-3	Heptachlor Epoxide	0.00086 J	0.0099 J	mg/kg	WHF-1485C-4201A	3/14	0.0018 - 0.0088	0.0099	NA	0.053 C	4.7 C	No	BSL
	Metals													
	7429-90-5	Aluminum	5510	9970	mg/kg	WHF-1485C-4301	17/17	- - -	9970	No	**7600 N**	709000 N	No	BKG
	7440-36-0	Antimony	0.26	0.94	mg/kg	WHF-1485C-4301	4/17	0.22 - 0.26	0.94	No	3.1 N	NA	No	BSL, BKG
	7440-38-2	Arsenic	1.2	5.4	mg/kg	WHF-1485C-4301	11/17	0.75 - 1.6	5.4	No	**0.39 C**	769 C	No	BKG
	7440-39-3	Barium	8.9	62.2	mg/kg	WHF-1485C-4001	17/17	- - -	62.2	Yes	540 N	70900 N	No	BSL
	7440-43-9	Cadmium	0.047	0.77	mg/kg	WHF-1485C-4301	6/17	0.03 - 0.44	0.77	No	3.7 N	1840 C	No	BSL, BKG
	7440-70-2	Calcium	397	2080	mg/kg	WHF-1485C-4101	17/17	- - -	2080	Yes	NA	NA	No	NUT
	7440-47-3	**Chromium**	4.9 J	75 J	mg/kg	WHF-1485C-3701	17/17	- - -	75	Yes	**22 N[10,11]**	276 C	**Yes**	ASL
	7440-48-4	Cobalt	0.57	1.8	mg/kg	1485CD00101	9/17	0.3 - 0.51	1.8	No	140 N[11]	1180 C	No	BSL, BKG
	7440-50-8	Copper	2.4	15.4	mg/kg	1485CD00501	17/17	- - -	15.4	Yes	310 N	NA	No	BSL
	7439-89-6	Iron	3100	7060	mg/kg	1485CD00201	17/17	- - -	7060	No	**2300 N**	NA	No	BKG
	7439-92-1	Lead	4.6 J	345	mg/kg	WHF-1485C-3701	17/17	- - -	345	Yes	400	NA	No	BSL
	7439-95-4	Magnesium	134	736	mg/kg	1485CD00101	17/17	- - -	736	Yes	NA	NA	No	NUT
	7439-96-5	Manganese	31.4 J	158	mg/kg	1485CD00601	17/17	- - -	158	No	180 N	7090 N	No	BSL, BKG
	7439-97-6	Mercury	0.01	0.023 J	mg/kg	WHF-1485C-4301	7/17	0.0042 - 0.046	0.023	No	2.3 N	NA	No	BSL, BKG
	7440-02-0	Nickel	1.6	8	mg/kg	1485CD00101	13/17	2.8 - 3.7	8	No	160 N	NA	No	BSL, BKG
	7440-09-7	Potassium	55.4	268	mg/kg	1485CD00101	17/17	- - -	268	Yes	NA	NA	No	NUT
	7440-23-5	Sodium	299	368	mg/kg	1485CD00401	6/17	25.3 - 29.7	368	Yes	NA	NA	No	NUT
	7440-62-2	Vanadium	8.1	20	mg/kg	WHF-1485C-3901	17/17	- - -	20	No	**7.8 N**	NA	No	BKG
	7440-66-6	Zinc	9.1 J	139 J	mg/kg	WHF-1485C-4301	17/17	- - -	139	Yes	2300 N	NA	No	BSL

TABLE 6-1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
2 OF 2

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration(1)	Maximum Concentration(1)	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects(2)	Concentration Used for Screening(3)	Site Above Background?(4)	EPA Region 9 PRG (Residential)(5)	EPA SSL Soil to Air Residential(6)	COPC Flag	Rationale for Contaminant Deletion or Selection(7)
	Miscellaneous Parameters													
	57-12-5	Cyanide	0.31	0.76 J	mg/kg	1485CD00601	3/17	0.51 - 0.61	0.76	NA	120 N	NA	No	BSL
	Petroleum Hydrocarbons													
	TTNUS001	Total Petroleum Hydrocarbons	9 J	190	mg/kg	WHF-1485C-4601	17/17	- - -	190	NA	NA	NA	No	NTX

Footnotes
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described as described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
5 - USEPA Region 9 Preliminary Remediation Goal Table. The noncarcinogenic values (denoted with a "N" flag) are the RBC divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (USEPA Region 9, November 2004, Update December 29, 2004).
6 - USEPA Soil Screening Levels. EPA Internet Site at http://rais.ornl.gov/calc_start.shtml. (Soil-to-air SSLs for noncarcinogens are divided by 10).
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be greater than site background.
8 - The PRG for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
9 - The PRG for chlordane is used as surrogates for alpha- and gamma-chlordane.
10 - The PRG for hexavalent chromium is presented.
11 - One tenth of the noncarcinogenic PRG is less than the carcinogenic PRG, therefore the noncarcinogenic PRG is presented.

Shaded criterion indicates that the maximum detected concentration exceeds one or more screening criteria. Shaded chemical name indicates that the chemical was retained as a COPC.

Associated Samples

1485CD00101	1485CSS1901	WHF-148SC-SS-2301
1485CD00201	1485CSS2001	WHF-148SC-SS-2401
1485CD00301	WHF-1485C-3401	WHF-148SC-SS-2501
1485CD00401	WHF-1485C-3501	WHF-148SC-SS-2601
1485CD00501	WHF-1485C-3601	WHF-148SC-SS-2701
1485CD00601	WHF-1485C-3701	WHF-148SC-SS-2801
1485CSS0701	WHF-1485C-3801	WHF-148SC-SS-2901
1485CSS0801	WHF-1485C-3901	WHF-148SC-SS-3001
1485CSS0901	WHF-1485C-4001	WHF-148SC-SS-3101
1485CSS1001	WHF-1485C-4101	WHF-148SC-SS-3201
1485CSS1101	WHF-1485C-4101A	WHF-148SC-SS-3301
1485CSS1201	WHF-1485C-4201	WHF-41-SS-48-1
1485CSS1301	WHF-1485C-4201A	WHF-41-SS-49-1
1485CSS1301-AVG	WHF-1485C-4301	WHF-41-SS-50-1
1485CSS1301-D	WHF-1485C-4401	WHF-41-SS-51-1
1485CSS1401	WHF-1485C-4501	WHF-41-SS-52-1
1485CSS1501	WHF-1485C-4601	WHF-41-SS-53-1
1485CSS1601	WHF-1485C-4701	
1485CSS1701	WHF-148SC-SS-2101	
1485CSS1801	WHF-148SC-SS-2201	

Definitions:
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value
N = Noncarcinogen
NA = Not Applicable/Not Available
sat = soil saturation concentration
SSL = Soil Screening Level

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level and site background.

For elimination as a COPC:
BKG = Less than Background Concentration
BSL = Below COPC Screening Level
NUT = Essential nutrient
NTX = No toxicity criteria

TABLE 6-2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
1 OF 2

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects[2]	Concentration Used for Screening[3]	Site Above Background?[4]	EPA Region 9 PRG (Residential)[5]	EPA SSL Soil to Air Residential[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
Site 41	**Volatile Organic Compounds**													
	78-93-3	2-Butanone	0.0019 J	0.0041 J	mg/kg	WHF-1485C-4502	3/26	0.0047 - 0.011	0.0041	NA	2200 N	24000 sat	No	BSL
	67-64-1	Acetone	0.016 J	0.029	mg/kg	WHF-1485C-4503	3/26	0.019 - 0.057	0.029	NA	1400 N	NA	No	BSL
	Semivolatile Organic Compounds													
	100-01-6	4-Nitroaniline	0.17 J	0.17 J	mg/kg	WHF-1485C-4302	1/26	0.37 - 3.6	0.17	NA	23 C	567000 N	No	BSL
	120-12-7	Anthracene	0.052 J	0.052 J	mg/kg	WHF-1485C-4302	1/26	0.007 - 0.41	0.052	NA	2200 N	NA	No	BSL
	56-55-3	**Benzo(a)anthracene**	0.002 J	2.5	mg/kg	WHF-1485C-4302	10/26	0.0071 - 0.41	2.5	NA	**0.62 C**	NA	**Yes**	ASL
	50-32-8	**Benzo(a)pyrene**	0.0014 J	2	mg/kg	WHF-1485C-4302	42/67	0.007 - 0.41	2	NA	**0.062 C**	NA	**Yes**	ASL
	205-99-2	**Benzo(b)fluoranthene**	0.0021 J	3.1	mg/kg	WHF-1485C-4302	15/25	0.0071 - 0.41	3.1	NA	**0.62 C**	NA	**Yes**	ASL
	191-24-2	Benzo(g,h,i)perylene	0.0017 J	1.2 J	mg/kg	WHF-1485C-4302	15/26	0.0071 - 0.41	1.2	NA	230 N[8]	NA	No	BSL
	207-08-9	Benzo(k)fluoranthene	0.0015 J	1.7	mg/kg	WHF-1485C-4302	11/26	0.0071 - 0.41	1.7	NA	6.2 C	NA	No	BSL
	86-74-8	Carbazole	0.33 J	0.33 J	mg/kg	WHF-1485C-4302	1/26	0.35 - 0.73	0.33	NA	24 C	NA	No	BSL
	218-01-9	Chrysene	0.002 J	3.6	mg/kg	WHF-1485C-4302	12/26	0.0071 - 0.41	3.6	NA	62 C	NA	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	0.0017 J	0.3 J	mg/kg	WHF-1485C-4302	14/44	0.0071 - 0.41	0.3	NA	**0.062 C**	NA	**Yes**	ASL
	206-44-0	Fluoranthene	0.0016 J	3.1	mg/kg	WHF-1485C-4302	15/26	0.0071 - 0.41	3.1	NA	230 N	NA	No	BSL
	86-73-7	Fluorene	0.0019 J	0.0042 J	mg/kg	WHF-1485C-4502	2/26	0.007 - 0.41	0.0042	NA	270 N	NA	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	0.0016 J	0.98	mg/kg	WHF-1485C-4302	14/26	0.0071 - 0.41	0.98	NA	**0.62 C**	NA	**Yes**	ASL
	85-01-8	Phenanthrene	0.0016 J	0.32 J	mg/kg	WHF-1485C-4302	10/26	0.0071 - 0.41	0.32	NA	230 N[8]	NA	No	BSL
	129-00-0	Pyrene	0.0017 J	3.7	mg/kg	WHF-1485C-4302	14/26	0.0071 - 0.41	3.7	NA	230 N	NA	No	BSL
		Benzo(a)pyrene Equivalents	0.0026	2.9786	mg/kg	WHF-1485C-4302	45/67	0.007 - 0.41	2.9786	NA	**0.062 C**	NA	**Yes**	ASL
	Pesticides/PCBs													
	72-54-8	4,4'-DDD	0.00039 J	1.1 J	mg/kg	WHF-1485C-4302	5/26	0.0018 - 0.037	1.1	NA	2.4 C	NA	No	BSL
	72-55-9	4,4'-DDE	0.0002 J	1	mg/kg	-1485C-4302, WHF-1485C-	10/25	0.0018 - 0.037	1	NA	1.7 C	NA	No	BSL
	50-29-3	**4,4'-DDT**	0.00079 J	5.7	mg/kg	WHF-1485C-4302	5/26	0.0018 - 0.037	5.7	NA	**1.7 C**	750 C	**Yes**	ASL
	309-00-2	**Aldrin**	0.00035 J	0.049	mg/kg	WHF-1485C-4102A	3/44	0.00177 - 0.95	0.049	NA	**0.029 C**	3.4 C	**Yes**	ASL
	5103-71-9	alpha-Chlordane	0.00053 J	0.58 J	mg/kg	WHF-1485C-4303	9/25	0.0018 - 0.0041	0.58	NA	1.6 C[9]	72 C	No	BSL
	319-85-7	beta-BHC	0.00023 J	0.00023 J	mg/kg	WHF-1485C-4602	1/26	0.0018 - 0.95	0.00023	NA	0.32 C	6 C	No	BSL
	60-57-1	**Dieldrin**	0.00046 J	0.94 J	mg/kg	WHF-1485C-4303	14/41	0.0018 - 0.0052	0.94	NA	**0.03 C**	1.1 C	**Yes**	ASL
	33213-65-9	Endosulfan II	0.0006 J	0.0006 J	mg/kg	WHF-1485C-4203A	1/26	0.0018 - 0.95	0.0006	NA	37 N	NA	No	BSL
	72-20-8	Endrin	0.0068 J	0.0068 J	mg/kg	WHF-1485C-4102A	1/25	0.0018 - 0.95	0.0068	NA	1.8 N	NA	No	BSL
	5103-74-2	gamma-Chlordane	0.0025 J	0.79	mg/kg	WHF-1485C-4302	6/22	0.0018 - 0.0041	0.79	NA	1.6 C[9]	72 C	No	BSL
	1024-57-3	Heptachlor Epoxide	0.00033 J	0.00053 J	mg/kg	WHF-1485C-4202A	2/24	0.0018 - 0.95	0.00053	NA	0.053 C	4.7 C	No	BSL
	Metals													
	7429-90-5	Aluminum	5480	37400	mg/kg	1485CD00810	26/26	- - -	37400	No	**7600 N**	709000 N	No	BKG
	7440-36-0	Antimony	0.51	10.7	mg/kg	WHF-1485C-4303	4/26	0.22 - 0.32	10.7	No	**3.1 N**	NA	No	BKG
	7440-38-2	Arsenic	0.98	15.2	mg/kg	WHF-1485C-4302	26/26	- - -	15.2	No	**0.39 C**	769 C	No	BKG
	7440-39-3	Barium	4.6	73.8	mg/kg	WHF-1485C-4303	26/26	- - -	73.8	Yes	540 N	70900 N	No	BSL
	7440-43-9	Cadmium	0.86	2.2	mg/kg	WHF-1485C-4302	2/26	0.04 - 0.047	2.2	No	3.7 N	1840 C	No	BSL, BKG
	7440-70-2	Calcium	60.3	1570	mg/kg	WHF-1485C-4303	26/26	- - -	1570	Yes	NA	NA	No	NUT
	7440-47-3	Chromium	4.4 J	37.3	mg/kg	1485CD00810	26/26	- - -	37.3	No	**22 N[10,11]**	276 C	No	BKG
	7440-48-4	Cobalt	1.4	2.4	mg/kg	WHF-1485C-4302	2/26	0.13 - 0.53	2.4	No	140 N[11]	1180 C	No	BSL, BKG
	7440-50-8	Copper	1.6	26	mg/kg	WHF-1485C-4302	26/26	- - -	26	Yes	310 N	NA	No	BSL
	7439-89-6	Iron	2530	26700	mg/kg	1485CD00810	26/26	- - -	26700	No	**2300 N**	NA	No	BKG
	7439-92-1	Lead	1.1 J	322 J	mg/kg	WHF-1485C-4303	26/26	- - -	322	No	400	NA	No	BSL, BKG
	7439-95-4	Magnesium	31.2	313	mg/kg	WHF-1485C-4302	26/26	- - -	313	No	NA	NA	No	NUT, BKG
	7439-96-5	Manganese	1.8 J	410 J	mg/kg	WHF-1485C-4302	26/26	- - -	410	No	**180 N**	7090 N	No	BKG
	7439-97-6	Mercury	0.0075 J	0.078 J	mg/kg	WHF-1485C-4303	10/26	0.02 - 0.09	0.078	Yes	2.3 N	NA	No	BSL

TABLE 6-2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
2 OF 2

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration[1]	Maximum Concentration[1]	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondects[2]	Concentration Used for Screening[3]	Site Above Background?[4]	EPA Region 9 PRG (Residential)[5]	EPA SSL Soil to Air Residential[6]	COPC Flag	Rationale for Contaminant Deletion or Selection[7]
	7440-02-0	Nickel	0.92 J	6.1	mg/kg	WHF-1485C-4302	25/26	0.7 - 0.7	6.1	Yes	160 N	NA	No	BSL
	7440-09-7	Potassium	47.1	306	mg/kg	WHF-1485C-4302	24/26	100 - 133	306	Yes	NA	NA	No	NUT
	7782-49-2	Selenium	4.8 J	4.8 J		1485CD00705	1/26	0.24 - 2.7	4.8	Yes	39 N	NA	No	BSL
	7440-23-5	Sodium	95.7	115 J	mg/kg	1485CD00810	4/26	25.8 - 30.4	115	Yes	NA	NA	No	NUT
	7440-62-2	Vanadium	7.3	68.1	mg/kg	1485CD00810	26/26	- - -	68.1	No	**7.8 N**	NA	No	BKG
	7440-66-6	Zinc	4.3	246 J	mg/kg	WHF-1485C-4302	26/26	- - -	246	Yes	2300 N	NA	No	BSL
	Miscellaneous Parameters													
	57-12-5	Cyanide	0.31	1.8 J	mg/kg	1485CD00810	2/26	0.53 - 0.62	1.8	NA	120 N	NA	No	BSL
	Petroleum Hydrocarbons													
	TTNUS001	Total Petroleum Hydrocarbons	5.2	920	mg/kg	WHF-1485C-4303	10/26	4.2 - 10	920	NA	NA	NA	No	NTX

Footnotes
1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits.
3 - The maximum detected concentration is used for screening purposes.
4 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described as described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
5 - USEPA Region 9 Preliminary Remediation Goal Table. The noncarcinogenic values (denoted with a "N" flag) are the RBC divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (USEPA Region 9, November 2004, Update December 29, 2004).
6 - USEPA Soil Screening Levels. EPA Internet Site at http://rais.ornl.gov/calc_start.shtml. (Soil-to-air SSLs for noncarcinogens are divided by 10).
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be greater than site background.
8 - The PRG for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.
9 - The PRG for chlordane is used as surrogates for alpha- and gamma-chlordane.
10 - The PRG for hexavalent chromium is presented.
11 - One tenth of the noncarcinogenic PRG is less than the carcinogenic PRG, therefore the noncarcinogenic PRG is presented.

Shaded criterion indicates that the maximum detected concentration exceeds one or more screening criteria. Shaded chemical name indicates that the chemical was retained as a COPC.

Associated Samples

1485CD00510	WHF-1485C-4002	WHF-1485C-4603	WHF-148SC-SS-3302	WHF-41-SS-52-3
1485CD00605	WHF-1485C-4003	WHF-1485C-4702	WHF-148SC-SS-3303	WHF-41-SS-53-2
1485CD00705	WHF-1485C-4102	WHF-1485C-4703	WHF-41-SS-31-4	WHF-41-SS-53-3
1485CD00810	WHF-1485C-4102A	WHF-148SC-SS-0902	WHF-41-SS-31-5	
WHF-1485C-3104	WHF-1485C-4103	WHF-148SC-SS-2102	WHF-41-SS-31-6	
WHF-1485C-3402	WHF-1485C-4103A	WHF-148SC-SS-2202	WHF-41-SS-43-4	
WHF-1485C-3403	WHF-1485C-4202	WHF-148SC-SS-2302	WHF-41-SS-43-5	
WHF-1485C-3502	WHF-1485C-4202A	WHF-148SC-SS-2402	WHF-41-SS-43-6	
WHF-1485C-3503	WHF-1485C-4203	WHF-148SC-SS-2502	WHF-41-SS-48-2	
WHF-1485C-3602	WHF-1485C-4203A	WHF-148SC-SS-2602	WHF-41-SS-48-3	
WHF-1485C-3603	WHF-1485C-4302	WHF-148SC-SS-2702	WHF-41-SS-49-2	
WHF-1485C-3702	WHF-1485C-4303	WHF-148SC-SS-2802	WHF-41-SS-49-3	
WHF-1485C-3703	WHF-1485C-4402	WHF-148SC-SS-2902	WHF-41-SS-50-2	
WHF-1485C-3802	WHF-1485C-4403	WHF-148SC-SS-3002	WHF-41-SS-50-3	
WHF-1485C-3803	WHF-1485C-4502	WHF-148SC-SS-3102	WHF-41-SS-51-2	
WHF-1485C-3902	WHF-1485C-4503	WHF-148SC-SS-3103	WHF-41-SS-51-3	
WHF-1485C-3903	WHF-1485C-4602	WHF-148SC-SS-3202	WHF-41-SS-52-2	

Definitions:
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value
N = Noncarcinogen
NA = Not Applicable/Not Available
sat = soil saturation concentration
SSL = Soil Screening Level

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level and site background.

For elimination as a COPC:
BKG = Less than Background Concentration
BSL = Below COPC Screening Level
NUT = Essential nutrient
NTX = No toxicity criteria

- Individual chemicals may be eliminated as COPCs if they are detected at a frequency of less than 5 percent in any given medium but only if there are no other indications the chemical would pose an unacceptable risk to receptors (e.g., there is no evidence of a contaminant “hot spot”). Chemicals exhibiting unusually high concentrations or are clearly site-related may be retained as COPCs at the discretion of the human health risk assessor.

- The essential nutrients (calcium, magnesium, potassium, and sodium) are not identified as COPCs.

6.2 SELECTION OF COPCS FOR HUMAN HEALTH RISK ASSESSMENT – USEPA METHODOLOGY

The direct contact, USEPA Region 9 risk-based screening levels defined in Section 6.1.1.2 were used to select COPCs for quantitative evaluation at Site 41. A discussion of the chemicals selected as COPCs (i.e., those chemicals detected at concentrations in excess of USEPA direct contact screening criteria and the rationale for COPC selection are provided in the following paragraphs. COPC selection tables for surface soil and subsurface soil are presented as Tables 6-1 and 6-2, respectively.

6.2.1 Surface Soil

One VOC, 12 SVOCs, 10 pesticides/PCBs, 19 inorganics, cyanide, and petroleum hydrocarbons were detected in surface soil samples collected at Site 41. A comparison of the maximum detected surface soil concentrations to screening levels based on USEPA Region 9 PRGs for residential exposures is presented in Table 6-1. Also presented in Table 6-1 are the results of the site data-to-background data comparisons. The following chemicals were detected in surface soils at maximum concentrations exceeding the direct contact, risk based COPC screening levels and background, and were retained as COPCs for surface soil:

- SVOCs [benzo(a)pyrene and dibenzo(a,h)anthracene]
- Pesticides/PCBs [Dieldrin]
- Inorganics [chromium]

These constituents were retained for the quantitative evaluation presented in Section 6.4. The maximum concentrations of aluminum, arsenic, iron, and vanadium exceeded the screening levels but were within background levels in surface soil. Consequently, aluminum, arsenic, iron, and vanadium were not retained as COPCs for surface soil.

6.2.2 Subsurface Soil

Two VOCs, 15 SVOCs, 11 pesticides/PCBs, 20 inorganics, cyanide, and petroleum hydrocarbons were detected in subsurface soil samples collected at Site 41. A comparison of the maximum detected subsurface soil concentrations to screening levels based on USEPA Region 9 PRGs for residential exposures is presented in Table 6-2. Also presented in Table 6-2 are the results of the site data-to-background data comparisons. The following chemicals were detected in subsurface soils at maximum concentrations exceeding the direct contact, risk based COPC screening levels and background, and were retained as COPCs for subsurface soil:

- SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3,cd)pyrene, and benzo(a)pyrene equivalents)

- Pesticides/PCBs (4,4'-DDT, aldrin, and dieldrin)

These constituents were retained for the quantitative evaluation presented in Section 6.4. The maximum concentrations of aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium exceeded the screening levels but were within background levels in surface soil. Consequently, these chemicals were not retained as COPCs for subsurface soil.

6.3 EXPOSURE ASSESSMENT/ESTIMATION OF RISK

The exposure assessment defines and evaluates, quantitatively or qualitatively, the type and magnitude of human exposure to the chemicals present at or migrating from the site. The exposure assessment is designed to depict the physical setting of the site, to identify potentially exposed populations and applicable exposure pathways, to determine concentrations of COPCs to which receptors might be exposed, and to estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures at a site are determined based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has three components: (1) a source of chemicals that can be released to the environment, (2) a route of contaminant transport through an environmental medium, and (3) an exposure or contact point for a human receptor. These components can be integrated and described by means of a conceptual site model (CSM), which is an essential element of the exposure assessment.

Current or potential human exposures identified by the CSM are evaluated using the "risk-ratio" approach defined in Section 6.3.3. As noted above, this approach is supported by USEPA Region 4. The approach uses exposure point concentrations (EPCs) for the COPCs in soil and relevant risk-based concentrations to generate cancer and non-cancer risk estimates for receptors of concern. The risk-based concentrations for soil used to estimate risk are the FDEP SCTLs developed for the residential and industrial land use scenarios and risk-based concentrations developed for other receptors using USEPA and FDEP guidance documents. The risk-based concentrations define and incorporate all the exposure factors (e.g., soil and water ingestion rates) used to determine chemical intake/exposure by receptors of concern.

6.3.1 Conceptual Site Model

The foundation of an exposure assessment is the CSM, which identifies site characteristics including potential contaminant sources, contaminant release mechanisms, transport routes, receptors under current and future land use scenarios, and other appropriate information. The CSM integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors to be evaluated in the risk assessment. A well-defined CSM allows for a better understanding of the risks at a site and aids risk managers in the identification of the potential need for remediation. A general overview of CSM information relevant to Site 41 is provided below. Table 6-3 provides a general summary of the potential receptors and exposure routes evaluated in the risk assessment for Site 41.

As note above, the CSM depicts the relationships among the following elements:

- Site sources of contamination
- Contaminant release mechanisms
- Transport/migration pathways
- Exposure routes
- Potential receptors

A general discussion of these elements is provided in following paragraphs.

Site Background and History

NAS Whiting Field is located in Santa Rosa County, in Florida's northwest coastal area, approximately 5.5 miles north of Milton and 25 miles northeast of Pensacola. Mobile, Alabama, is approximately 70 miles west of NAS Whiting Field, and Tallahassee, the capital of Florida, is 174 miles to the east. The installation was constructed in the early 1940s and has served as a naval aviation training facility since then. NAS Whiting Field presently consists of two airfields (North and South Fields) and provides the support facilities for flight and academic training.

TABLE 6-3

**EXPOSURE ROUTES FOR QUANTITATIVE EVALUATION
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA**

Receptors	Exposure Routes
Adult and Adolescent Trespassers / Recreational Users	• Soil dermal contact (surface) • Soil ingestion (surface) • Inhalation of air/dust/emissions (surface soil)
Maintenance Workers	• Soil dermal contact (surface) • Soil ingestion (surface) • Inhalation of air/dust/emissions (surface)
Construction Workers	• Soil dermal contact (surface and subsurface) • Soil ingestion (surface and subsurface) • Inhalation of air/dust/emissions (surface and subsurface)
Occupational Workers	• Soil dermal contact (surface)[1] • Soil ingestion (surface)[1] • Inhalation of air/dust/emissions (surface)[1]
Residents (Adult/Children)	• Soil dermal contact (surface)[1] • Soil ingestion (surface)[1] • Inhalation of air/dust/emissions (surface)[1]

1 Occupational workers and residents are also evaluated for exposure to chemicals of potential concern (COPCs) in subsurface soil. This scenario is included to account for the possibility that subsurface soil could be brought to the surface in future excavation projects.

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested areas to the south and southwest, and forests along the remaining boundaries. Located on an upland area, elevations at NAS Whiting Field range from 50 to 190 feet (ft) above sea level. The facility is bounded by low-lying receiving water: Clear Creek to the west and south, and Big Coldwater Creek to the east. Both creeks are tributaries of the Blackwater River. The Blackwater River discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system.

Site 41 is the site of the former Pesticide Storage Building 1485C. The building was located within the Base Operating Services Compound northwest of the eastern termination of Yorktown Street and was used for storage of ground maintenance equipment and limited amounts of pesticide compounds. The former Building 1485C was used during an undetermined period for storage of ground maintenance equipment and limited amounts of pesticide compounds. The building caught fire in the late 1980's and was completely destroyed. Following the fire, cleanup activities at the site included the removal of all building materials and the concrete slab flooring. The depth of the removal excavation and the disposal history of the excavated materials are unknown.

Potential Contaminant Migration Routes

Assuming surface soil and subsurface soil contamination has occurred as a result of chemical usage and chemicals may migrate to deeper subsurface soils and groundwater, the primary plausible contaminant release and migration mechanisms at Site 41 are as follows:

- Migration of soil contaminants downward through the soil column with infiltrating precipitation. Chemicals may continue to migrate in groundwater via dispersion and advection in the downgradient direction. However, the chemicals of concern at the site are not environmentally mobile and do not tend to leach through the soil column under typical environmental conditions.

- Migration of fugitive dusts from surface soils (and subsurface soils if construction/excavation activities occur) into ambient air. However as indicated in COPC selection Tables 6-1 and 6-2, the site soil concentrations of all detected chemicals were less than USEPA inhalation SSLs and, therefore, the soil-to-air inhalation pathway is not considered significant and is not further evaluated in the risk assessment.

A secondary release by stormwater runoff could affect the surface water in the surrounding area resulting in humans and both terrestrial and aquatic biota becoming potential receptors via ingestion and dermal contact. However, because no surface water bodies are present in the immediate vicinity of Site 41, the potential for runoff from surface soil to a surface water body is not addressed.

Potential Current and Future Receptors of Concern and Exposure Pathways

NAS Whiting Field is an active facility and will remain active for the foreseeable future. However, for purposes of completeness, the baseline risk assessment prepared for Site 41 considers receptor exposure under residential, industrial, and recreational land use scenarios. Based on current and potential future land use, the following potential receptors are assumed to be exposed to contaminated environmental media at Site 41:

- **Site Maintenance Worker** – An on-site receptor under current/future land use. This includes adult military or civilian personnel assigned to work (primarily groundskeeping/outdoor maintenance activities) at a site. This receptor could be exposed to surface soil by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors) during groundskeeping or maintenance activities. This receptor would not be expected to be routinely exposed to subsurface soils. This receptor is expected to be exposed to surface soil for 30 days per year for 25 years based on professional judgment. Maintenance workers are considered one of the more likely receptors under current land use.

- **Construction/Excavation Worker** – A plausible on-site receptor under future land use if major construction activities were to occur. This receptor could be exposed to surface and subsurface soils by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors). The construction worker is assumed to be exposed to soil for 250 days per year for one year (USEPA, December 2002b) assuming a Reasonable Maximum Exposure (RME) scenario.

- **Typical Occupational Worker** – An on-site receptor under future land use. Future occupational workers may work at the site if the facility were to close and be developed for commercial/industrial uses. To provide information for risk management decisions, potential risks to future occupational workers are quantified in the risk assessment. This receptor could be exposed to surface soil by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors). This receptor would not be expected to be routinely exposed to subsurface soils. The occupational worker is expected to be exposed to surface soils for 250 days per year for 25 years (USEPA, May 1993 and December 2002b) but less intensely than the maintenance or construction worker.

- **Adult and Adolescent Recreational User/Trespasser** – A plausible receptor under current and future land use. Although access to the base is controlled, once inside the base, access to Site 41 is not limited by any physical constraints. This receptor may be exposed to potentially contaminated surface soil by incidental ingestion, dermal contact, and inhalation (i.e., airborne particulates/vapors). Recreational users/trespassers are assumed to be exposed to COPCs in soil for 45 days per year, based on professional judgment. Direct contact with subsurface soils is not anticipated for this receptor. Recreational users are considered one of the more likely receptors under current land use.

- **On-Site Child and Adult Resident** – A hypothetical on-site receptor under future land use. The future residential scenario was quantitatively evaluated in the risk assessment for decision-making purposes although this scenario is unlikely for the NAS Whiting Field. It is assumed a resident may be exposed to surface soils by incidental ingestion, dermal contract, and inhalation (i.e., airborne particulates/vapors).

6.3.2 Calculation of Exposure Point Concentrations

The exposure point concentration (EPC), calculated for COPCs only, is a reasonable estimate of the chemical concentration likely to be contacted over time by a receptor and is used to calculate estimated exposure intakes. Calculation of EPCs considered guidance described in the USEPA's Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (December 2002a) and Florida's 62-780 F.A.C (FDEP, April 2005).

The 95-percent upper confidence limit (UCL), which is based on the distribution of a dataset, is considered to be the best estimate of the exposure concentration for datasets with 10 or more samples (USEPA, May 1992). For datasets with less than 10 samples, the UCL is considered to be a poor estimate of the mean, and the EPC is defined as the maximum concentration. As specified in Chapter 62-780 F.A.C., the Florida UCL Calculator tool (Version 1.0) (FUCL) was used to calculate the UCLs. FUCL was developed with consideration of the methods and guidelines presented in the USEPA's guidance document for Calculating UCLs for EPCs at Hazardous Waste Sites (December, 2002). Thus, in many respects the methodology incorporated into the software is very similar to the USEPA's Pro-UCL software. FUCL differs from Pro-UCL in that FUCL tends to not recommend the calculation of UCLs via non-parametric methods (e.g., boot strap methods) and FUCL pays particular attention to the handling censored results (i.e., non-detect results). Also, generally, EPCs developed using FUCL tend to be more conservative than (i.e., higher than) EPCs developed using Pro-UCL.

The following decision rules were used to calculate EPCs:

- If a soil dataset contains fewer than 10 samples, the EPC is defined as the maximum detected concentration.

- If a soil dataset contains 10 or more samples, the 95-percent UCL on the arithmetic mean (calculated using the Florida UCL Calculator Tool), which is based on the distribution of the dataset, was selected as the EPC.

- If the calculated 95-percent UCL exceeded the maximum detected concentration, the maximum concentration was used as the EPC.

- Sample and duplicate analytical results were averaged before the EPC was calculated.

- A data value less than the sample-specific detection limit was substituted with one-half the detection limit.

6.3.3 Chemical Intake and Risk Estimation

To evaluate risks by USEPA methodology, cancer and non-cancer risk estimates for COPCs detected in soil are determined using the following simple "risk ratio" technique, which involves the selection (or development) of risk-based concentrations established at the 1 x 10^{-6} cancer risk level or HQ of 1 and the calculation of cancer and non-cancer risks based on the EPC and the risk based concentration:

$$\frac{\text{Risk Based Concentration}}{\text{EPC for COPC}} = \frac{\text{HQ of 1 or Cancer Risk Estimate of } 1 \times 10^{-6}}{\text{HQ or Cancer Risk Estimate for COPC}}$$

This is a valid technique for estimating risk because all of the intake and risk characterization equations used to develop risk-based concentrations are linear. The risk-based concentrations used in the HHRAs for the evaluation of exposure to soil are the State of Florida SCTLs or risk-based concentrations based on the methodology for the development of residential and industrial SCTLs presented in the draft Technical Report: Development of Cleanup Target Levels (CTLs) for Chapter 62-777 (FDEP, April 2005).

Cancer and non-cancer risk estimates for all other receptors evaluated in the HHRA (i.e., the construction worker, the maintenance worker, and the recreational user/trespasser) are based on risk-based concentrations developed using the exposure dose assumptions and the simple intake equations presented in the following sections and the toxicity criteria (slope factors and reference doses) discussed in Section 6.4. The simple intake equations are combined to produce one risk-based concentration per chemical that accounts for ingestion, dermal, and inhalation exposures. (The risk-based concentration calculations are presented in Appendix C.) The risk-based concentrations are established by setting the cancer and non-cancer risk levels at 1 x 10^{-6} or hazard index of 1, respectively, and solving for the associated contaminant concentration in soil as demonstrated in the USEPA Risk Assessment Guidance for Superfund, Part B (USEPA December 1991). The exposure assumptions selected for the construction worker, the maintenance worker, the recreational user/trespasser were based on current USEPA risk assessment guidance (December 1989 and July 2004) and State of Florida guidance (FDEP, April 2005). Risk assessment spreadsheets for the calculation of the risk estimates are presented in Appendix C.

6.3.3.1 Incidental Ingestion of Soil

Incidental ingestion of soil by potential receptors coincides with dermal exposure. Exposures associated with incidental ingestion were estimated in the following manner (USEPA, December 1989):

$$Intake_{si} = (C_{si})(IR_s)(FI)(EF)(ED)(CF)/(BW)(AT)$$

where: $Intake_{si}$ = intake of contaminant "i" from soil (mg/kg/day)

C_{si}	=	concentration of contaminant "i" in soil (mg/kg)
IR_s	=	ingestion rate (mg/day)
FI	=	fraction ingested from contaminated source (dimensionless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
CF	=	conversion factor ($1x10^{-6}$ kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (days);

for noncarcinogens, AT = ED x 365 days/year;
for carcinogens, AT = 70 years x 365 days/year

As noted above, the State of Florida SCTLs are used to calculate cancer and non-cancer risk estimates for the hypothetical future resident and a typical industrial worker exposed to soil. Exposure assumptions for the other receptors are described below and were used to develop risk-based concentrations for the construction worker, the maintenance worker, and the recreational user/trespasser (Appendix C).

A default value of 1.0 (USEPA, December 1989) is recommended for the fraction of soil ingested from the contaminated source. The ingestion rates were 330 mg per day for the construction worker (USEPA, December 2002b), 50 mg per day for the maintenance workers (FDEP, February 2005), and 100 mg per day for adult and adolescent trespassers/recreational users (USEPA, May 1993). The exposure frequencies used to estimate intakes for incidental ingestion of soil are presented in Section 6.3.1.

6.3.3.2 Dermal Contact with Soil

Direct physical contact with soil may result in the dermal absorption of chemicals. Exposures associated with the dermal route were estimated in the following manner (USEPA, December 1989 and July 2004):

$$Intake_{si} = (C_{si})(SA)(AF)(ABS)(CF)EF)(ED)/(BW)(AT)$$

where: $Intake_{si}$ = amount of chemical "i" absorbed during contact with soil (mg/kg/day)

C_{si} = concentration of chemical "i" in soil (mg/kg)

SA = skin surface area available for contact (cm^2/day)

AF = skin adherence factor (mg/cm^2)

ABS = absorption factor (dimensionless)

CF = conversion factor ($1x10^{-6}$ kg/mg)

EF = exposure frequency (days/year)

ED = exposure duration (year)

BW = body weight (kg)

AT = averaging time (days);
for noncarcinogens, AT = ED x 365 days/year;
for carcinogens, AT = 70 years x 365 days/year

As noted above, the State of Florida SCTLs were used to calculate cancer and non-cancer risk estimates for the hypothetical future resident and a typical industrial worker. Exposure assumptions for the other receptors are described below and were used to develop risk-based concentrations for the construction worker, the maintenance worker, and the recreational user/trespasser.

The exposed surface areas of the body available for dermal contact are determined on a receptor-specific basis and are based on assumed human activities and clothing worn during exposure events. Current guidance (USEPA, August 1997 and July 2004) was used to develop the assumptions concerning the amount of skin surface area available for contact for a receptor. The rationales used to select the skin areas are as follows:

- The head, hands, and forearms of excavation/construction worker and maintenance workers were assumed to be exposed to soils (assuming the receptors wear a short-sleeved shirt, long pants, and shoes). As recommended in the Risk Assessment Guidance for Superfund (RAGS) Part E (USEPA, July 2004), the skin surface area for a worker was assumed to be 3,300 cm^2. This value represents the average of the 50^{th}-percentile areas of males and females more than 18 years old.

- For the adolescent trespassers/recreational user, 25 percent of the total body surface area for an adolescent (aged 7 to 16) was assumed to be available for surface soil contact. The RME value (3,280 cm^2) was derived from the 95^{th}-percentile surface area data.

- For the adult trespasser/recreational user assumed to be exposed to surface soil, the exposed skin surface area available for contact was the value recommended for the adult resident in

Exhibit 3-5 of RAGS Part E (USEPA, July 2004), 5,700 cm^2. This surface area assumes the head, hands, forearms, and lower legs of the receptor are available for contact.

The following values of soil adherence factors and chemical-specific dermal absorption factors provided in RAGS Part E (USEPA, July 2004) were used to evaluate risks from exposure to soil:

- Maintenance Worker - 0.2 mg/cm^2 (Exhibit 3.5; USEPA, July 2004).

- Construction workers - 0.3 mg/cm^2. This value is the 95^{th}-percentile value for construction workers, (Exhibit 3.3; USEPA, July 2004).

- Adolescent Trespassers/Recreational Users - 0.3 mg/cm^2. This adherence factor is the 95^{th}-percentile value presented for soccer players (teens) playing in moist conditions (Exhibit 3.3; USEPA, July 2004).

- Future adult trespassers/recreational users - 0.07 mg/cm^2 (Exhibit 3.5; USEPA, July 2004).

For the constituents identified as COPCs in soil, the following dermal absorption factors were used (USEPA, Exhibit 3-4, and July 2004):

- Polynuclear aromatic hydrocarbons (PAHs) - 0.13
- arsenic - 0.03
- cadmium – 0.001
- other metals – 0.001

The dermal absorption factors for PAHs, arsenic, and cadmium are based on USEPA guidance (USEPA, Exhibit 3-4, July 2004) and the dermal absorption factors for the other metals are USEPA Region 4 values.

The same exposure frequencies and durations used in the estimation of ingestion intakes were used to estimate exposure via dermal contact.

6.3.3.3 Inhalation of Air and Fugitive Dust/Volatile Emissions

The amount of a chemical a receptor takes in as a result of breathing is determined using the concentration of the contaminant in air. Intakes of both particulates and vapors/gases are calculated using the same equation, as follows (USEPA, July 1996):

$$\text{Intake}_{ai} = \frac{(C_{ai})(IR_a)(ET)(EF)(ED)}{(BW)(AT)}$$

where:

Intake_{ai}	=	intake of chemical "i" from air via inhalation (mg/kg/day)
C_{ai}	=	concentration of chemical "i" in air (mg/m^3)
IR_a	=	inhalation rate (m^3/hour)
ET	=	exposure time (hours/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (year)
PEF	=	Particulate Emission Factor (m^3/kg)
VF	=	Volatilization Factor (chemical-specific) (m^3/kg)
BW	=	body weight (kg)
AT	=	averaging time (days);
	=	for noncarcinogens, AT = ED x 365 days/year;
	=	for carcinogens, AT = 70 year x 365 days/year

As noted above, the State of Florida SCTLs are used to calculate cancer and non-cancer risk estimates for the hypothetical future resident and a typical industrial worker. Exposure assumptions for the other receptors are described below and were used to develop risk-based concentrations for the construction worker, the maintenance worker, and the recreational user/trespasser.

The same exposure frequencies and durations used in the estimation of ingestion and dermal intakes of soil were used to estimate exposure via inhalation of air and fugitive dust/volatile emissions. Additionally, for construction/excavation workers and maintenance workers, an inhalation rate of 2.5 m^3 per hour (USEPA, December 2002b) and an exposure time of 8 hours/day (i.e., 20 m^3 per day) were used to evaluate risks from inhalation of fugitive dusts and volatile emissions.

For adult and adolescent trespassers/recreational users, inhalation rates of 1.6 m^3 per hour and 1.2 m^3 per hour (USEPA, August 1997), respectively, and an exposure time of 4 hours per day were used to evaluate risks from inhalation of fugitive dusts and volatile emissions.

The concentrations of chemicals in air resulting from emissions from soil were developed following procedures presented in USEPA Soil Screening Guidance (July 1996 and December 2002b), as follows:

$$C_a = C_s \times \left[\frac{1}{PEF} + \frac{1}{VF}\right]$$

where: C_a = chemical concentration in air, mg/m^3

C_s = chemical concentration in soil, mg/kg

PEF = Particulate Emission Factor, 1.241×10^9 m^3/kg (FDEP, February 2005)

VF = chemical-specific Volatilization Factor, m^3/kg

For chemicals in soil that are not classified as volatile, the above equation reduces to:

$$C_a = C_s \times \left[\frac{1}{PEF}\right]$$

The Particulate Emissions Factor (PEF) relates the concentration of the chemical in soil with the concentration of dust particles in air. The Volatilization Factor (VF) relates the concentration of the chemical in soil with the concentration in ambient air. The VFs used to calculate the alternate SCTLs were obtained from Table 4 of the 62-777 Technical Report (FDEP, February 2005). With the exception of the construction worker, the PEF value used to estimate risks from inhalation of fugitive dusts was 1.241×10^9 m^3/kg, which was developed by the State of Florida in FAC 62-777 (FDEP, February 2005). The PEF calculated for the construction worker was 2.43×10^6 m^3/kg (USEPA, December 2002).

6.4 TOXICITY ASSESSMENT PROTOCOL

The objective of a toxicity assessment is to identify the potential for human health hazards and adverse effects in exposed populations. A significant portion of the toxicity assessment of the HHRAs has been completed because CSFs and RfDs were selected by the State of Florida during the development of the residential and industrial soil SCTLs and groundwater CTLs. A CSF is an indicator of the potency of a chemical carcinogen (i.e., the greater the CSF, the more potent the carcinogen). An RfD is the dose at or below which adverse non-carcinogenic effects are not anticipated. These factors represent quantitative estimates of the relationship between the magnitude and types of exposures and the severity or probability of human health effects and were used to develop risk-based concentrations as described above.

6.4.1 Sources of Toxicity Criteria

Oral and inhalation RfDs and CSFs used in the HHRAs were obtained from the following primary recommended USEPA sources:

- Integrated Risk Information System (IRIS) (online)

- USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment (NCEA) Superfund Health Risk

Technical Support Center develops PPRTVs on a chemical-specific basis when requested by USEPA's Superfund program.

- Other Toxicity Values – These sources include but are not limited to California Environmental Protection Agency (Cal EPA) toxicity values, the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), Tables 5a and 5b of the FDEP 62-777 Technical Report (FDEP, February 2005), and the Annual Health Effects Assessment Summary Tables (HEAST) (USEPA, July 1997).

Although RfDs and CSFs can be found in several toxicological sources, USEPA's IRIS online database, which is continuously updated, is the preferred source of toxicity values. The USEPA Region 9 PRG Tables (USEPA, October 2004) and Region 3 Risk-Based Concentration (RBC) tables (USEPA, April 2007) are also used as sources of toxicity criteria when criteria are not available from the aforementioned references.

6.4.2 Toxicity Criteria for Dermal Exposure

RfDs and CSFs found in literature are frequently expressed as administered doses; therefore, these values are considered to be inappropriate for estimating the risks associated with dermal routes of exposure. Oral dose-response parameters based on administered doses must be adjusted to absorbed doses before comparisons to estimated dermal exposure intakes are made.

The adjustment from administered to absorbed dose was made using the following chemical-specific absorption efficiencies published in RAGS Part E:

$$RfD_{dermal} = (RfD_{oral})(ABS_{GI})$$

$$CSF_{dermal} = (CSF_{oral})/(ABS_{GI})$$

where: ABS_{GI} = absorption efficiency in the gastrointestinal tract

6.4.3 Toxicity Criteria for Carcinogenic Effects of PAHs

Limited toxicity values are available to evaluate the carcinogenic effects from exposure to PAHs. The most extensively studied PAH is benzo(a)pyrene, which is classified by the USEPA as a probable human carcinogen. Although CSFs are available for benzo(a)pyrene, insufficient data are available to calculate CSFs for other carcinogenic PAHs. Toxic effects for these chemicals were evaluated using the concept of estimated orders of potential potency, as presented in USEPA Region 4 guidance (May 2000) and in the Rule 62-777 Technical Report. Toxicity Equivalence Factors (TEFs), which indicate the potency of each PAH compound relative to that of benzo(a)pyrene, are available for select carcinogenic PAHs. The equivalent oral and inhalation CSFs for PAHs other than benzo(a)pyrene are derived by multiplying the CSF for benzo(a)pyrene by the TEF for the PAH compounds (USEPA Region 4, May 2000 and FDEP, February 2005).

These TEFs were used to convert the individual carcinogenic PAH concentrations to an equivalent concentration of benzo(a)pyrene. Both the COPC screening and quantitative risk estimates were based on an evaluation of the equivalent concentrations of benzo(a)pyrene. The carcinogenic PAHs actually detected at least once in a soil dataset were used in the calculation. Non-detect results were assigned a value of ½ the sample quantitation limit prior to the calculation. However, those carcinogenic PAHs not detected in any sample within the dataset were not considered in the calculation. If carcinogenic PAHs were not detected in a sample, ½ the sample quantitation limit presented for benzo(a)pyrene was used to calculate the equivalent concentration of benzo(a)pyrene in that sample.

6.5 RISK CHARACTERIZATION (USEPA METHODOLOGY)

This section provides a characterization of the human health risks associated with the potential exposures to chemicals in surface soil and subsurface soil at Site 41. The results of the risk characterization are discussed below. Potential risks (non-carcinogenic and carcinogenic) for individual chemicals detected in soil at Site 41 were estimated using the simple risk ratio technique presented in Section 6.3.3. As discussed in Section 6.3.1, potential risks were estimated for five receptors (the hypothetical future resident, the typical industrial worker, the construction worker, the maintenance worker, and the recreational user/trespasser) using USEPA and FDEP risk assessment guidance. The total risk from exposure to all COPCs was calculated in accordance with the risk assessment methods outlined in USEPA guidance (December 1989). Risks to human receptors are also characterized per FDEP guidelines/criteria established in Rule 62-780, FAC in Section 6.6. Supporting documentation for the site-specific HHRAs is presented in Appendix C.

6.5.1 Evaluation of Chemicals Other Than Lead

Quantitative estimates of risk for chemicals other than lead were calculated according to risk assessment methods outlined in Section 6.3.3. The methodology is based on standard USEPA guidance (December 1989). Lifetime cancer risks are expressed in the form of dimensionless probabilities referred to as incremental lifetime cancer risks (ILCRs), which are based on CSFs. An ILCR of 1×10^{-6} indicates the exposed receptor has an one-in-one-million chance of developing cancer under the defined exposure scenario. Alternatively, such a risk may be interpreted as representing one additional case of cancer in an exposed population of one million persons. Cancer risk estimates developed for individual chemicals are summed and presented as the total cancer risk estimate for each receptor. Non-carcinogenic risk estimates for individual chemicals are presented as HQs, which are based on RfDs. An HQ is the ratio of the intake to the RfD and is an indicator of the potential for adverse non-carcinogenic health effects. An HI is generated by summing the individual HQs for all COPCs. The HI is not a mathematical prediction of the severity of toxic effects and therefore is not a true "risk"; it is simply a numerical indicator of the possibility of the occurrence of non-carcinogenic (threshold) effects. As discussed below, HIs were calculated on a target organ/target effect basis.

6.5.2 Interpretation of Quantitative Risk Assessment Results

To interpret the quantitative risks and to aid risk managers in determining the need for remediation at a site, quantitative risk estimates are compared to typical risk benchmarks. Calculated ILCRs are interpreted using the USEPA's target range (1×10^{-6} to1 $\times 10^{-4}$) (i.e., a one-in-ten-thousand to one-in-one-million chance of developing cancer) and the State of Florida goal for a total cancer risk of 1×10^{-6}. HIs are evaluated using a value of 1.0.

The USEPA has defined the range of 1×10^{-6} to 1×10^{-4} as the ILCR target range for hazardous waste facilities addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). Individual or cumulative ILCRs greater than 1×10^{-4} are generally not considered as protective of human health. The State of Florida has established a cumulative cancer goal of 1×10^{-6} for receptors exposed to contaminated environmental media at a site. These benchmarks are used in the interpretation of the risk characterization results.

An HI exceeding unity (1.0) indicates there may be potential non-carcinogenic health risks associated with exposure. However, when an HI exceeds unity, target organs effects associated with exposure to COPCs are considered. Only the HQs for those chemicals affecting the same target organ(s) or exhibit similar critical effect(s) are regarded as truly additive. Consequently, it may be possible for a cumulative HI to exceed 1.0, but no adverse health effects are anticipated if the COPCs do not affect the same target organ or exhibit the same critical effect (i.e., the HIs developed on a target-organ-specific basis do not exceed 1). Individual target organ HIs for all receptors are presented in the risk calculation tables in Appendix C.

6.5.3 Risk Characterization Using USEPA Guidelines

This section contains a summary of the results of the risk characterization for Site 41 conducted according to USEPA guidance. Quantitative risk estimates for potential human receptors were developed for those chemicals identified as COPCs in Section 6.2. Potential cancer risks and HIs were calculated using the methodology presented in Section 6.3 and are summarized in Table 6-4. The results are discussed below. Chemical-specific risks are presented in Appendix C.

Non-Carcinogenic Risk

Cumulative HIs estimated for exposures to surface soil and subsurface soil by all receptors were less than 1, indicating that adverse non carcinogenic effects are not anticipated for these receptors under the conditions established in the exposure assessment.

Carcinogenic Risk

Cumulative ILCRs for exposure to surface soil and subsurface soil were less than or within USEPA's target risk range of 10^{-4} to 10^{-6} for all receptors.

ILCRs exceeded the State of Florida's target risk level of 1 x 10^{-6} for exposure to surface soil by industrial workers, construction workers, lifelong recreational users, and hypothetical future residents. ILCRs exceeded the target risk level for exposure to subsurface soil by industrial workers and hypothetical future residents. Carcinogenic PAHs were the major contributors to the ILCRs.

6.6 RISK CHARACTERIZATION USING FDEP RULES 62-777 AND 62-780, F.A.C.

This section describes the State of Florida methodology used to evaluate risks for soil at Site 41. The risk assessment methodology is based on guidance provided in Rule 62-780 FAC which makes use of a phased risk-based corrective action process that is iterative and tailors site rehabilitation to site-specific conditions and risks. Rule 62-780 is used in conjunction with Rule 62-777 FAC which provides the methodology used to establish the FDEP cleanup target levels (CTLs) for the residential, commercial/industrial, or alternate land use scenarios. The methodologies described in the following paragraphs are presented in Appendix C and Appendix E of the Technical Report for Chapter 62-777 F.A.C. (FDEP, February 2005)

The FDEP risk characterization is performed, in part, through a series of tables in which concentrations of chemicals detected at a site are compared to various FDEP soil criteria or to criteria developed according to guidelines presented in Chapter 62-777 FAC. The soil criteria include SCTLs for direct contact (i.e., ingestion, dermal contact, and inhalation), SCTLs for leachability to groundwater, soil saturation concentrations (C_{sat}) for an evaluation of free product, and background levels for metals.

TABLE 6-4
SUMMARY OF CANCER RISKS AND HAZARD INDICES
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Receptor	Media	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals with HI > 1
Industrial Workers	Surface Soil	2E-06	- -	- -	- -	0.01	- -
	Subsurface Soil	2E-06	- -	- -	- -	0.02	- -
Construction Workers	Surface Soil	2E-06	- -	- -	- -	0.1	- -
	Subsurface Soil	5E-07	- -	- -	- -	0.05	- -
Maintenance Workers	Surface Soil	5E-07	- -	- -		0.001	- -
Adolescent Recreational Users	Surface Soil	5E-07	- -	- -	- -	0.004	- -
Adult Recreational Users	Surface Soil	7E-07	- -	- -	- -	0.002	- -
Lifelong Recreational Users	Surface Soil	2E-06	- -	- -	Carcinogenic PAHs	NA	- -
Hypothetical Future Residents	Surface Soil	1E-05	- -	- -	Carcinogenic PAHs, Dieldrin	0.2	- -
	Subsurface Soil	9E-06	- -	- -	Carcinogenic PAHs, Aldrin, Dieldrin	0.2	- -

Notes:
1. No carcinogenic COPCs were detected in the deep groundwater samples.
NA - Not applicable.
HI - Hazard Index.

6.6.1 Florida Methodology for Evaluating Soil

Using the guidance provided in Rules 62-780 and 62-777, soil at Site 41 was evaluated for the following land use scenarios:

- Residential land use (Risk Management Option (RMO)Level I)
- Commercial/industrial land use (RMO Level II)
- Recreational land use (RMO Level III)

The evaluation of the hypothetical future residential and commercial/industrial land use of a site is described under RMO Levels I and II, respectively, of Rule 62.780.680. RMO Level III of the rule allows for the development and use of alternative SCTLs based on, for example, a site-specific risk assessment. In this risk assessment, alternative SCTLs were calculated for a recreational user/trespasser using the equations provided in Chapter 62-777 FAC, the most recent toxicological information presented in IRIS, and the exposure factors presented in Section 6.3.3.

A site is first evaluated for residential land use (Level I) for surface and subsurface soil. If the concentrations of chemicals detected at the site are less than their respective criteria, the site is not evaluated further. However, if any of the Level I criteria are exceeded, the site is evaluated for commercial/industrial land use (Level II). The process is then repeated for potential recreational land use (Level III), if necessary. The comparisons conducted for each level are presented in a Tables 6-5 through 6-12 with the chemicals exceeding the relevant screening levels (i.e., the potential COCs) highlighted. Supporting documentation is presented in Appendix C, as necessary. Using the guidance provided in Chapters 62-777 and 62-780 the following evaluations were performed for Site 41:

Comparison with Direct Contact SCTLs. According to the FDEP guidance documents, under Risk Management Options Level I and Level II, the maximum detected concentration of each contaminant may be compared with the respective default SCTL listed in Chapter 62-777, F.A.C. or, the 95% Upper Confidence Limit (UCL) of the mean of the site concentrations can be compared with apportioned chronic toxicity-based SCTLs. Under Risk Management Option Level III, UCLs may be compared with apportioned chronic toxicity-based SCTLs only.

In this risk assessment, for RMO Levels I and II, maximum detected surface and subsurface soil concentrations are compared to the default (non-apportioned) SCTLs because an initial review of the analytical data, the maximum detected concentrations, and the EPCs (calculated as described in Section 6.3.3) indicated the list of potential COCs would not increase if the maximum detected concentration versus the EPC were evaluated using the default SCTLs.) Therefore, if the maximum detected concentration for a chemical exceeds the direct contact SCTL for RMO Levels I and II (and background

TABLE 6-5
FLORIDA LEVEL 1 (RESIDENTIAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
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CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Non-Apportioned Florida Residential SCTL-Direct Contact(2)	Ratio of Maximum Concentration/ Non-apportioned Residential SCTL	Is Chemical a Potential Level 1 COC?(3)	Rationale/Comments
Volatile Organic Compounds (mg/kg)									
67-64-1	Acetone	1/17	0.0271 J	1485CD00301	NA	11000 N	0.000002	No	maximum < SCTL
Semivolatile Organic Compounds (mg/kg)									
120-12-7	Anthracene	3/17	0.014 J	WHF-1485C-4101A	NA	21000 N	0.0000007	No	maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	14/17	0.349	1485CD00601	NA	2500 N	0.0001	No	maximum < SCTL
206-44-0	Fluoranthene	14/17	0.8	WHF-1485C-4101A	NA	3200 N	0.0003	No	maximum < SCTL
85-01-8	Phenanthrene	13/16	0.22 J	1485CD00601	NA	2200 N	0.0001	No	maximum < SCTL
129-00-0	Pyrene	14/17	0.61	WHF-1485C-4101A	NA	2400 N	0.0003	No	maximum < SCTL
	Benzo(a)pyrene Equivalents	44/53	9	WHF-148SC-SS-3101	NA	0.1 C	**90**	**Yes**	maximum > SCTL
Pesticides/PCBs (mg/kg)									
72-54-8	4,4'-DDD	5/17	0.11	WHF-1485C-4301	NA	4.2 C	0.03	No	maximum < SCTL
72-55-9	4,4'-DDE	9/15	0.13	WHF-1485C-4301	NA	2.9 C	0.04	No	maximum < SCTL
50-29-3	4,4'-DDT	8/17	0.33	WHF-1485C-4301	NA	2.9 C	0.1	No	maximum < SCTL
309-00-2	Aldrin	7/23	0.0058 J	WHF-1485C-4201A	NA	0.06 C	0.10	No	maximum < SCTL
5103-71-9	alpha-Chlordane	10/17	0.61	WHF-1485C-4001	NA	2.8 C(4)	0.2	No	maximum < SCTL
60-57-1	**Dieldrin**	20/23	0.34 J	WHF-1485C-4001	NA	0.06 C	**5.7**	**Yes**	maximum > SCTL
72-20-8	Endrin	2/16	0.018 J	WHF-1485C-4301	NA	25 N	0.0007	No	maximum < SCTL
53494-70-5	Endrin Ketone	1/16	0.004 J	WHF-1485C-4301	NA	25 N(5)	0.0002	No	maximum < SCTL
5103-74-2	gamma-Chlordane	8/15	0.56	WHF-1485C-4001	NA	2.8 C(4)	0.2	No	maximum < SCTL
1024-57-3	Heptachlor Epoxide	3/14	0.0099 J	WHF-1485C-4201A	NA	0.1 C	0.10	No	maximum < SCTL
Metals (mg/kg)									
7429-90-5	Aluminum	17/17	9970	WHF-1485C-4301	No	80000 N	0.1	No	maximum < SCTL
7440-36-0	Antimony	4/17	0.94	WHF-1485C-4301	No	27 N	0.03	No	maximum < SCTL
7440-38-2	Arsenic	11/17	5.4	WHF-1485C-4301	No	2.1 C	**2.6**	No	Background(1)
7440-39-3	Barium	17/17	62.2	WHF-1485C-4001	Yes	120 N	0.5	No	maximum < SCTL
7440-43-9	Cadmium	6/17	0.77	WHF-1485C-4301	No	82 N	0.009	No	maximum < SCTL
7440-47-3	Chromium	17/17	75 J	WHF-1485C-3701	Yes	210 N	0.4	No	maximum < SCTL
7440-48-4	Cobalt	9/17	1.8	1485CD00101	No	1700 N	0.001	No	maximum < SCTL
7440-50-8	Copper	17/17	15.4	1485CD00501	Yes	150 N	0.1	No	maximum < SCTL
7439-89-6	Iron	17/17	7060	1485CD00201	No	53000 N	0.1	No	maximum < SCTL
7439-92-1	Lead	17/17	345	WHF-1485C-3701	Yes	400	0.9	No	maximum < SCTL
7439-96-5	Manganese	17/17	158	1485CD00601	No	3500 N	0.05	No	maximum < SCTL
7439-97-6	Mercury	7/17	0.023 J	WHF-1485C-4301	No	3 N	0.008	No	maximum < SCTL
7440-02-0	Nickel	13/17	8	1485CD00101	No	340 N	0.02	No	maximum < SCTL
7440-62-2	Vanadium	17/17	20	WHF-1485C-3901	No	67 N	0.3	No	maximum < SCTL
7440-66-6	Zinc	17/17	139 J	WHF-1485C-4301	Yes	26000 N	0.005	No	maximum < SCTL
Miscellaneous Parameters (mg/kg)									
57-12-5	Cyanide	3/17	0.76 J	1485CD00601	NA	34 N	0.02	No	maximum < SCTL
Petroleum Hydrocarbons (mg/kg)									
	Total Petroleum Hydrocarbons	17/17	190	WHF-1485C-4601	NA	460 N	0.4	No	maximum < SCTL

TABLE 6-5
FLORIDA LEVEL 1 (RESIDENTIAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
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Footnotes

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 - A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL and, for metals, if the site concentrations exceed background levels. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
4 - Value is for chlordane.
5 - Value is for endrin.
NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-6
FLORIDA LEVEL 2 (INDUSTRIAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?[1]	Non-Apportioned Florida Industrial SCTL-Direct Contact[2]	Ratio of Maximum Concentration/ Non-apportioned Industrial SCTL	Is Chemical a Potential Level 2 COC?[3]	Rationale/Comments
Volatile Organic Compounds (mg/kg)									
67-64-1	Acetone	1/17	0.0271 J	1485CD00301	NA	68000 N	0.0000004	No	maximum < SCTL
Semivolatile Organic Compounds (mg/kg)									
120-12-7	Anthracene	3/17	0.014 J	WHF-1485C-4101A	NA	300000 N	0.00000005	No	maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	14/17	0.349	1485CD00601	NA	52000 N	0.000007	No	maximum < SCTL
206-44-0	Fluoranthene	14/17	0.8	WHF-1485C-4101A	NA	59000 N	0.00001	No	maximum < SCTL
85-01-8	Phenanthrene	13/16	0.22 J	1485CD00601	NA	36000 N	0.000006	No	maximum < SCTL
129-00-0	Pyrene	14/17	0.61	WHF-1485C-4101A	NA	45000 N	0.00001	No	maximum < SCTL
	Benzo(a)pyrene Equivalents	44/53	9	WHF-148SC-SS-3101	NA	0.7 C	**13**	**Yes**	maximum > SCTL
Pesticides/PCBs (mg/kg)									
72-54-8	4,4'-DDD	5/17	0.11	WHF-1485C-4301	NA	22 C	0.005	No	maximum < SCTL
72-55-9	4,4'-DDE	9/15	0.13	WHF-1485C-4301	NA	15 C	0.009	No	maximum < SCTL
50-29-3	4,4'-DDT	8/17	0.33	WHF-1485C-4301	NA	15 C	0.02	No	maximum < SCTL
309-00-2	Aldrin	7/23	0.0058 J	WHF-1485C-4201A	NA	0.3 C	0.02	No	maximum < SCTL
5103-71-9	alpha-Chlordane	10/17	0.61	WHF-1485C-4001	NA	14 C[4]	0.04	No	maximum < SCTL
60-57-1	Dieldrin	20/23	0.34 J	WHF-1485C-4001	NA	0.3 C	1	No	maximum <= SCTL
72-20-8	Endrin	2/16	0.018 J	WHF-1485C-4301	NA	510 N	0.00004	No	maximum < SCTL
53494-70-5	Endrin Ketone	1/16	0.004 J	WHF-1485C-4301	NA	510 N[5]	0.000008	No	maximum < SCTL
5103-74-2	gamma-Chlordane	8/15	0.56	WHF-1485C-4001	NA	14 C[4]	0.04	No	maximum < SCTL
1024-57-3	Heptachlor Epoxide	3/14	0.0099 J	WHF-1485C-4201A	NA	0.5 C	0.02	No	maximum < SCTL
Metals (mg/kg)									
7429-90-5	Aluminum	17/17	9970	WHF-1485C-4301	No	(6)	---	No	maximum < SCTL
7440-36-0	Antimony	4/17	0.94	WHF-1485C-4301	No	370 N	0.003	No	maximum < SCTL
7440-38-2	Arsenic	11/17	5.4	WHF-1485C-4301	No	12 C	0.5	No	maximum < SCTL
7440-39-3	Barium	17/17	62.2	WHF-1485C-4001	Yes	130000 N	0.0005	No	maximum < SCTL
7440-43-9	Cadmium	6/17	0.77	WHF-1485C-4301	No	1700 N	0.0005	No	maximum < SCTL
7440-47-3	Chromium	17/17	75 J	WHF-1485C-3701	Yes	470 N	0.2	No	maximum < SCTL
7440-48-4	Cobalt	9/17	1.8	1485CD00101	No	42000 N	0.00004	No	maximum < SCTL
7440-50-8	Copper	17/17	15.4	1485CD00501	Yes	89000 N	0.0002	No	maximum < SCTL
7439-89-6	Iron	17/17	7060	1485CD00201	No	(6)	---	No	maximum < SCTL
7439-92-1	Lead	17/17	345	WHF-1485C-3701	Yes	1400	0.2	No	maximum < SCTL
7439-96-5	Manganese	17/17	158	1485CD00601	No	43000 N	0.004	No	maximum < SCTL
7439-97-6	Mercury	7/17	0.023 J	WHF-1485C-4301	No	17 N	0.001	No	maximum < SCTL
7440-02-0	Nickel	13/17	8	1485CD00101	No	35000 N	0.0002	No	maximum < SCTL
7440-62-2	Vanadium	17/17	20	WHF-1485C-3901	No	10000 N	0.002	No	maximum < SCTL
7440-66-6	Zinc	17/17	139 J	WHF-1485C-4301	Yes	630000 N	0.0002	No	maximum < SCTL
Miscellaneous Parameters (mg/kg)									
57-12-5	Cyanide	3/17	0.76 J	1485CD00601	NA	11000 N	0.00007	No	maximum < SCTL
Petroleum Hydrocarbons (mg/kg)									
	Total Petroleum Hydrocarbons	17/17	190	WHF-1485C-4601	NA	2700 N	0.07	No	maximum < SCTL

TABLE 6-6
FLORIDA LEVEL 2 (INDUSTRIAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
2 OF 2

Footnotes

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Section 6.1.1.1. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 - A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL and, for metals, if the site concentrations exceed background levels. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
4 - Value is for chlordane.
5 - Value is for endrin.
6 - Chemical is not a health concern for this exposure scenario.

NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-7
FLORIDA LEVEL 3 (RECREATIONAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Exposure Point Concentration[1]	Sample of Maximum Concentration	Site Above Background?[2]	Non-Apportioned Florida Recreational SCTL-Direct Contact[3]	Ratio of Maximum Concentration/ Non-apportioned Recreational SCTL	Target Organ[4]	Exceedance Ratio (Weighted Apportionment)[5]	Is Exposure Point Concentration /Apportioned Recreational SCTL Ratio > 3?	Is Chemical a Potential Level 3 COC?[6]	Rationale/Comments
Volatile Organic Compounds (mg/kg)													
67-64-1	Acetone	1/17	0.0271 J	0.027	1485CD00301	NA	800000 N	0.00000003	Kidney, Liver, Neurological	--	No	No	Maximum < SCTL
Semivolatile Organic Compounds (mg/kg)													
120-12-7	Anthracene	3/17	0.014 J	0.559	WHF-1485C-4101A	NA	1000000 N	0.00000001	None Specified	--	No	No	Maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	14/17	0.349	0.349	1485CD00601	NA	110000 N	0.000003	Neurological	--	No	No	Maximum < SCTL
206-44-0	Fluoranthene	14/17	0.8	0.541	WHF-1485C-4101A	NA	64000 N	0.00001	Blood, Kidney, Liver	--	No	No	Maximum < SCTL
85-01-8	Phenanthrene	13/16	0.22 J	0.310	1485CD00601	NA	110000 N	0.000002	Kidney	--	No	No	Maximum < SCTL
129-00-0	Pyrene	14/17	0.61	0.538	WHF-1485C-4101A	NA	110000 N	0.000006	Kidney	--	No	No	Maximum < SCTL
	Benzo(a)pyrene Equivalents	44/53	9	1.02	WHF-148SC-SS-3101	NA	0.8 C	**11**	Carcinogen	**1.3**	**Yes**	**Yes**	Maximum > 3 x SCTL
Pesticides/PCBs (mg/kg)													
72-54-8	4,4'-DDD	5/17	0.11	0.130	WHF-1485C-4301	NA	39 C	0.003	Carcinogen	--	No	No	Maximum < SCTL
72-55-9	4,4'-DDE	9/15	0.13	0.047	WHF-1485C-4301	NA	27 C	0.005	Carcinogen	--	No	No	Maximum < SCTL
50-29-3	4,4'-DDT	8/17	0.33	0.109	WHF-1485C-4301	NA	27 C	0.012	Carcinogen, Liver	--	No	No	Maximum < SCTL
309-00-2	Aldrin	7/23	0.0058 J	0.005	WHF-1485C-4201A	NA	0.4 C	0.015	Carcinogen, Liver	--	No	No	Maximum < SCTL
5103-71-9	alpha-Chlordane	10/17	0.61	0.128	WHF-1485C-4001	NA	19 C[4]	0.03	Carcinogen, Liver	--	No	No	Maximum < SCTL
60-57-1	Dieldrin	20/23	0.34 J	0.125	WHF-1485C-4001	NA	0.4 C	0.9	Carcinogen, Liver	0.3	No	No	Maximum < SCTL
72-20-8	Endrin	2/16	0.018 J	0.018	WHF-1485C-4301	NA	550 N	0.00003	Liver	--	No	No	Maximum < SCTL
53494-70-5	Endrin Ketone	1/16	0.004 J	0.004	WHF-1485C-4301	NA	550 N[5]	0.000007	Liver	--	No	No	Maximum < SCTL
5103-74-2	gamma-Chlordane	8/15	0.56	0.153	WHF-1485C-4001	NA	19 C[4]	0.03	Carcinogen, Liver	--	No	No	Maximum < SCTL
1024-57-3	Heptachlor Epoxide	3/14	0.0099 J	0.009	WHF-1485C-4201A	NA	0.7 C	0.014	Carcinogen, Liver	--	No	No	Maximum < SCTL
Metals (mg/kg)													
7429-90-5	Aluminum	17/17	9970	9474	WHF-1485C-4301	No	3500000 N	0.003	Body Weight	--	No	No	Maximum < SCTL Background[2]
7440-36-0	Antimony	4/17	0.94	0.573	WHF-1485C-4301	No	1460 N	0.0006	Blood	--	No	No	Maximum < SCTL Background[2]
7440-38-2	Arsenic	11/17	5.4	2.83	WHF-1485C-4301	No	6.2 C	0.9	Carcinogen, Skin, Cardiovascular	--	No	No	Maximum < SCTL Background[2]
7440-39-3	Barium	17/17	62.2	33.6	WHF-1485C-4001	Yes	251000 N	0.0002	Cardiovascular	--	No	No	Maximum < SCTL
7440-43-9	Cadmium	6/17	0.77	0.342	WHF-1485C-4301	No	1310 N	0.0006	Carcinogen, Kidney	--	No	No	Maximum < SCTL Background[2]
7440-47-3	Chromium	17/17	75 J	30.6	WHF-1485C-3701	Yes	10900 N	0.007	Carcinogen, Respiratory	--	No	No	Maximum < SCTL
7440-48-4	Cobalt	9/17	1.8	1.09	1485CD00101	No	64300 N	0.00003	Cardiovascular, Immunological, Neurological, Reproductive	--	No	No	Maximum < SCTL Background[2]
7440-50-8	Copper	17/17	15.4	8.28	1485CD00501	Yes	146000 N	0.0001	Gastrointestinal	--	No	No	Maximum < SCTL
7439-89-6	Iron	17/17	7060	5218	1485CD00201	No	1090000 N	0.006	Gastrointestinal	--	No	No	Maximum < SCTL Background[2]
7439-92-1	Lead	17/17	345	142	WHF-1485C-3701	Yes	3000	0.1	Neurological	--	No	No	Maximum < SCTL
7439-96-5	Manganese	17/17	158	107	1485CD00601	No	69300 N	0.002	Neurological	--	No	No	Maximum < SCTL Background[2]
7439-97-6	Mercury	7/17	0.023 J	0.023	WHF-1485C-4301	No	1100 N	0.00002	Neurological	--	No	No	Maximum < SCTL Background[2]
7440-02-0	Nickel	13/17	8	4.09	1485CD00101	No	73000 N	0.0001	Body Weight	--	No	No	Maximum < SCTL Background[2]
7440-62-2	Vanadium	17/17	20	13.9	WHF-1485C-3901	No	3650 N	0.005	Hair Loss	--	No	No	Maximum < SCTL Background[2]
7440-66-6	Zinc	17/17	139 J	69.9	WHF-1485C-4301	Yes	1090000 N	0.0001	Blood	--	No	No	Maximum < SCTL

TABLE 6-7
FLORIDA LEVEL 3 (RECREATIONAL) DIRECT CONTACT EVALUATION - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
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CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Exposure Point Concentration(1)	Sample of Maximum Concentration	Site Above Background?(2)	Non-Apportioned Florida Recreational SCTL-Direct Contact(3)	Ratio of Maximum Concentration/ Non-apportioned Recreational SCTL	Target Organ(4)	Exceedance Ratio (Weighted Apportionment)(5)	Is Exposure Point Concentration /Apportioned Recreational SCTL	Is Chemical a Potential Level 3 COC?(6)	Rationale/Comments
Miscellaneous Parameters (mg/kg)													
57-12-5	Cyanide	3/17	0.76 J	0.696	1485CD00601	NA	36800 N	0.00002	Neurological, Thyroid	--	No	No	Maximum < SCTL
Petroleum Hydrocarbons (mg/kg)													
	Total Petroleum Hydrocarbons	17/17	190	103	WHF-1485C-4601	NA	25400 N	0.007	Multiple Endpoints	--	No	No	Maximum < SCTL

Total(9)	1.6

Footnotes:
1 - Exposure point concentrations (EPCs) are maximum concentrations or 95 % upper confidence limits (UCLs) on the arithmetic mean as determined by statistical tests and calculations performed by Florida's UCL Calculator.
2 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
3 - SCTLs for recreational users were developed using the methods presented in Chapter 62-777, F.A.C., April 2005 and the most current toxicological data available in IRIS. The recreational users are assumed to be exposed 45 days per year by ingestion, inhalation, and dermal contact. Calculations of the recreational SCTLs are presented in Appendix C.
4 - Target organs are obtained from Table II, Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
5 - The exceedance ratio uses the weighted apportionment method whereby the exposure point concentration is divided by the recreational SCTL. Chemicals with maximum concentrations less than 0.1 of the non-apportioned SCTL are not included in the apportionment process.
6 - A chemical is selected as a potential COC if the maximum concentration is greater than 3 times the non-apportioned SCTL or if it contributes to an exceedance ratio greater than 1, and, for metals, if the site concentrations exceed background levels.
7 - Value is for chlordane.
8 - Value is for endosulfan.
9 - If the Total Exceedance Ratio in less than 1 then the FDEP risk goals have been met.

NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-8
COMPARISON WITH SCTLS FOR LEACHABILITY TO GROUNDWATER AND CSAT LIMITS - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?[1]	Florida Leachability to Groundwater[2]	Soil Saturation Limit, Csat[3]
Volatile Organic Compounds (mg/kg)							
67-64-1	Acetone	1/17	0.0271 J	1485CD00301	NA	25	100000
Semivolatile Organic Compounds (mg/kg)							
120-12-7	Anthracene	3/17	0.014 J	WHF-1485C-4101A	NA	2500	---
56-55-3	Benzo(a)anthracene	14/17	0.282 J	1485CD00601	NA	0.8	---
50-32-8	Benzo(a)pyrene	44/53	9	WHF-148SC-SS-3101	NA	**8**	---
205-99-2	Benzo(b)fluoranthene	14/17	0.39	WHF-1485C-4101A	NA	2.4	---
191-24-2	Benzo(g,h,i)perylene	14/17	0.349	1485CD00601	NA	32000	---
207-08-9	Benzo(k)fluoranthene	14/17	0.266 J	1485CD00601	NA	24	---
218-01-9	Chrysene	14/17	0.422	1485CD00601	NA	77	---
53-70-3	Dibenzo(a,h)anthracene	16/23	0.1	WHF-41-SS-52-1	NA	0.7	---
206-44-0	Fluoranthene	14/17	0.8	WHF-1485C-4101A	NA	1200	---
193-39-5	Indeno(1,2,3-cd)pyrene	14/17	0.386	1485CD00601	NA	6.6	---
85-01-8	Phenanthrene	13/16	0.22 J	1485CD00601	NA	250	---
129-00-0	Pyrene	14/17	0.61	WHF-1485C-4101A	NA	880	---
Pesticides/PCBs (mg/kg)							
72-54-8	4,4'-DDD	5/17	0.11	WHF-1485C-4301	NA	5.8	---
72-55-9	4,4'-DDE	9/15	0.13	WHF-1485C-4301	NA	18	---
50-29-3	4,4'-DDT	8/17	0.33	WHF-1485C-4301	NA	11	---
309-00-2	Aldrin	7/23	0.0058 J	WHF-1485C-4201A	NA	0.2	---
5103-71-9	alpha-Chlordane[4]	10/17	0.61	WHF-1485C-4001	NA	9.6	---
60-57-1	Dieldrin	20/23	0.34 J	WHF-1485C-4001	NA	**0.002**	---
72-20-8	Endrin	2/16	0.018 J	WHF-1485C-4301	NA	1	---
53494-70-5	Endrin Ketone[5]	1/16	0.004 J	WHF-1485C-4301	NA	1	---
5103-74-2	gamma-Chlordane[4]	8/15	0.56	WHF-1485C-4001	NA	9.6	---
1024-57-3	Heptachlor Epoxide	3/14	0.0099 J	WHF-1485C-4201A	NA	0.6	---

TABLE 6-8
COMPARISON WITH SCTLS FOR LEACHABILITY TO GROUNDWATER AND CSAT LIMITS - SURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Florida Leachability to Groundwater(2)	Soil Saturation Limit, Csat(3)
Metals (mg/kg)							
7429-90-5	Aluminum	17/17	9970	WHF-1485C-4301	No	---	---
7440-36-0	Antimony	4/17	0.94	WHF-1485C-4301	No	5.4	---
7440-38-2	Arsenic	11/17	5.4	WHF-1485C-4301	No	---	---
7440-39-3	Barium	17/17	62.2	WHF-1485C-4001	Yes	1600	---
7440-43-9	Cadmium	6/17	0.77	WHF-1485C-4301	No	7.5	---
7440-47-3	Chromium	17/17	75 J	WHF-1485C-3701	Yes	38	---
7440-48-4	Cobalt	9/17	1.8	1485CD00101	No	---	---
7440-50-8	Copper	17/17	15.4	1485CD00501	Yes	---	---
7439-89-6	Iron	17/17	7060	1485CD00201	No	---	---
7439-92-1	Lead	17/17	345	WHF-1485C-3701	Yes	---	---
7439-96-5	Manganese	17/17	158	1485CD00601	No	---	---
7439-97-6	Mercury	7/17	0.023 J	WHF-1485C-4301	No	2.1	---
7440-02-0	Nickel	13/17	8	1485CD00101	No	130	---
7440-62-2	Vanadium	17/17	20	WHF-1485C-3901	No	980	---
7440-66-6	Zinc	17/17	139 J	WHF-1485C-4301	Yes	---	---
Miscellaneous Parameters (mg/kg)							
57-12-5	Cyanide	3/17	0.76 J	1485CD00601	NA	0.8	---
Petroleum Hydrocarbons (mg/kg)							
	Total Petroleum Hydrocarbons	17/17	190	WHF-1485C-4601	NA	340	---

Shaded cells indicate that the specified criterion or background level has been exceeded

Footnotes:

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Leachability Based on Groundwater Criteria, Table 2, Chapter 62-777 Technical Report (FDEP, February 2005).
3 - Soil Saturation Limits (CSAT), Table 8, Chapter 62-777 Technical Report (FDEP, February 2005).
4 - Chlordane is used as a surrogate for alpha- and gamma-chlordane.
5 - Endrin is used as a surrogate for endrin ketone.
NA - Not Applicable. According to proposed Florida Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-9
FLORIDA LEVEL 1 (RESIDENTIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Non-Apportioned Florida Residential SCTL-Direct Contact(2)	Ratio of Maximum Concentration/ Non apportioned Residential SCTL	Is Chemical a Potential Level 1 COC?(3)	Rationale/Comments
Volatile Organic Compounds (mg/kg)									
78-93-3	2-Butanone	3/26	0.0041 J	WHF-1485C-4502	NA	16000 N	0.0000003	No	maximum < SCTL
67-64-1	Acetone	3/26	0.029	WHF-1485C-4503	NA	11000 N	0.000003	No	maximum < SCTL
Semivolatile Organic Compounds (mg/kg)									
100-01-6	4-Nitroaniline	1/26	0.17 J	WHF-1485C-4302	NA	17 C	0.01	No	maximum < SCTL
120-12-7	Anthracene	1/26	0.052 J	WHF-1485C-4302	NA	21000 N	0.000002	No	maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	15/26	1.2 J	WHF-1485C-4302	NA	2500 N	0.0005	No	maximum < SCTL
86-74-8	Carbazole	1/26	0.33 J	WHF-1485C-4302	NA	49 C	0.007	No	maximum < SCTL
206-44-0	Fluoranthene	15/26	3.1	WHF-1485C-4302	NA	3200 N	0.0010	No	maximum < SCTL
86-73-7	Fluorene	2/26	0.0042 J	WHF-1485C-4502	NA	2600 N	0.000002	No	maximum < SCTL
85-01-8	Phenanthrene	10/26	0.32 J	WHF-1485C-4302	NA	2200 N	0.0001	No	maximum < SCTL
129-00-0	Pyrene	14/26	3.7	WHF-1485C-4302	NA	2400 N	0.002	No	maximum < SCTL
	Benzo(a)pyrene Equivalents	45/67	2.9786	WHF-1485C-4302	NA	0.1 C	**30**	**Yes**	maximum > SCTL
Pesticides/PCBs (mg/kg)									
72-54-8	4,4'-DDD	5/26	1.1 J	WHF-1485C-4302	NA	4.2 C	0.3	No	maximum < SCTL
72-55-9	4,4'-DDE	10/25	1	WHF-1485C-4302, WHF-1485C-4303	NA	2.9 C	0.3	No	maximum < SCTL
50-29-3	**4,4'-DDT**	5/26	5.7	WHF-1485C-4302	NA	2.9 C	**2.0**	**Yes**	maximum > SCTL
309-00-2	Aldrin	3/44	0.049	WHF-1485C-4102A	NA	0.06 C	0.8	No	maximum < SCTL
5103-71-9	alpha-Chlordane	9/25	0.58 J	WHF-1485C-4303	NA	2.8 C(4)	0.2	No	maximum < SCTL
319-85-7	beta-BHC	1/26	0.00023 J	WHF-1485C-4602	NA	0.5 C	0.0005	No	maximum < SCTL
60-57-1	**Dieldrin**	14/41	0.94 J	WHF-1485C-4303	NA	0.06 C	**16**	**Yes**	maximum > SCTL
33213-65-9	Endosulfan II	1/26	0.0006 J	WHF-1485C-4203A	NA	450 N(5)	0.000001	No	maximum < SCTL
72-20-8	Endrin	1/25	0.0068 J	WHF-1485C-4102A	NA	25 N	0.0003	No	maximum < SCTL
5103-74-2	gamma-Chlordane	6/22	0.79	WHF-1485C-4302	NA	2.8 C(6)	0.3	No	maximum < SCTL
1024-57-3	Heptachlor Epoxide	2/24	0.00053 J	WHF-1485C-4202A	NA	0.1 C	0.005	No	maximum < SCTL
Metals (mg/kg)									
7429-90-5	Aluminum	26/26	37400	1485CD00810	No	80000 N	0.5	No	maximum < SCTL
7440-36-0	Antimony	4/26	10.7	WHF-1485C-4303	No	27 N	0.4	No	maximum < SCTL
7440-38-2	Arsenic	26/26	15.2	WHF-1485C-4302	No	2.1 C	**7.2**	No	Background(1)
7440-39-3	Barium	26/26	73.8	WHF-1485C-4303	Yes	120 N	0.6	No	maximum < SCTL
7440-43-9	Cadmium	2/26	2.2	WHF-1485C-4302	No	82 N	0.03	No	maximum < SCTL
7440-47-3	Chromium	26/26	37.3	1485CD00810	No	210 N	0.2	No	maximum < SCTL
7440-48-4	Cobalt	2/26	2.4	WHF-1485C-4302	No	1700 N	0.001	No	maximum < SCTL
7440-50-8	Copper	26/26	26	WHF-1485C-4302	Yes	150 N	0.2	No	maximum < SCTL
7439-89-6	Iron	26/26	26700	1485CD00810	No	53000 N	0.5	No	maximum < SCTL
7439-92-1	Lead	26/26	322 J	WHF-1485C-4303	No	400	0.8	No	maximum < SCTL
7439-96-5	Manganese	26/26	410 J	WHF-1485C-4302	No	3500 N	0.1	No	maximum < SCTL
7439-97-6	Mercury	10/26	0.078 J	WHF-1485C-4303	Yes	3 N	0.03	No	maximum < SCTL
7440-02-0	Nickel	25/26	6.1	WHF-1485C-4302	Yes	340 N	0.02	No	maximum < SCTL
7782-49-2	Selenium	1/26	4.8 J	1485CD00705	Yes	440 N	0.01	No	maximum < SCTL
7440-62-2	Vanadium	26/26	68.1	1485CD00810	No	67 N	1.0	No	Background(1)
7440-66-6	Zinc	26/26	246 J	WHF-1485C-4302	Yes	26000 N	0.009	No	maximum < SCTL

TABLE 6-9
FLORIDA LEVEL 1 (RESIDENTIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?[1]	Non-Apportioned Florida Residential SCTL-Direct Contact[2]	Ratio of Maximum Concentration/ Non apportioned Residential SCTL	Is Chemical a Potential Level 1 COC?[3]	Rationale/Comments
Miscellaneous Parameters (mg/kg)									
57-12-5	Cyanide	2/26	1.8 J	1485CD00810	NA	34 N	0.05	No	maximum < SCTL
Petroleum Hydrocarbons (mg/kg)									
	Total Petroleum Hydrocarbons	10/26	920	WHF-1485C-4303	NA	460 N	**2.0**	**Yes**	maximum > SCTL

Footnotes

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 - A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL and, for metals, if the site concentrations exceed background levels. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
4 - Value is for chlordane.
5 - Value is for endosulfan.
6 - Value is for chlordane.

NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-10
FLORIDA LEVEL 2 (INDUSTRIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Non-Apportioned Florida Industrial SCTL-Direct Contact(2)	Ratio of Maximum Concentration/ Non apportioned Industrial SCTL	Is Chemical a Potential Level 2 COC?(3)	Rationale/Comments
Volatile Organic Compounds (mg/kg)									
78-93-3	2-Butanone	3/26	0.0041 J	WHF-1485C-4502	NA	110000 N	0.0000000	No	maximum < SCTL
67-64-1	Acetone	3/26	0.029	WHF-1485C-4503	NA	68000 N	0.0000004	No	maximum < SCTL
Semivolatile Organic Compounds (mg/kg)									
100-01-6	4-Nitroaniline	1/26	0.17 J	WHF-1485C-4302	NA	96 C	0.002	No	maximum < SCTL
120-12-7	Anthracene	1/26	0.052 J	WHF-1485C-4302	NA	300000 N	0.0000002	No	maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	15/26	1.2 J	WHF-1485C-4302	NA	52000 N	0.00002	No	maximum < SCTL
86-74-8	Carbazole	1/26	0.33 J	WHF-1485C-4302	NA	240 C	0.001	No	maximum < SCTL
206-44-0	Fluoranthene	15/26	3.1	WHF-1485C-4302	NA	59000 N	0.00005	No	maximum < SCTL
86-73-7	Fluorene	2/26	0.0042 J	WHF-1485C-4502	NA	33000 N	0.0000001	No	maximum < SCTL
85-01-8	Phenanthrene	10/26	0.32 J	WHF-1485C-4302	NA	36000 N	0.000009	No	maximum < SCTL
129-00-0	Pyrene	14/26	3.7	WHF-1485C-4302	NA	45000 N	0.00008	No	maximum < SCTL
	Benzo(a)pyrene Equivalents	45/67	2.9786	WHF-1485C-4302	NA	0.7 C	**4**	**Yes**	maximum > SCTL
Pesticides/PCBs (mg/kg)									
72-54-8	4,4'-DDD	5/26	1.1 J	WHF-1485C-4302	NA	22 C	0.05	No	maximum < SCTL
72-55-9	4,4'-DDE	10/25	1	WHF-1485C-4302, WHF-1485C-4303	NA	15 C	0.07	No	maximum < SCTL
50-29-3	4,4'-DDT	5/26	5.7	WHF-1485C-4302	NA	15 C	0.4	No	maximum < SCTL
309-00-2	Aldrin	3/44	0.049	WHF-1485C-4102A	NA	0.3 C	0.2	No	maximum < SCTL
5103-71-9	alpha-Chlordane	9/25	0.58 J	WHF-1485C-4303	NA	14 C(4)	0.04	No	maximum < SCTL
319-85-7	beta-BHC	1/26	0.00023 J	WHF-1485C-4602	NA	2.4 C	0.0001	No	maximum < SCTL
60-57-1	**Dieldrin**	14/41	0.94 J	WHF-1485C-4303	NA	0.3 C	**3**	**Yes**	maximum > SCTL
33213-65-9	Endosulfan II	1/26	0.0006 J	WHF-1485C-4203A	NA	7600 N(5)	0.000000	No	maximum < SCTL
72-20-8	Endrin	1/25	0.0068 J	WHF-1485C-4102A	NA	510 N	0.00001	No	maximum < SCTL
5103-74-2	gamma-Chlordane	6/22	0.79	WHF-1485C-4302	NA	14 C(6)	0.06	No	maximum < SCTL
1024-57-3	Heptachlor Epoxide	2/24	0.00053 J	WHF-1485C-4202A	NA	0.5 C	0.001	No	maximum < SCTL

TABLE 6-10
FLORIDA LEVEL 2 (INDUSTRIAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?[1]	Non-Apportioned Florida Industrial SCTL-Direct Contact[2]	Ratio of Maximum Concentration/ Non-apportioned Industrial SCTL	Is Chemical a Potential Level 2 COC?[3]	Rationale/Comments
Metals (mg/kg)									
7429-90-5	Aluminum	26/26	37400	1485CD00810	No	(6)	---	No	maximum < SCTL
7440-36-0	Antimony	4/26	10.7	WHF-1485C-4303	No	370 N	0.03	No	maximum < SCTL
7440-38-2	Arsenic	26/26	15.2	WHF-1485C-4302	No	12 C	**1.3**	No	Background[1]
7440-39-3	Barium	26/26	73.8	WHF-1485C-4303	Yes	130000 N	0.0006	No	maximum < SCTL
7440-43-9	Cadmium	2/26	2.2	WHF-1485C-4302	No	1700 N	0.001	No	maximum < SCTL
7440-47-3	Chromium	26/26	37.3	1485CD00810	No	470 N	0.08	No	maximum < SCTL
7440-48-4	Cobalt	2/26	2.4	WHF-1485C-4302	No	42000 N	0.00006	No	maximum < SCTL
7440-50-8	Copper	26/26	26	WHF-1485C-4302	Yes	89000 N	0.0003	No	maximum < SCTL
7439-89-6	Iron	26/26	26700	1485CD00810	No	(6)	---	No	maximum < SCTL
7439-92-1	Lead	26/26	322 J	WHF-1485C-4303	No	1400	0.2	No	maximum < SCTL
7439-96-5	Manganese	26/26	410 J	WHF-1485C-4302	No	43000 N	0.01	No	maximum < SCTL
7439-97-6	Mercury	10/26	0.078 J	WHF-1485C-4303	Yes	17 N	0.005	No	maximum < SCTL
7440-02-0	Nickel	25/26	6.1	WHF-1485C-4302	Yes	35000 N	0.0002	No	maximum < SCTL
7782-49-2	Selenium	1/26	4.8 J	1485CD00705	Yes	11000 N	0.0004	No	maximum < SCTL
7440-62-2	Vanadium	26/26	68.1	1485CD00810	No	10000 N	0.007	No	maximum < SCTL
7440-66-6	Zinc	26/26	246 J	WHF-1485C-4302	Yes	630000 N	0.0004	No	maximum < SCTL
Miscellaneous Parameters (mg/kg)									
57-12-5	Cyanide	2/26	1.8 J	1485CD00810	NA	11000 N	0.0002	No	maximum < SCTL
Petroleum Hydrocarbons (mg/kg)									
	Total Petroleum Hydrocarbons	10/26	920	WHF-1485C-4303	NA	2700 N	0.3	No	maximum < SCTL

Footnotes

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
3 - A chemical is selected as a potential COC if the maximum concentration exceeds the non-apportioned SCTL and, for metals, if the site concentrations exceed background levels. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
4 - Value is for chlordane.
5 - Value is for endosulfan.
6 - Value is for chlordane.

NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-11
FLORIDA LEVEL 3 (RECREATIONAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Exposure Point Concentration(1)	Sample of Maximum Concentration	Site Above Background?(2)	Non-Apportioned Florida Recreational SCTL-Direct Contact(3)	Ratio of Maximum Concentration/ Non-apportioned Recreational SCTL	Target Organ(4)	Exceedance Ratio (Weighted Apportionment)(5)	Is Exposure Point Concentration /Apportioned Recreational SCTL Ratio > 3?	Is Chemical a Potential Level 3 COC?(6)	Rationale/Comments
Volatile Organic Compounds (mg/kg)													
78-93-3	2-Butanone	3/26	0.0041 J	0.008	WHF-1485C-4502	NA	750000 N	0.000000005	Developmental	--	No	No	Maximum < SCTL
67-64-1	Acetone	3/26	0.029	0.039	WHF-1485C-4503	NA	800000 N	0.00000004	Kidney, Liver, Neurological	--	No	No	Maximum < SCTL
Semivolatile Organic Compounds (mg/kg)													
100-01-6	4-Nitroaniline	1/26	0.17 J	0.170	WHF-1485C-4302	NA	560 C	0.0003	Carcinogen, Blood	--	No	No	Maximum < SCTL
120-12-7	Anthracene	1/26	0.052 J	0.052	WHF-1485C-4302	NA	1000000 N	0.0000001	None Specified	--	No	No	Maximum < SCTL
191-24-2	Benzo(g,h,i)perylene	15/26	1.2 J	0.294	WHF-1485C-4302	NA	110000 N	0.00001	Neurological	--	No	No	Maximum < SCTL
86-74-8	Carbazole	1/26	0.33 J	0.330	WHF-1485C-4302	NA	330 C	0.0010	Carcinogen	--	No	No	Maximum < SCTL
206-44-0	Fluoranthene	15/26	3.1	0.687	WHF-1485C-4302	NA	64000 N	0.00005	Blood, Kidney, Liver	--	No	No	Maximum < SCTL
86-73-7	Fluorene	2/26	0.0042 J	0.004	WHF-1485C-4502	NA	140000 N	0.0000000	Blood	--	No	No	Maximum < SCTL
85-01-8	Phenanthrene	10/26	0.32 J	0.123	WHF-1485C-4302	NA	110000 N	0.000003	Kidney	--	No	No	Maximum < SCTL
129-00-0	Pyrene	14/26	3.7	0.814	WHF-1485C-4302	NA	110000 N	0.00003	Kidney	--	No	No	Maximum < SCTL
	Benzo(a)pyrene Equivalents	45/67	2.9786	0.288	WHF-1485C-4302	NA	0.8 C	3.7	Carcinogen	0.4	No	No	Maximum < SCTL
Pesticides/PCBs (mg/kg)													
72-54-8	4,4'-DDD	5/26	1.1 J	0.280	WHF-1485C-4302	NA	39 C	0.03	Carcinogen	--	No	No	Maximum < SCTL
72-55-9	4,4'-DDE	10/25	1	0.323	WHF-1485C-4302, WHF-1485C-4303	NA	27 C	0.04	Carcinogen	--	No	No	Maximum < SCTL
50-29-3	4,4'-DDT	5/26	5.7	1.73	WHF-1485C-4302	NA	27 C	0.2	Carcinogen, Liver	--	No	No	Maximum < SCTL
309-00-2	Aldrin	3/44	0.049	0.161	WHF-1485C-4102A	NA	0.4 C	0.12	Carcinogen, Liver	--	No	No	Maximum < SCTL
5103-71-9	alpha-Chlordane	9/25	0.58 J	0.208	WHF-1485C-4303	NA	19 C(7)	0.03	Carcinogen, Liver	--	No	No	Maximum < SCTL
319-85-7	beta-BHC	1/26	0.00023 J	0.0002	WHF-1485C-4602	NA	6 C	0.00004	Carcinogen	--	No	No	Maximum < SCTL
60-57-1	Dieldrin	14/41	0.94 J	0.171	WHF-1485C-4303	NA	0.4 C	2	Carcinogen, Liver	0.4	No	No	Maximum < SCTL
33213-65-9	Endosulfan II	1/26	0.0006 J	0.0006	WHF-1485C-4203A	NA	11000 N(8)	0.00000005	Cardiovascular, Kidney	--	No	No	Maximum < SCTL
72-20-8	Endrin	1/25	0.0068 J	0.007	WHF-1485C-4102A	NA	550 N	0.00001	Liver	--	No	No	Maximum < SCTL
5103-74-2	gamma-Chlordane	6/22	0.79	0.289	WHF-1485C-4302	NA	19 C(7)	0.04	Carcinogen, Liver	--	No	No	Maximum < SCTL
1024-57-3	Heptachlor Epoxide	2/24	0.00053 J	0.0005	WHF-1485C-4202A	NA	0.7 C	0.0008	Carcinogen, Liver	--	No	No	Maximum < SCTL
Metals (mg/kg)													
7429-90-5	Aluminum	26/26	37400	17644	1485CD00810	No	3500000 N	0.01	Body Weight	--	No	No	Maximum < SCTL Background(2)
7440-36-0	Antimony	4/26	10.7	2.44	WHF-1485C-4303	No	1460 N	0.007	Blood	--	No	No	Maximum < SCTL Background(2)
7440-38-2	Arsenic	26/26	15.2	4.98	WHF-1485C-4302	No	6.2 C	2	Carcinogen, Skin, Cardiovascular	--	No	No	Maximum < SCTL Background(2)
7440-39-3	Barium	26/26	73.8	28.0	WHF-1485C-4303	Yes	251000 N	0.0003	Cardiovascular	--	No	No	Maximum < SCTL
7440-43-9	Cadmium	2/26	2.2	2.20	WHF-1485C-4302	No	1310 N	0.002	Carcinogen, Kidney	--	No	No	Maximum < SCTL Background(2)
7440-47-3	Chromium	26/26	37.3	16.4	1485CD00810	No	10900 N	0.003	Carcinogen, Respiratory	--	No	No	Maximum < SCTL Background(2)
7440-48-4	Cobalt	2/26	2.4	2.40	WHF-1485C-4302	No	64300 N	0.00004	Cardiovascular, Immunological, Neurological, Reproductive	--	No	No	Maximum < SCTL Background(2)
7440-50-8	Copper	26/26	26	10.1	WHF-1485C-4302	Yes	146000 N	0.0002	Gastrointestinal	--	No	No	Maximum < SCTL
7439-89-6	Iron	26/26	26700	12453	1485CD00810	No	1090000 N	0.02	Gastrointestinal	--	No	No	Maximum < SCTL Background(2)
7439-92-1	Lead	26/26	322 J	95.4	WHF-1485C-4303	No	3000	0.1	Neurological	--	No	No	Maximum < SCTL Background(2)
7439-96-5	Manganese	26/26	410 J	65.7	WHF-1485C-4302	No	69300 N	0.006	Neurological	--	No	No	Maximum < SCTL Background(2)

TABLE 6-11
FLORIDA LEVEL 3 (RECREATIONAL) DIRECT CONTACT EVALUATION - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
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CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Exposure Point Concentration[1]	Sample of Maximum Concentration	Site Above Background?[2]	Non-Apportioned Florida Recreational SCTL-Direct Contact[3]	Ratio of Maximum Concentration/ Non-apportioned Recreational SCTL	Target Organ[4]	Exceedance Ratio (Weighted Apportionment)[5]	Is Exposure Point Concentration /Apportioned Recreational SCTL Ratio > 3?	Is Chemical a Potential Level 3 COC?[6]	Rationale/Comments
7439-97-6	Mercury	10/26	0.078 J	0.032	WHF-1485C-4303	No	1100 N	0.00007	Neurological	--	No	No	Maximum < SCTL Background[2]
7440-02-0	Nickel	25/26	6.1	3.24	WHF-1485C-4302	Yes	73000 N	0.00008	Body Weight	--	No	No	Maximum < SCTL
7782-49-2	Selenium	1/26	4.8 J	4.80	1485CD00705	Yes	18200 N	0.0003		--	No	No	Maximum < SCTL
7440-62-2	Vanadium	26/26	68.1	24.2	1485CD00810	No	3650 N	0.02	Hair Loss	--	No	No	Maximum < SCTL Background[2]
7440-66-6	Zinc	26/26	246 J	79.0	WHF-1485C-4302	Yes	1090000 N	0.0002	Blood	--	No	No	Maximum < SCTL
Miscellaneous Parameters (mg/kg)													
57-12-5	Cyanide	2/26	1.8 J	1.80	1485CD00810	NA	36800 N	0.00005	Neurological, Thyroid	--	No	No	Maximum < SCTL
Petroleum Hydrocarbons (mg/kg)													
	Total Petroleum Hydrocarbons	10/26	920	246	WHF-1485C-4303	NA	25400 N	0.04	Multiple Endpoints	--	No	No	Maximum < SCTL
									Total[9]	0.8			

Footnotes
1 - Exposure point concentrations (EPCs) are maximum concentrations or 95 % upper confidence limits (UCLs) on the arithmetic mean as determined by statistical tests and calculations performed by Florida's UCL Calculator.
2 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
3 - SCTLs for recreational users were developed using the methods presented in Chapter 62-777, F.A.C., April 2005 and the most current toxicological data available in IRIS. The recreational users are assumed to be exposed 45 days per year by ingestion, inhalation, and dermal contact. Calculations of the recreational SCTLs are presented in Appendix C.
4 - Target organs are obtained from Table II, Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Florida Department of Environmental Protection (FDEP), April 2005.
5 - The exceedance ratio uses the weighted apportionment method whereby the exposure point concentration is divided by the recreational SCTL. Chemicals with maximum concentrations less than 0.1 of the non-apportioned SCTL are not included in the apportionment process.
6 - A chemical is selected as a potential COC if the maximum concentration is greater than 3 times the non-apportioned SCTL or if it contributes to an exceedance ratio greater than 1, and, for metals, if the site concentrations exceed background levels.
7 - Value is for chlordane.
8 - Value is for endosulfan.
9 - If the Total Exceedance Ratio in less than 1 then the FDEP risk goals have been met.
NA - Not Applicable. According to Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

TABLE 6-12
COMPARISON WITH SCTLS FOR LEACHABILITY TO GROUNDWATER AND CSAT LIMITS - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Florida Leachability to Groundwater(2)	Soil Saturation Limit, Csat(3)
Volatile Organic Compounds (mg/kg)							
78-93-3	2-Butanone	3/26	0.0041 J	WHF-1485C-4502	NA	17	25000
67-64-1	Acetone	3/26	0.029	WHF-1485C-4503	NA	25	100000
Semivolatile Organic Compounds (mg/kg)							
100-01-6	4-Nitroaniline	1/26	0.17 J	WHF-1485C-4302	NA	**0.008**	---
120-12-7	Anthracene	1/26	0.052 J	WHF-1485C-4302	NA	2500	---
56-55-3	Benzo(a)anthracene	10/26	2.5	WHF-1485C-4302	NA	**0.8**	
50-32-8	Benzo(a)pyrene	42/67	2	WHF-1485C-4302	NA	8	
205-99-2	Benzo(b)fluoranthene	15/25	3.1	WHF-1485C-4302	NA	**2.4**	
191-24-2	Benzo(g,h,i)perylene	15/26	1.2 J	WHF-1485C-4302	NA	32000	---
207-08-9	Benzo(k)fluoranthene	11/26	1.7	WHF-1485C-4302	NA	24	
86-74-8	Carbazole	1/26	0.33 J	WHF-1485C-4302	NA	**0.2**	---
218-01-9	Chrysene	12/26	3.6	WHF-1485C-4302	NA	77	
53-70-3	Dibenzo(a,h)anthracene	14/44	0.3 J	WHF-1485C-4302	NA	0.7	
206-44-0	Fluoranthene	15/26	3.1	WHF-1485C-4302	NA	1200	---
86-73-7	Fluorene	2/26	0.0042 J	WHF-1485C-4502	NA	160	---
193-39-5	Indeno(1,2,3-cd)pyrene	14/26	0.98	WHF-1485C-4302	NA	6.6	
85-01-8	Phenanthrene	10/26	0.32 J	WHF-1485C-4302	NA	250	---
129-00-0	Pyrene	14/26	3.7	WHF-1485C-4302	NA	880	---
Pesticides/PCBs (mg/kg)							
72-54-8	4,4'-DDD	5/26	1.1 J	WHF-1485C-4302	NA	5.8	---
72-55-9	4,4'-DDE	10/25	1	WHF-1485C-4302, WHF-1485C-4303	NA	18	---
50-29-3	4,4'-DDT	5/26	5.7	WHF-1485C-4302	NA	11	---
309-00-2	Aldrin	3/44	0.049	WHF-1485C-4102A	NA	0.2	---
5103-71-9	alpha-Chlordane(4)	9/25	0.58 J	WHF-1485C-4303	NA	9.6	---
319-85-7	beta-BHC	1/26	0.00023 J	WHF-1485C-4602	NA	0.001	---
60-57-1	Dieldrin	14/41	0.94 J	WHF-1485C-4303	NA	**0.002**	---
33213-65-9	Endosulfan II(5)	1/26	0.0006 J	WHF-1485C-4203A	NA	3.8	---
72-20-8	Endrin	1/25	0.0068 J	WHF-1485C-4102A	NA	1	---
5103-74-2	gamma-Chlordane(4)	6/22	0.79	WHF-1485C-4302	NA	9.6	---
1024-57-3	Heptachlor Epoxide	2/24	0.00053 J	WHF-1485C-4202A	NA	0.6	---

TABLE 6-12
COMPARISON WITH SCTLS FOR LEACHABILITY TO GROUNDWATER AND CSAT LIMITS - SUBSURFACE SOIL
SITE 41
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

CAS Number	Chemical	Frequency of Detection	Maximum Concentration	Sample of Maximum Concentration	Site Above Background?(1)	Florida Leachability to Groundwater(2)	Soil Saturation Limit, Csat(3)
Metals (mg/kg)							
7429-90-5	Aluminum	26/26	37400	1485CD00810	No	---	---
7440-36-0	Antimony	4/26	10.7	WHF-1485C-4303	No	**5.4**	---
7440-38-2	Arsenic	26/26	15.2	WHF-1485C-4302	**Yes**	---	---
7440-39-3	Barium	26/26	73.8	WHF-1485C-4303	**Yes**	1600	---
7440-43-9	Cadmium	2/26	2.2	WHF-1485C-4302	No	7.5	---
7440-47-3	Chromium	26/26	37.3	1485CD00810	No	38	---
7440-48-4	Cobalt	2/26	2.4	WHF-1485C-4302	No	---	---
7440-50-8	Copper	26/26	26	WHF-1485C-4302	**Yes**	---	---
7439-89-6	Iron	26/26	26700	1485CD00810	No	---	---
7439-92-1	Lead	26/26	322 J	WHF-1485C-4303	No	---	---
7439-96-5	Manganese	26/26	410 J	WHF-1485C-4302	No	---	---
7439-97-6	Mercury	10/26	0.078 J	WHF-1485C-4303	**Yes**	2.1	---
7440-02-0	Nickel	25/26	6.1	WHF-1485C-4302	**Yes**	130	---
7782-49-2	Selenium	1/26	4.8 J	1485CD00705	**Yes**	5.2	---
7440-62-2	Vanadium	26/26	68.1	1485CD00810	No	980	---
7440-66-6	Zinc	26/26	246 J	WHF-1485C-4302	**Yes**	---	---
Miscellaneous Parameters (mg/kg)							
57-12-5	Cyanide	2/26	1.8 J	1485CD00810	NA	**0.8**	---
Petroleum Hydrocarbons (mg/kg)							
	Total Petroleum Hydrocarbons	10/26	920	WHF-1485C-4303	NA	**340**	---

Shaded cells indicate that the specified criterion or background level has been exceeded.

Footnotes:

1 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Appendix D.3. If the maximum concentration of a chemical is less than the background value, that chemical was not selected as a COPC.
2 - Soil Cleanup Target Levels (SCTLs) for Leachability Based on Groundwater Criteria, Table 2, Chapter 62-777 Technical Report (FDEP, February 2005).
3 - Soil Saturation Limits (CSAT), Table 8, Chapter 62-777 Technical Report (FDEP, February 2005).
4 - Chlordane is used as a surrogate for alpha- and gamma-chlordane.
5 - Endosulfan is used as a surrogate for endosulfan II.
NA - Not Applicable. According to proposed Florida Rule 62-780 only naturally occurring (inorganic) constituents are considered in the background evaluation.

levels for metals), the constituent is identified as a potential COC and may be further evaluated using various apportionment approaches described in the following sections.

Methods of Apportioning the SCTLs

Simple Apportionment. For situations in which apportionment is applicable, several methods of apportionment are available, as described in Appendix C of the Technical Report. The most straightforward method is simple apportionment. For simple apportionment, the default SCTL for each chemical is divided by the number of chemicals that produce the same type of toxicity. For carcinogens, the value of the simple apportioned SCTL is calculated by dividing the non-apportioned SCTL (residential, commercial/industrial, or recreational) by the number carcinogenic chemicals detected in a surface or subsurface soil dataset. For example, if five carcinogens were detected in a surface soil dataset for a site, the simple apportioned SCTLs for carcinogens are the non-apportioned SCTLs divided by 5 (FDEP, February 2005). For noncarcinogens, the simple apportioned SCTL is determined by dividing the non-apportioned SCTL by the number of chemicals impacting the same target organ. If the liver, for example, is identified as the target organ for 7 noncarcinogens in a dataset, the simple apportioned SCTLs for those chemicals are the non-apportioned values divided by 7.

Not all SCTLs should be apportioned. The Technical Report (FDEP, February 2005) lists the following exceptions to apportioning:

1. Do not apportion an SCTL based on natural background concentration or practical quantitation limit. These are criteria that are not directly risk-based, and therefore are not subject to apportionment.

2. Do not apportion an SCTL based on acute toxicity. These SCTLs are always regarded as not-to-exceed values, and the default value should be compared with the maximum concentration on site. [Note that acute toxicity SCTLs are applicable only in situations where small children might be present, such as a residence, playground, or school.] Of the chemicals detected in soil at Site 41, the residential SCTLs for barium, copper, and vanadium are acute values.

3. Do not apportion lead (Pb) SCTLs. Both residential and commercial/industrial lead SCTLs are based on a unique type of toxicological analysis that is not amenable to the standard apportionment process.

4. Do not apportion the SCTLs for chemicals present in low concentrations. Eliminate from consideration at a site chemicals whose maximum concentration is less than or equal to 1/10 the default SCTL. Chemicals present in low concentrations are unlikely to contribute substantially to

risk and unnecessarily complicate the apportionment process. As shown in Tables 6-6 through 6-12, the maximum concentrations of most detected chemicals (all except carcinogenic PAHs, arsenic, barium, copper, lead, and vanadium) were less than 1/10 of the default SCTLs for surface and subsurface soil. Therefore, the SCTLs for most chemicals detected in soil at Site 41 were not apportioned.

5. Do not apportion the SCTLs for chemicals detected infrequently. A chemical can be eliminated from consideration at a site if it is detected a) in only one out of 10 or more samples, or 5% or fewer out of 20 or more samples, and in only one environmental medium; and b) in low concentrations (no more than the default SCTL); and c) there is no reason to believe that the chemical may be present due to historical site activities. These criteria are intended to eliminate chemical detections that are artifacts from sampling, analytical, or other problems. They are not intended to eliminate chemicals present due to site activities in localized areas of contamination.

Weighted Apportionment. In most situations, simple apportionment will be overly conservative in that the sum of the risks represented by the individual chemical SCTLs are likely to be below FDEP target risks of $1x10^{-6}$ and a hazard index [for each target organ/system or effect] of 1. This can be avoided by weighted apportioning. One method of weighted apportioning involves calculation of ratios of the 95% UCLs for chemicals to their SCTLs. The 95% UCL for each chemical subject to apportionment is divided by its default SCTL. If the sum of the ratios is less than 1, the chemicals have met the FDEP's risk goals. If the sum is greater than 1, dividing the concentration of each by the sum of the ratios will yield apportioned SCTLs that match exactly the risk goals. In this approach, steps to achieve the apportioned SCTLs are expected to produce proportional decreases in the concentrations of each chemical. This approach makes sense if the chemicals are co-located, such that removal of one chemical results in similar reduction in others.

Weighted apportionment is performed on a chemical by chemical basis when it is feasible and appropriate, as determined by the human health risk assessor. In practice, weighted apportionment is often an option when cumulative quantitative risk assessment results derived as described in preceding sections are less than FDEP risk benchmarks (i.e., a cancer risk estimate of $1x10^{-6}$ for carcinogens and an HI of 1 for noncarcinogens).

Non-Proportional Weighted Apportionment. Another method of weighted apportionment is non-proportional reductions in default SCTLs among chemicals with additive effects. As with other methods, the objective of the reduction in default SCTLs is to achieve a situation in which the sum of the risks posed by apportioned SCTLs does not exceed FDEP's risk goals for any health effect. However, in this approach, the reduction may be taken unevenly among the chemicals. This approach is useful if the chemicals are not co-located, and removal of one or more chemicals can be achieved more easily or more economically than the others. Risks can be distributed optimally among the apportioned SCTLs based on site conditions, as long as the sums of the risks they represent meet the goals of 1×10^{-6} excess cancer risk and a hazard index of 1.

When the 95% UCL approach is used to develop exposure concentrations, two criteria must be satisfied when comparing site concentrations to the SCTLs, either default or alternative:

1. The 95% UCL must meet or be below the apportioned SCTL; and

2. The maximum concentration remaining on site must meet or be below a concentration three-times the unapportioned SCTL in Risk Management Option Levels I and II, and below three-times the apportioned SCTL in Risk Management Option Level III. Using the 95% UCL as the basis to determine whether the SCTL has been achieved for a site means that some areas can have concentrations above the SCTL, as long as other areas are below. In this context, it is important to insure that concentrations above the SCTL allowed to remain do not constitute an unacceptable health risk.

In the risk assessment for Site 41, SCTLs were apportioned (by weighted apportionment) for Risk Management Option Level III.

Comparison with Leachability-based SCTLs

The potential for leaching was addressed through comparisons with SCTLs for Leachability Based on Groundwater Criteria (FDEP, February 2005). Unlike direct contact SCTLs, which are based primarily on long-term exposure covering a specified area, leachability-based default SCTLs are intended to protect water resources at all locations. Consequently, maximum rather than average (or 95% UCL) concentrations are compared with leaching criteria. If the maximum concentration of a chemical exceeds its respective leachability SCTL, that chemical is identified as a potential COC.

Evaluation of Free Product in Soil.

The potential for the presence of free product (for organic chemicals) was evaluated by comparing maximum site concentrations to C_{sat} limits. The C_{sat} values are provided in Table 8 of Chapter 62-777 FAC (FDEP, February 2005). The C_{sat} comparisons indicated the concentrations of all organic chemicals detected in soil at the sites evaluated in this report were significantly less than the C_{sat} levels. Therefore, it is unlikely these chemicals are present as free product at any of the sites.

6.6.2 Risk Characterization Using State of Florida Guidelines

This section contains a summary of the results of the risk characterization for Site 41 conducted using guidelines presented in Florida Rule 62-780 FAC and the Rule 62-777 Technical Report. The results are summarized in Tables 6-6 through 6-12 and are discussed below.

6.6.2.1 Results of Surface Soil Evaluation – Florida Methodology

Level 1 Evaluation (Residential)

Table 6-5 presents a comparison of the maximum detected concentrations for surface soil to the FDEP residential SCTLs. The following chemicals were identified as exceeding the Level 1 SCTLs and were retained as potential COCs for residential exposures to surface soil at Site 41:

- cPAHs (expressed as benzo(a)pyrene equivalents)
- Dieldrin

Level 2 (Industrial)

The results of the Level 1 evaluation identified cPAHs as a COC; therefore, a Level 2 evaluation was conducted. A comparison of the maximum concentrations in surface soil to the FDEP industrial SCTLs is presented in Table 6-6. The following constituent was identified as exceeding the Level 2 SCTL, and was retained as a potential COC for industrial exposures to surface soil at Site 41:

- cPAHs

Level 3 (Recreational)

The results of the Level 2 evaluation identified cPAHs and dieldrin as COCs; therefore, a Level 3 evaluation was conducted assuming a future recreational land use scenario for Site 41. Alternative SCTLs for recreational exposures were derived following the methodology presented in Section 6.3.3. A comparison of the maximum detected concentrations and EPCs for surface soil to the alternative CTLs is presented in Table 6-7. As shown in the table, the maximum cPAHs concentration exceeded the alternative SCTL. Based on weighted apportionment the chemicals exceed the FDEP risk goals and the maximum cPAHs concentration were more than three times the non-apportioned Level 3 alternative SCTLs. Therefore, cPAHs were retained as COCs for recreational exposure to surface soil at Site 41.

Comparison of Chemicals in Surface Soil with Leachability SCTLs and Csat

Table 6-8 presents comparisons of maximum detected concentrations in surface soil with Florida criteria based on leachability to groundwater. As shown in the table, maximum concentrations of benzo(a)pyrene, dieldrin, and chromium were greater than the leachability criteria indicating that there is potential for contaminants detected in surface soil to adversely impact groundwater. Table 6-8 also presents comparisons of maximum concentrations with soil saturation concentrations to evaluate the potential for presence of free product. As shown in the table, the concentrations of organic compounds in surface soil were significantly less than the C_{sat} concentrations, indicating that free product is not present in surface soil.

6.6.2.2 Results of Subsurface Soil Evaluation – Florida Methodology

Level 1 Evaluation (Residential)

Table 6-9 presents a comparison of the maximum detected concentrations for subsurface soil to the FDEP residential SCTLs. The following chemicals were identified as exceeding the Level 1 SCTLs and were retained as potential COCs for residential exposures to subsurface soil at Site 41:

- cPAHs (expressed as benzo(a)pyrene equivalents)
- Pesticides (4,4'-DDT and Dieldrin)
- Total Petroleum Hydrocarbons

Level 2 (Industrial)

The results of the Level 1 evaluation identified several chemicals as COCs; therefore, a Level 2 evaluation was conducted. A comparison of the maximum concentrations in subsurface soil to the FDEP industrial SCTLs is presented in Table 6-10. The following constituents were identified as exceeding the Level 2 SCTL, and were retained as potential COCs for industrial exposures to subsurface soil at Site 41:

- cPAHs
- Dieldrin

Level 3 (Recreational)

The results of the Level 2 evaluation identified cPAHs and Dieldrin as COCs; therefore, a Level 3 evaluation was conducted assuming a future recreational land use scenario for Site 41. Alternative SCTLs for recreational exposures were derived following the methodology presented in Section 6.3.3. A comparison of the maximum detected concentrations and EPCs for subsurface soil to the alternative

CTLs is presented in Table 6-11. As shown in the table, the maximum cPAHs concentration exceeded the alternative SCTL. However, based on weighted apportionment the chemicals meet the FDEP risk goals and the maximum concentrations of all chemicals were less than three times the non-apportioned Level 3 alternative SCTLs. Therefore, no chemicals were retained as COCs for recreational exposure to subsurface soil at Site 41.

Comparison of Chemicals in Subsurface Soil with Leachability SCTLs

Table 6-12 presents comparisons of maximum detected concentrations in subsurface soil with Florida criteria based on leachability to groundwater. The following constituents were detected at concentrations that exceeded the leachability SCTLs:

- SVOCs [4-nitroaniline, benzo(a)anthracene, benzo(b)fluoranthene, and carbazole]
- Dieldrin
- Antimony
- Cyanide
- Total Petroleum Hydrocarbons

Table 6-12 also presents comparisons of maximum concentrations with soil saturation concentrations to evaluate the potential for presence of free product. As shown in the table, the concentrations of organic compounds in subsurface soil were significantly less than the C_{sat} concentrations, indicating that free product is not present in subsurface soil.

6.7 HUMAN HEALTH RISK UNCERTAINTY ANALYSIS

This section presents a summary of uncertainties inherent in the risk assessment and includes a discussion of how they may affect the quantitative risk estimates and conclusions of the risk analysis. The baseline HHRA for Site 41 was performed in accordance with current USEPA and Florida guidance. However, there are varying degrees of uncertainty associated with the baseline HHRA. The following sections discuss general uncertainties in risk assessment and uncertainties specific to the risk assessment for Site 41.

Uncertainty in the selection of COPCs was related to the current status of the predictive databases, the grouping of samples, the numbers, types and distributions of samples, data quality, and the procedures used to include or exclude constituents as COPCs. Uncertainty associated with the exposure assessment included the values used as input variables for a given intake route or scenario, the assumptions made to determine EPCs, and the predictions regarding future land use and population characteristics. Uncertainty in the toxicity assessment included the quality of the existing toxicity data needed to support dose-response relationships and the weight-of-evidence used to determine the carcinogenicity of COPCs. Uncertainty in risk characterization was associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier steps of the risk assessment process.

Whereas there were various sources of random uncertainty and bias, the magnitude of bias and uncertainty and the direction of bias were influenced by the assumptions made throughout the risk assessment including selection of COPCs and selection of values for dose-response relationships. Throughout the entire risk assessment assumptions that considered safety factors were made so that the final calculated risks were overestimated.

Generally, risk assessments carry two types of uncertainty: measurement and informational uncertainty. Measurement uncertainty refers to the usual variance that accompanies scientific measurements. For example, this type of uncertainty is associated with analytical data collected for each site. The risk assessment reflects the accumulated variances of the individual values used.

Informational uncertainty stems from inadequate availability of information needed to complete the toxicity and exposure assessments. Often, this gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical, the biological mechanism of action of a chemical, or the behavior of a chemical in soil.

Once the risk assessment is complete, the results must be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Reliance on results from a risk assessment without consideration of uncertainties, limitations, and assumptions inherent in the process can be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates were made to ensure that the particular assumptions were protective of sensitive subpopulations or the maximum exposed individuals. If a number of conservative assumptions are combined in an exposure model, the resulting calculations can propagate the uncertainties associated with those assumptions, thereby producing a much larger uncertainty for the final results. This uncertainty is biased toward overpredicting both carcinogenic and noncarcinogenic risks. Thus, both the results of the risk assessment and the uncertainties associated with those results must be considered when making risk management decisions.

This interpretation of uncertainty is especially relevant when the risks exceed the point of departure for defining "acceptable" risk. For example, when risks calculated using a high degree of uncertainty are less than an acceptable risk level (i.e., 10^{-6}), the interpretation of no significant risk is typically straightforward.

However, when risks calculated using a high degree of uncertainty exceed an acceptable risk level (i.e., 10^{-4}), a conclusion can be difficult unless uncertainty is considered.

6.7.1 Uncertainty in Selection of COPCs

The most significant issues related to uncertainty in COPC selection were the usability of existing databases (i.e., the use of validated and unvalidated sample results [only validated data were used in this risk assessment] and the completeness, precision, and accuracy of the data set), the inclusion of chemicals potentially attributable to background in the quantitative risk assessment, the screening levels used, and the absence of screening levels for a few chemicals detected in the site media. A brief discussion of each of these issues is provided in the remainder of this section.

Chemicals Potentially Attributable to Background

Aluminum, arsenic, iron and vanadium in surface soil and aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium in subsurface soil were eliminated as COPCs on the basis of background. Concentrations of aluminum, iron, and vanadium in surface soil and aluminum, antimony, iron, manganese, and vanadium exceeded the COPC screening levels [set at a HI of 0.1]; however they did not exceed the USEPA Region 9 PRGs for soil. Concentrations of these inorganics in surface soil and subsurface soil were also less than the FDEP residential SCTLs. Concentrations of arsenic in surface and subsurface soil exceeded the COPC screening levels (set at an ILCR of 1×10^{-6}) but would not exceed levels associated with the upper bound of USEPA's target risk range of 10^{-4} to 10^{-6}. Based on this discussion, the results and conclusions of the risk assessment are not affected by the elimination of inorganics on the basis of background.

COPC Screening Levels

The use of risk-based screening values (for the USEPA analysis) based on conservative land use scenarios (i.e., residential land use for soil corresponding to an ILCR of 10^{-6} and HI of 0.1 ensured that all the significant contributors to risk from a site were evaluated. The elimination of chemicals present at concentrations that correspond to an ILCR less than 10^{-6} and an HI less than 0.1 should not affect the final conclusions of the risk assessment because those chemicals are not expected to cause a potential health concern at the detected concentrations.

Chemicals without Established Screening Levels

Region 9 PRGs are currently not available for some constituents (e.g., benzo(g,h,i)perylene, phenanthrene, and alpha- and gamma-chlordane). Appropriate surrogates were selected for these chemicals based on similar chemical structures, if available. For example, pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene, and chlordane is use as a surrogate for alpha- and gamma-chlordane. Applying toxicity values of one compound to another increases the uncertainty in the risk assessment both in regard to the selection of COPCs and the calculated risks. The direction of the uncertainty is not known. Note that the State of Florida does provide CTLs for these compounds and they were evaluated in the analysis using FDEP methodology. Therefore, the uncertainty associated with the use of surrogates is likely to be minimal.

6.7.2 Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arose because of the methods used to calculate exposure point concentrations, the determination of land use conditions, the selection of receptors and scenarios, the estimation of EPCs, and the selection of exposure parameters. Each of these is discussed below.

Land Use

The current land use patterns at NAS Whiting Field are well established, thereby limiting the uncertainty associated with land use assumptions. Land use at Site 41 is currently limited and is expected to be limited in the future, as long as NAS Whiting Field remains open. To be conservative, risks to potential and future construction workers, maintenance workers, occupational workers, recreational users, and on-site residents were estimated for the site. Maintenance workers and recreational users are considered to be the most likely receptors under current land use.

Exposure Point Concentrations

EPCs for soil were calculated using the Florida UCL Calculator (Version 1.0). Uncertainty is associated with the use of the 95 percent UCL on the mean concentration as the EPC. As a result of using the 95 percent UCL, the estimations of potential risk for the RME scenario were most likely overstated because this is a representation of the upper limit that potential receptors would be exposed to over the entire exposure period. Uncertainty was also introduced when the nondetects results were assigned a value of one-half the nondetect quantitation limit in the calculation of the EPC. This may either overstate or understate the risks to potential receptors.

Exposure Routes and Receptor Identification

The determination of various receptor groups and exposure routes of potential concern was based on current land use observed at the site and the anticipated future land use. Therefore, the uncertainty associated with the selection of exposure routes and potential receptors was minimal because they were considered to be well defined.

Exposure Parameters

The risk-based concentrations used to estimate risks by the USEPA methodology were calculated by the equations and exposure factors presented in Section 6.3.3. Each exposure factor selected for use in the risk assessment has some associated uncertainty. Generally, exposure factors were 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. The exposure factors used in this report, in most cases, were obtained from USEPA or Florida guidance documents for the Reasonable Maximum Exposure (RME), which generally specify the use of the 95th percentile value for most parameters. Therefore, the selected values for the RME receptor represented an upper bound of the observed or expected habits of the majority of the population.

Generally, the uncertainty can be assessed quantitatively for many assumptions made in determining factors for calculating exposures and intakes. Many of these parameters were determined from statistical analyses on human population characteristics. Often, the database used to summarize a particular exposure parameter (i.e., body weight) is quite large. Consequently, the values chosen for such variables in the RME scenario have low uncertainty.

For many parameters for which limited information exists (i.e., dermal absorption of chemicals from soil), greater uncertainty exists. For example, current USEPA dermal guidance (USEPA, July 2004) does not provide dermal absorption factors for exposure to most metals (except arsenic and cadmium) in soil. Therefore, risks for dermal contact from soil were not evaluated for most metals in this risk assessment. Consequently, risks from exposure to soil may have been underestimated.

6.7.3 Uncertainty in the Toxicological Evaluation

The risk-based concentrations used to assess risk were also developed using the toxicity criteria discussed in Section 6.4. Uncertainties associated with the toxicity assessment (determination of RfDs and CSFs and use of available criteria) are presented in this section.

Derivation of Toxicity Criteria

Uncertainty associated with the toxicity assessment was associated with hazard assessment and dose-response evaluations for the COPCs. The hazard assessment dealt with characterizing the nature and strength of the evidence of causation or the likelihood that a chemical that induces adverse effects in animals will also induce adverse effects in humans. Hazard assessment of carcinogenicity was evaluated as a weight-of-evidence determination using USEPA methods. Positive animal cancer test data suggest that humans contain tissue(s) that may manifest a carcinogenic response; however, the animal data cannot necessarily be used to predict the target tissue in humans. In the hazard assessment of noncancer effects, however, positive animal data often suggest the nature of the effects (i.e., the target tissues and type of effects) anticipated in humans.

Uncertainty in hazard assessment arose from the nature and quality of the animal and human data. Uncertainty was reduced when similar effects were observed across species, strain, sex, and exposure route; when the magnitude of the response was clearly dose related; when pharmacokinetic data indicated a similar fate in humans and animals; when postulated mechanisms of toxicity were similar for humans and animals; and when the chemical of concern was structurally similar to other chemicals for which the toxicity is more completely characterized.

Uncertainty in the dose-response evaluation included the determination of a CSF for the carcinogenic assessment and derivation of an RfD for the noncarcinogenic assessment. Uncertainty was introduced from interspecies (animal to human) extrapolation, which, in the absence of quantitative pharmacokinetic or mechanistic data, is usually based on consideration of interspecies differences in basal metabolic rate. Uncertainty also resulted from intraspecies variation. Most toxicity experiments are performed with animals that are very similar in age and genotype, so intragroup biological variation is minimal, but the human population of concern may reflect a great deal of heterogeneity, including unusual sensitivity or tolerance to the COPC. Even toxicity data from human occupational exposure reflect a bias because only those individuals sufficiently healthy to attend work regularly (the "healthy worker effect") and those not unusually sensitive to the chemical are likely to be occupationally exposed. Finally, uncertainty arises from the quality of the key study from which the quantitative estimate was derived and the database used. For cancer effects, the uncertainty associated with dose-response factors was mitigated by assuming the 95 percent upper bound for the slope factor. Another source of uncertainty in carcinogenic assessment is the method by which data from high doses in animal studies are extrapolated to the dose range expected for environmentally exposed humans. The linearized multistage model, which is used in nearly all quantitative estimations of human risk from animal data, is based on a nonthreshold assumption of carcinogenesis. Evidence suggests, however, that epigenetic carcinogens, as well as many genotoxic carcinogens, have a threshold below which they are noncarcinogenic. Therefore, the use of the linearized multistage model was conservative for chemicals that exhibited a threshold for carcinogenicity.

For noncancer effects, additional uncertainty factors may have been applied in the derivation of the RfD to mitigate poor quality of the key study or gaps in the database. Additional uncertainty for noncancer effects arose from the use of an effect level in the estimation of an RfD, because this estimation was predicated on the assumption of a threshold less than which adverse effects were not expected. Therefore, an uncertainty factor is usually applied to estimate a no-effect level. Additional uncertainty arose in estimation of an RfD for chronic exposure from subchronic data. Unless empirical data indicated that effects did not worsen with increasing duration of exposure, an additional uncertainty factor was applied to the no-effect level in the subchronic study. Uncertainty in the derivation of RfDs was mitigated by the use of uncertainty and modifying factors that normally ranged between 3 and 10. The resulting combination of uncertainty and modifying factors may have reached 1,000 or more.

The derivation of dermal RfDs and CSFs from oral values may have caused uncertainty. This was particularly the case when no gastrointestinal absorption rates were available in the literature or when only qualitative statements regarding absorption were available.

Uncertainty Associated with Evaluation of the Dermal Exposure Pathway

According to RAGS Part E (USEPA, July 2004), risks for dermal absorption of chemicals in soil are quantitatively evaluated for arsenic, cadmium, chlordane, 2,4-dichlorophenoxyacetic acid, DDT, TCDD (and other dioxins), PAHs, PCBs, pentachlorophenol, and SVOCs only because of the limited information guidance available to evaluate dermal exposure to other constituents. However, risks associated with dermal exposure to other metals in soil (except for arsenic and cadmium) were also evaluated in the risk assessment using the dermal absorption factors provided in FDEP guidance (FDEP, April 2005). Generally, potential risks associated with the metals may result in an overestimation of risk because metals do not readily desorb from soil and become available for absorption through the skin.

Use of Iron Toxicity Criteria

An NCEA provisional RfD was used to evaluate noncarcinogenic effects from exposure to iron. The provisional RfD for iron is based on allowable intakes rather than adverse effect levels. Therefore, there was some degree of uncertainty associated with the use of the RfD used to calculate risk-based concentrations for iron. Note that some U.S. EPA regions (e.g., Region 1) consider the use of the oral RfD for iron inappropriate and recommend that this metal not be evaluated quantitatively in risk assessments.

6.7.4 Uncertainty in the Risk Characterization

Uncertainty in risk characterization resulted from assumptions made regarding additivity of effects from exposure to multiple COPCs from various exposure routes. High uncertainty existed when summing noncancer risks for several substances across different exposure pathways. This assumed that each substance has a similar effect and/or mode of action. Even when compounds affect the same target organs, they may have different mechanisms of action or differ in their fate in the body, so additivity may not have been an appropriate assumption. However, the assumption of additivity was considered because in most cases it represented a conservative estimate of risk.

Risks to any individual may also have been overestimated by summing multiple assumed exposure pathway risks for any single receptor. Although every effort was made to develop reasonable scenarios, not all individual receptors may have been exposed via all pathways considered.

Finally, the risk characterization did not consider antagonistic or synergistic effects. Little or no information was available to determine the potential for antagonism or synergism for the COPCs. Because chemical-specific interactions could not be predicted, the likelihood for risks to be overpredicted or underpredicted could not be defined, but the methodology used was based on current USEPA guidance.

6.8 SUMMARY AND CONCLUSIONS

An HHRA was conducted for the chemical concentrations detected in surface soil and subsurface soil samples collected at Site 41. The evaluation was conducted using both USEPA and State of Florida regulations and guidelines for HHRA. The results of the USEPA and Florida risk assessments are summarized in the following sections.

6.8.1 Summary of USEPA Risk Assessment

The USEPA risk assessment considered five receptors, the hypothetical future resident, the typical industrial worker, the construction worker, the maintenance worker, and the trespasser/recreational user, assuming exposure via the ingestion, dermal contact, and inhalation route of exposures. However, maintenance workers and trespassers/recreational users are considered to be the most likely receptors at Site 41 under current land use.

The list of COPCs for Site 41 included the following:

- Surface Soil – carcinogenic PAHs, Dieldrin, and chromium
- Subsurface Soil – carcinogenic PAHs, 4,4’-DDT, aldrin, and dieldrin

Quantitative estimates of noncarcinogenic and carcinogenic risks (HIs and ILCRs, respectively) were developed for potential human receptors. Results of these evaluations are summarized below.

Noncarcinogenic risks are below the target hazard index of 1.0 to satisfy EPA and FDEP requirements for exposure to surface soil and subsurface soil.

Carcinogenic risks for exposure to surface and subsurface soil are within the USEPA’s target risk range of 10^{-4} to 10^{-6} for all receptors. However, risks associated with exposure to surface soil exceed FDEP’s target risk level of 10^{-6} for the industrial workers, construction workers, lifelong recreational users, and hypothetical future residents. Carcinogenic risks associated with exposure to subsurface soil exceed FDEP's target risk level for the industrial workers and hypothetical future residents.

6.8.2 Summary of Florida Risk Assessment

The risk assessment conducted per the State of Florida regulations and guidelines evaluated risks to a hypothetical future resident and a typical industrial worker using the published SCTLs for the residential and industrial land use scenario, respectively. Risks to a hypothetical future recreational user were evaluated using SCTLs specifically developed for this risk assessment as stipulated in the State of Florida regulations and guidelines. The following chemicals were identified as potential COCs for surface soils based on a comparison of maximum concentrations or EPCs to these SCTLs:

FLORIDA SURFACE SOIL EVALUTION

Residential SCTLs	Industrial SCTLs	Recreational SCTLs
cPAHs, Dieldrin	cPAHs	cPAHs

The following chemicals were identified as potential COCs for subsurface soils based on a comparison of maximum concentrations or EPCs to the SCTLs:

FLORIDA SUBSURFACE SOIL EVALUTION

Residential SCTLs	Industrial SCTLs	Recreational SCTLs
cPAHs, 4,4'-DDT, Dieldrin, Total Petroleum Hydrocarbons	cPAHs, Dieldrin	No COCs

Chemicals detected in soil were also evaluated for the potential to impact groundwater quality at the site by comparing maximum concentrations with FDEP SSLs for migration from soil to groundwater. Maximum concentrations of benzo(a)pyrene, dieldrin, and chromium in surface soil were greater than the leachability criteria indicating that there is potential for contaminants detected in surface soil to adversely impact groundwater. In subsurface soil maximum concentrations of 4-nitroaniline, benzo(a)anthracene, benzo(b)fluoranthene, carbazole, dieldrin, antimony, cyanide, and total petroleum hydrocarbons in subsurface soil were greater than the leachability criteria indicating that there is potential for contaminants detected in subsurface soil to adversely impact groundwater.

7.0 ECOLOGICAL RISK ASSESSMENT

This ecological risk assessment was conducted to evaluate potential site-related risks to ecological receptors at Site 41. The ecological risk assessment consisted of Steps 1 through 3a of USEPA's 8-step ecological risk assessment process, and was conducted in accordance with USEPA and Navy guidance (USEPA, 1997; 2000a; 2001; DON, 1999). Steps 1 through 3a consist of the following:

Step 1	Screening-Level Problem Formulation and Ecological Effects Evaluation
Step 2	Screening-Level Exposure Estimate and Risk Calculation
Step 3a	Refinement of Preliminary Chemicals of Potential Concern

Section 7.1.1 describes the environmental setting at Site 41. The fate and transport characteristics of the chemicals detected in soil are provided in Section 7.1.2. The ecotoxicity of site contaminants and potential ecological receptors are described in Section 7.1.3. Section 7.1.4 describes complete exposure pathways, and Section 7.1.5 provides assessment and measurement endpoints. Sections 7.2, 7.3, and 7.4 describe the ecological effects evaluation, exposure estimates, and risk calculation, respectively. Section 7.5 describes the refinement of preliminary chemicals of potential concern. Uncertainties inherent in the ecological risk assessment are discussed in Section 7.6. The summary and conclusions of the ecological risk assessment are provided in Section 7.7.

7.1 SCREENING-LEVEL PROBLEM FORMULATION

7.1.1 Environmental Setting

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested areas to the south and southwest, and forests along the remaining boundaries. Located on an upland area, elevations at NAS Whiting Field range from 50 to 190 feet (ft) above sea level. Clear Creek is to the west and south, and Big Coldwater Creek is to the east. Both creeks are tributaries of the Blackwater River. The Blackwater River discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system. Site 41 was the site of a former building and has very sparse vegetation consisting of weeds and grasses. Portions of the site are also covered with dirt, pea gravel, and sand. Very little ecological habitat is present at the site.

7.1.2 Contaminant Fate and Transport

Site 41 is the site of the former Pesticide Storage Building 1485C and was initially designated Potential Source of Contamination (PSC) 1485C. The building was located within the Base Operating Services Compound northwest of the eastern termination of Yorktown Street and was used for storage of ground maintenance equipment and limited amounts of pesticide compounds. The building caught fire in the late 1980’s and was completely destroyed. Following the fire, cleanup activities at the site included the removal of all building materials and the concrete slab flooring. The depth of the removal excavation and the disposal history of the excavated materials are unknown.

Pesticides, inorganics (metals and cyanide), and SVOCs were detected in surface soil samples collected at Site 41. The discussion below is limited to a brief review of the fate and transport of contaminants at Site 41 as related to migration pathways and ecological exposure.

Contaminant migration pathways applicable at the site include volatilization, erosion, overland runoff, and infiltration. Contaminants in soil could volatilize from surficial material. Soil erosion due to storm water runoff may occur. If surface soil is disturbed through activities such as excavation, soils could serve as a source for airborne transport of contaminants; soil contaminants could then be transported to downwind locations. Infiltrating precipitation could cause contamination of subsurface soil and groundwater at Site 41. Contaminated groundwater or surface water could discharge into the streams on and adjacent to the site.

Most SVOCs detected in Site 41 surface soil were PAH compounds. PAHs are a diverse group of compounds consisting of two or more substituted and unsubstituted polynuclear aromatic rings formed by the incomplete combustion of carbonaceous materials. PAHs are ubiquitous in the modern environment and are common constituents of coal tar, soot, vehicle exhaust, cigarette smoke, certain petroleum products, road tar, mineral oils, creosote, and many cooked foods. PAHs can also be released to the environment through natural sources such as forest fires. PAHs are transferred from surface water by volatilization and sorption to settling particles. The compounds are transformed in surface water by photooxidation, chemical oxidation, and microbial metabolism (ATSDR, 1989a). In soil and sediments, microbial metabolism is the major process for degradation of PAHs (ATSDR, 1989a).

The fate and transport characteristics of PAHs are dependent on their molecular weights. Low molecular weight PAHs are more soluble and volatile, and therefore more mobile. They may volatilize and photolyze from soil and surface water, and they also may be biodegraded. High molecular weight PAHs tend to be immobile and insoluble, binding strongly to organic matter (reducing the potential for leaching to groundwater), and they are resistant to volatilization, photolysis, and biodegradation (Eisler, 2000). Upper trophic level organisms are exposed to PAHs primarily through their diet, but most wildlife can metabolize and excrete PAHs. Food-chain transfer and biomagnification of PAHs is expected to be minimal. PAHs may be absorbed by plants but are expected to be translocated, metabolized, and potentially photo-degraded. Accumulation within plants is likely to occur only in heavily polluted locations where uptake exceeds metabolism and degradation (Edwards, 1983).

Many metals occur naturally at various concentrations in the surface water and sediment primarily to chemical weathering of rocks and fallout from volcanoes. Most metals are toxic to aquatic (i.e., fish, invertebrates) and terrestrial (i.e., plants, invertebrates, vertebrates) ecological receptors above certain concentrations, with some metals being more toxic at lower concentrations than others. Also, different chemical forms of the metals may be more toxic than others. For example, hexavalent chromium is typically more toxic than trivalent chromium, and methylmercury is more toxic than inorganic mercury. Many factors (e.g., pH, Eh, clay content, organic matter content) influence the bioavailability of metals to invertebrates in soils.

Organochlorine insecticides such as DDT, chlordane, aldrin, dieldrin, heptachlor, endosulfan, and endrin and their associated breakdown products generally degrade very slowly and tend to be soluble in lipids. These result in bioaccumulation and possible increases in concentrations through food webs (Newman, 1998). Pesticides have high Log K_{OC} values so they are expected to sorb strongly to soil and sediment particles when released to the environment. Consequently, these compounds may migrate from their site of application when the soil is eroded, although they will not have a tendency to leach to groundwater. DDT, DDE, and DDD are highly lipid soluble, which combined with an extremely long half-life, results in bioaccumulation (ATSDR, 1989b).

7.1.3 Ecotoxicity and Potential Receptors

Few generalizations can be made about the ecotoxicity of PAHs because of the extreme variability in toxicity and physiochemical properties of PAHs. Adverse impacts to plants from PAHs, however, are rare (Eisler, 2000). In most animal species, PAHs are metabolized by a mixed-function oxidase enzyme system into intermediates that may be toxic, mutagenic, or carcinogenic to the host. Some invertebrate species cannot efficiently metabolize PAHs (Eisler, 2000), and PAHs can be chronically toxic to invertebrates, but overall, very little is known about the toxicological mechanisms of PAHs in invertebrates (Erstfield and Snow-Ashbrook, 1999). PAHs can bind to cellular macromolecules and thereby disrupt their function in higher level organisms such as mammals and birds. Biological macromolecules include polymers of carbohydrates (e.g., starch), amino acids (proteins), and nucleotides (e.g., DNA). The cellular functions of these polymers include structure, energy storage, energy transfer, material transport, and the storage and transmittal of genetic information. PAHs show little tendency to biomagnify in the food web (Eisler, 2000). Microbial metabolism is the major process for degradation of PAHs in soil (ATSDR, 1989b).

It is difficult to make generalizations about the toxic actions of metals because of diverse affinities for organic molecules in biologic structures, a wide array of biological effects, and a multiplicity of target organs and systems (Amdur et al., 1991). At the molecular level, metals can manifest toxicity in many ways, including selectively accumulating in target organs (such as the kidneys), substituting for “essential” metals, and mimicking essential substrates (Clarkson, 1983). The reactions of metals at the molecular level typically affect enzyme systems, leading to disruption of cellular transport, cellular respiration, cell division, and other physiological processes. Metal toxicity to aquatic organisms is manifested through a broad spectrum of effects that may range from a reduction in growth rate to death.

Pesticides are used to control pestiferous invertebrates and, therefore, they are toxic to many soil and aquatic invertebrates. In addition, many pesticides are toxic to ecological receptors at higher trophic levels such as mammals and birds. For example, DDT compounds have been linked to eggshell thinning and subsequent decreased survival of several birds of prey (such as eagles and falcons). Other pesticides such as chlordanes, dieldrin, aldrin, endrin, and heptachlor are also very toxic to mammals and birds through various mechanisms (Newell et al., 1987).

7.1.4 Complete Exposure Pathways

Several groups of terrestrial ecological receptors can be exposed to contaminants in surface soil. Invertebrates such as earthworms are exposed to contaminants as they move through the soil and ingest soil particles while searching for food. Plants are exposed to contaminants via direct contact as contaminants are absorbed through the roots and are then translocated to different parts of the plants (e.g., leaves, seeds). These pathways were evaluated in this Screeing-level Ecological Risk Assessment (SERA).

Small birds and mammals may be exposed to contaminants in soil via several exposure routes. They may be exposed by direct contact as they search for food or burrow into the soil. Exposure of terrestrial wildlife to contaminants in the soil via dermal contact is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons are expected to minimize transfer of contaminants across dermal tissue. Therefore, the dermal pathway was not evaluated in the SERA. Small birds and mammals also may be exposed to contaminants in the soil via incidental ingestion of soil and ingestion of plants and/or invertebrates that have accumulated contaminants from the soil.

Ecological receptors are not directly exposed to contaminants in groundwater at the site. Exposure to groundwater discharging as a seep or directly to a surface water body represents a complete exposure pathway. However, this pathway is not evaluated because there is no surface water present at the Site, but is discussed in the uncertainties.

Inhalation of particulates by mammals and birds is not considered a complete pathway at Site 41 because there are no activities causing air contamination. Also, inhalation pathways are not typically evaluated in SERAs because of the uncertainty inherent in estimating exposure levels and toxicological effects. Therefore, the air inhalation pathway is not evaluated in the SERA.

In summary, complete exposure pathways and routes of entry into biota at Site 41 that were evaluated in this ecological risk assessment consist of:

- direct contact with soil by plants/invertebrates
- incidental ingestion of soil and ingestion of plants and/or invertebrates that have accumulated contaminants from the soil by small birds and mammals.

7.1.5 Preliminary Assessment and Measurement Endpoints

An assessment endpoint is “an explicit expression of the environmental value that is to be protected,” while a measurement endpoint is “a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint” (USEPA, 1997). Measurement endpoints represent the assessment endpoints chosen for a site, and are measures of biological effects (USEPA, 1997).

USEPA Region 4 has specified that assessment endpoints for the screening-level assessment should be broad and generic. For the Site 41 screening level assessment, the preliminary assessment endpoint is the protection of terrestrial biota from adverse effects of chemicals on their growth, survival, and reproduction. The preliminary measurement endpoints are chemical concentrations in surface soil that are associated with no adverse effects on growth, survival, and reproduction of terrestrial organisms. The measurement endpoints are represented by USEPA Eco-SSLs and USEPA Region 4 ecological screening values (ESVs) for surface soil.

The soil ESVs are based on conservative endpoints and sensitive ecological effects data, and thus, the screening values represent chemical concentrations associated with a low probability of unacceptable risks to ecological receptors. For this reason, USEPA Region 4 considers their screening values to be protective of invertebrates and plants as well as upper level receptors such as birds and mammals. In the screening level ecological risk assessment, therefore, a distinction is not made between measurement endpoints associated with direct toxicity to invertebrates and plants versus measurement endpoints associated with food-chain effects.

7.2 SCREENING-LEVEL ECOLOGICAL EFFECTS EVALUATION

For the screening of media concentrations, soil screening values were used in the screening level ecological risk assessment including Ecological Soil Screening Levels (Eco-SSLs) established by USEPA (2007) and ESVs established by USEPA Region 4 (USEPA, 2001). If an Eco-SSL was available, the lowest Eco-SSL among plant, invertebrate, mammal, and avian values was used as the screening value. Eco-SSLs were preferentially used as soil screening values, but Eco-SSLs are currently available for only a few chemicals. USEPA Region 4 ESVs (USEPA, 2001) were used as screening values for chemicals that do not have an Eco-SSL. The term “soil ESV” is generally used for brevity in this report to refer to either the Eco-SSL or the Region 4 soil ESV.

If the maximum concentration of surface soil was less than the ESV, the chemical was eliminated from further consideration. If the maximum concentration equaled or exceeded the ESV, or if a screening value was not available, the chemical was then considered to be an ecological chemical of potential concern (COPC) and was retained for further evaluation.

7.3 SCREENING-LEVEL EXPOSURE ESTIMATE

Detailed sampling methodology is described in Section 3.0 of this RI including dates of sampling events, additional sampling locations and shifting of the sampling scheme to better define the area of former Pesticide Storage Building 1485C and the extent of contamination.

7.4 SCREENING-LEVEL RISK CALCULATION

The screening level risk calculation step compared maximum concentrations of chemicals in surface soil to ESVs. The ratio of the maximum concentration to the ESV is called the screening ecological effects quotient (EEQ). Analytes whose maximum concentrations were less than ESVs (i.e., EEQ < 1.0) were dropped from further consideration, and those that equaled or exceeded ESVs (i.e., EEQ $\geq$ 1.0), or did not have ESVs, were retained as ecological COPCs. An EEQ value greater than 1.0 indicates that ecological receptors are potentially at risk, and further evaluation or additional data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially since most toxicity benchmarks are developed using conservative exposure assumptions. Chemicals that were retained as COPCs were evaluated in Step 3a to determine if further investigation was warranted.

Calcium, magnesium, potassium, and sodium were not considered to be COPCs because they are essential nutrients that can be tolerated by living systems even at relatively high concentrations. There have been no activities at NAS Whiting Field that have resulted in known releases of high levels of these four chemicals at Site 41.

In surface soil, one PAH (benzo(a)pyrene) and total PAHs, nine pesticides, and six metals were retained as COPCs because their maximum concentrations exceeded ESVs. An ESV was not available for one VOC, acetone,, which was retained as a COPC (Table 7-1).

TABLE 7-1

SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN SELECTION -
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA
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Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Average Concentration(2)	Sample of Maximum Concentration	Site Above Background?(3)	Screening Level(4)	EEQ	Plants/Invertebrates		Food-chain Modeling	
									COPC	Rationale	COPC	Rationale
Volatile Organic Compounds (mg/kg)												
Acetone	1/17	0.0271 J	0.0271 J	0.0173	1485CD00301	NA	NSL	NV	Yes	NSL	No	NONBIO
Semivolatile Organic Compounds (mg/kg)												
Anthracene	3/17	0.00096 J	0.014 J	0.0054	WHF-1485C-4101A	NA	29	0.00048	No	BSL	Yes	BIO
Benzo(a)anthracene	14/17	0.011	0.282 J	0.154	1485CD00601	NA	1.1	0.256	No	BSL	Yes	BIO
Benzo(a)pyrene	44/53	0.0024 J	9	0.302	WHF-148SC-SS-3101	NA	1.1	8.18	Yes	ASL	Yes	BIO
Benzo(b)fluoranthene	14/17	0.022	0.39	0.198	WHF-1485C-4101A	NA	1.1	0.355	No	BSL	Yes	BIO
Benzo(g,h,i)perylene	14/17	0.021 J	0.349	0.168	1485CD00601	NA	1.1	0.317	No	BSL	Yes	BIO
Benzo(k)fluoranthene	14/17	0.013 J	0.266 J	0.143	1485CD00601	NA	1.1	0.242	No	BSL	Yes	BIO
Chrysene	14/17	0.018	0.422	0.183	1485CD00601	NA	1.1	0.384	No	BSL	Yes	BIO
Dibenzo(a,h)anthracene	16/23	0.0025 J	0.1	0.0895	WHF-41-SS-52-1	NA	1.1	0.091	No	BSL	Yes	BIO
Fluoranthene	14/17	0.041 J	0.8	0.279	WHF-1485C-4101A	NA	29	0.028	No	BSL	Yes	BIO
Indeno(1,2,3-cd)pyrene	14/17	0.02	0.386	0.181	1485CD00601	NA	1.1	0.351	No	BSL	Yes	BIO
Phenanthrene	13/16	0.0088	0.22 J	0.124	1485CD00601	NA	29	0.008	No	BSL	Yes	BIO
Pyrene	14/17	0.032 J	0.61	0.237	WHF-1485C-4101A	NA	1.1	0.555	No	BSL	Yes	BIO
Total PAHs	14/17	0.2145	3.935	1.52	WHF-1485C-4201A	NA	1.1 (5)	3.58	Yes	ASL	Yes	BIO
Pesticides (mg/kg)												
4,4'-DDD	5/17	0.00072 J	0.11	0.0214	WHF-1485C-4301	NA	0.021 (6)	5.24	Yes	ASL	Yes	BIO
4,4'-DDE	9/15	0.001 J	0.13	0.0174	WHF-1485C-4301	NA	0.021 (6)	6.19	Yes	ASL	Yes	BIO
4,4'-DDT	8/17	0.0018 J	0.33	0.0388	WHF-1485C-4301	NA	0.021 (6)	15.7	Yes	ASL	Yes	BIO
Aldrin	7/23	0.00043 J	0.0058 J	0.0022	WHF-1485C-4201A	NA	0.0025	2.32	Yes	ASL	Yes	BIO
alpha-Chlordane	10/17	0.0012 J	0.61	0.0538	WHF-1485C-4001	NA	0.1 (7)	6.1	Yes	ASL	Yes	BIO
Dieldrin	20/23	0.0013 J	0.34 J	0.0495	WHF-1485C-4001	NA	0.0049	69.4	Yes	ASL	Yes	BIO
Endrin	2/16	0.0004 J	0.018 J	0.0163	WHF-1485C-4301	NA	0.001	18	Yes	ASL	Yes	BIO
Endrin Ketone	1/16	0.004 J	0.004 J	0.004	WHF-1485C-4301	NA	0.001 (8)	4	Yes	ASL	No	NONBIO
gamma-Chlordane	8/15	0.00095 J	0.56	0.0568	WHF-1485C-4001	NA	0.1 (7)	5.6	Yes	ASL	Yes	BIO
Heptachlor Epoxide	3/14	0.00086 J	0.0099 J	0.00309	WHF-1485C-4201A	NA	0.1 (7)	0.10	No	BSL	Yes	BIO
Metals (mg/kg)												
Aluminum	17/17	5510	9970	7921	WHF-1485C-4301	No	pH (9)	NA	No	BSL	No	NONBIO
Antimony	4/17	0.26	0.94	0.243	WHF-1485C-4301	No	0.27	3.5	Yes	ASL	No	NONBIO
Arsenic	11/17	1.2	5.4	1.54	WHF-1485C-4301	No	18	0.3	No	BSL	Yes	BIO
Barium	17/17	8.9	62.2	19.4	WHF-1485C-4001	Yes	330	0.19	No	BSL	No	NONBIO
Cadmium	6/17	0.047	0.77	0.108	WHF-1485C-4301	No	0.36	2.1	Yes	ASL	Yes	BIO
Calcium	17/17	397	2080	1169	WHF-1485C-4101	Yes	NA	NV	No	NUT	No	NONBIO
Chromium	17/17	4.9 J	75 J	13.2	WHF-1485C-3701	Yes	26	2.9	Yes	ASL	Yes	BIO
Cobalt	9/17	0.57	1.8	0.605	1485CD00101	No	13	0.14	No	BSL	No	NONBIO
Copper	17/17	2.4	15.4	6.36	1485CD00501	Yes	28	0.55	No	BSL	Yes	BIO
Iron	17/17	3100	7060	4643	1485CD00201	No	pH (9)	NA	No	BSL	No	NONBIO
Lead	17/17	4.6 J	345	49.4	WHF-1485C-3701	Yes	11	31.4	Yes	ASL	Yes	BIO
Magnesium	17/17	134	736	300	1485CD00101	Yes	NA	NV	No	NUT	No	NONBIO
Manganese	17/17	31.4 J	158	82.7	1485CD00601	No	220	0.72	No	BSL	No	NONBIO
Mercury	7/17	0.01	0.023 J	0.0157	WHF-1485C-4301	No	0.1	0.230	No	BSL	Yes	BIO
Nickel	13/17	1.6	8	2.44	1485CD00101	No	38	0.21	No	BSL	Yes	BIO
Potassium	17/17	55.4	268	159	1485CD00101	Yes	NA	NV	No	NUT	No	NONBIO
Sodium	6/17	299	368	129	1485CD00401	Yes	NA	NV	No	NUT	No	NONBIO
Vanadium	17/17	8.1	20	12.3	WHF-1485C-3901	No	7.8	2.6	Yes	ASL	No	NONBIO
Zinc	17/17	9.1 J	139 J	32.4	WHF-1485C-4301	Yes	46	3.02	Yes	ASL	Yes	BIO

TABLE 7-1

**SURFACE SOIL CHEMICALS OF POTENTIAL CONCERN SELECTION -
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA
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Chemical	Frequency of Detection	Minimum Concentration(1)	Maximum Concentration(1)	Average Concentration(2)	Sample of Maximum Concentration	Site Above Background?(3)	Screening Level(4)	EEQ	Plants/Invertebrates		Food-chain Modeling	
									COPC	Rationale	COPC	Rationale
Miscellaneous Parameters (mg/kg)												
Cyanide	3/17	0.31	0.76 J	0.321	1485CD00601	NA	0.9	0.84	No	BSL	No	NONBIO

- Shaded cell indicates that the chemical was retained as a COPC.

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Average concentration is the mean concentration of all samples, using 1/2 the detection limit for non-detects, unless the value is greater than the maximum concentration.
In that case, the average concentration is the mean of the positive detections.
3 - To determine whether metal concentrations were within background levels, soil concentrations were compared to facility background levels described in Section 6.1.1.1.
If the maximum concentration of a chemical is less than the background value, that chemical was eleminated as a COPC in Step 3a.
4 - The lowest of the plant, invertebrate, avian, or mammal Eco SSLs was used first; if an Eco SSL is not available, the USEPA Region 4 ESV was used unless otherwise noted.
5 - ESV represents the lowest Eco SSL value for high molecular weight PAHs to be conservative.
6 - Total DDT value used
7 - Screening value for chlorinated pesticides used.
8 - Endrin used as a surrogate
9 - Aluminum is considered a COPC only when the soil pH is less than 5.5.
- Iron is not expected to be toxic to plants with a soil pH between 5 and 8.

Associated Samples

1485CD00101	1485CSS1801	WHF-148SC-SS-2101
1485CD00201	1485CSS1901	WHF-148SC-SS-2201
1485CD00301	1485CSS2001	WHF-148SC-SS-2301
1485CD00401	WHF-1485C-3401	WHF-148SC-SS-2401
1485CD00501	WHF-1485C-3501	WHF-148SC-SS-2501
1485CD00601	WHF-1485C-3601	WHF-148SC-SS-2601
1485CSS0701	WHF-1485C-3701	WHF-148SC-SS-2701
1485CSS0801	WHF-1485C-3801	WHF-148SC-SS-2801
1485CSS0901	WHF-1485C-3901	WHF-148SC-SS-2901
1485CSS1001	WHF-1485C-4001	WHF-148SC-SS-3001
1485CSS1101	WHF-1485C-4101	WHF-148SC-SS-3101
1485CSS1201	WHF-1485C-4101A	WHF-148SC-SS-3201
1485CSS1301	WHF-1485C-4201	WHF-148SC-SS-3301
1485CSS1301-AVG	WHF-1485C-4201A	WHF-41-SS-48-1
1485CSS1301-D	WHF-1485C-4301	WHF-41-SS-49-1
1485CSS1401	WHF-1485C-4401	WHF-41-SS-50-1
1485CSS1501	WHF-1485C-4501	WHF-41-SS-51-1
1485CSS1601	WHF-1485C-4601	WHF-41-SS-52-1
1485CSS1701	WHF-1485C-4701	WHF-41-SS-53-1

Definitions:

COPC = Chemical Of Potential Concern
J = Estimated value
NA = Not Applicable/Not Available
NV = No value/value could not be calculated

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level
NSL = No Screening Level
For elimination as a COPC:
BSL = Below COPC Screening Level
NUT = Essential nutrient

7.5 REFINEMENT OF PRELIMINARY CHEMICALS OF POTENTIAL CONCERN

At this point, the first two steps of the ecological risk assessment have been completed. The ecological risk assessment process includes a series of scientific/management decision points (SMDPs) (USEPA, 1997). The first SMDP occurs at the end of Step 2, and requires the risk managers to evaluate and approve or redirect the work up to that point and determine whether the risk assessment will continue into Step 3. However, USEPA Region 4 recognizes that most ecological risk assessments will proceed into Step 3, and facilities are encouraged to submit the results of Steps 1-3 as a single deliverable document (USEPA, 2000a). With this in mind, and since the screening level ecological risk assessment indicates a potential for adverse effects, a more thorough assessment is warranted. Therefore, the risk assessment process for Site 41 will proceed into Step 3 (Baseline Risk Assessment Problem Formulation).

7.5.1 General Approach

The baseline ecological risk assessment begins with a more balanced evaluation of the conservativeness inherent in the first two steps of the risk assessment process (USEPA, 1997; DON, 1999). The initial phase of Step 3 is typically known as Step 3a, and consists of a refinement of the conservative exposure assumptions in order to more realistically estimate potential risks to plants, invertebrates, and wildlife receptors. Examples of factors typically considered during Step 3a include toxicological evaluation of COPCs, spatial distribution of contaminants, frequency of detection, and habitat quality (USEPA, 1997; DON, 1999). Furthermore, the preliminary assessment and measurement endpoints are refined, the site conceptual model is developed, and initial food-chain modeling is conducted (at sites where applicable) to evaluate risks to upper level receptors (USEPA, 2000a). The objective of the Step 3a refinement is to better define those chemicals that contribute to potentially unacceptable levels of ecological risk, and to identify and eliminate from further consideration those chemicals that were initially selected as COPCs because of the use of very conservative assumptions.

7.5.2 Assessment and Measurement Endpoints

Based on the habitats present, migration pathways, and routes of exposure of chemicals at Site 41, the site-specific assessment endpoints are the protection of the following groups of receptors from adverse effects of site-related contaminants on growth, survival, and reproduction:

- Soil invertebrate communities
- Terrestrial vegetative communities
- Herbivorous bird and mammal communities
- Vermivorous bird and mammal communities

The assessment endpoints listed above were selected for evaluation in Step 3a of the baseline ecological risk assessment for the reasons described below.

7.5.2.1 Soil Invertebrates

Earthworms, insect larvae, and other soil invertebrates at Site 41 aid in the formation of soil and the redistribution and decomposition of organic matter in soil. They can also accumulate bioaccumulative contaminants that can then be transferred to higher trophic-level organisms that consume soil invertebrates.

7.5.2.2 Terrestrial Vegetation

Parts of Site 41 are covered by grasses and weeds, which can accumulate certain contaminants that can then be transferred to higher trophic-level organisms that consume plants. No shrubs or trees are located on the site.

7.5.2.3 Herbivorous Birds and Mammals

Herbivorous birds and mammals (animals that consume only plant tissue) might forage at the site. Their role in the community is essential because, without them, higher trophic-level animals could not exist. They may be exposed to and accumulate chemicals that are present in the plants they consume.

7.5.2.4 Vermivorous Birds and Mammals

Vermivorous birds and mammals consume primarily invertebrates and are considered first-level carnivores. They serve as a food source for higher trophic level carnivores and may be exposed to and accumulate chemicals that are present in the food items they consume.

7.5.2.5 Other Potential Endpoints

As indicated in USEPA guidance (USEPA, 1997), it is not practical to directly evaluate risks to all of the individual components of the ecosystem. Instead, assessment endpoints focus the risk assessment on particular components of the ecosystem that will tend to yield the highest risks; this should provide protection for endpoints that have lower risks.

Carnivorous birds and mammals generally have large home ranges. The boundary for Site 41 is approximately 100 ft. x 150 ft. (15000 sq. ft.), which is approximately one-third of an acre. When the size of the site is compared to the home range of top carnivores such as the red-tailed hawk (with an average of 1692 acres) and the red fox (with an average of 1793 acres), carnivores would only receive a very small portion of their diet from Site 41 and therefore are not included as receptors in this ERA. Threshold oral toxicity values for reptiles and amphibians are not available for most chemicals, so risks to reptiles and amphibians were not quantitatively evaluated. With the above factors in mind, amphibians, reptiles, and carnivores were not selected as assessment endpoints. Instead, potential risk from bioaccumulation and biomagnification of contaminants will be assessed for herbivorous and vermivorous birds and mammals.

7.5.2.6 Measurement Endpoints

Adverse impacts on survival, growth, and reproduction of plants and soil invertebrates were evaluated by comparing chemical concentrations in surface soil to USEPA Eco-SSLs and USEPA Region 4 soil screening values. Several contaminants present in soil samples collected at Site 41 are bioaccumulative and could accumulate through food ingestion by terrestrial animals. Therefore, adverse impacts on survival, growth, and reproduction of herbivorous and vermivorous birds and mammals were evaluated by comparing estimated ingested doses of contaminants in surface soil and food to oral toxicity threshold values.

7.5.2.7 Selection of Receptor Species

Many receptors in the soil environments at Site 41 are typically grouped into general categories such as invertebrates and vegetation. This is a reflection of the nature of the threshold values, effects values, or criteria typically used to characterize risk for such organisms. However, for vertebrate receptors, selection of a representative species is required so that risks to these upper-level species incurred by intake through eating and drinking can be estimated.

Ingestion is the primary route of exposure for most mammals and birds. The selection of species used to represent the receptor groups identified in Sections 7.5.2.1 through 7.5.2.5 was based on considerations of their preferred habitat, body size, sensitivity to contaminants, home range, abundance, commercial or sport utilization, legal status, and functional role (e.g., predators). The availability of exposure parameters such as body mass, feeding rate, and drinking rate was also a factor in selecting surrogate species. The following surrogate species were used in the food-chain modeling conducted as part of this SERA:

- Herbivorous mammal - Meadow vole
- Herbivorous bird - Bobwhite quail
- Insectivorous mammal - Short-tailed shrew
- Insectivorous bird - American woodcock

Appendix E provides a description of the surrogate species receptor profiles.

7.5.3 Step 3a Risk Characterization and Discussion

Several chemicals that were detected in surface soil were initially retained as ecological COPCs because their chemical concentrations exceeded ESVs or because ESVs were not available. The remainder of this section characterizes potential risk to terrestrial invertebrates and plants from COPCs in surface soil (Section 7.5.4.1) and potential risk to terrestrial wildlife exposed to bioaccumulative COPCs in surface soil (Section 7.5.4.2). Potential risk is characterized using a weight-of-evidence approach, and underlying uncertainties are discussed where applicable in this section and/or in Section 7.6.

7.5.3.1 Potential Risk to Terrestrial Invertebrates and Plants

7.5.3.1.1 Volatile Organic Compounds

Only one VOC, acetone, was retained as a COPC because an ESV was not available. Acetone is a common laboratory contaminant. VOCs are typically toxic to environmental receptors only at very high concentrations. Furthermore, acetone was detected in only one of 17 samples. Therefore, acetone is eliminated for further evaluation as a COPC for plants/invertebrates in surface soils at Site 41.

7.5.3.1.2 Semivolatile Organic Compounds

Thirty samples were analyzed for benzo(a)pyrene only and six samples were analyzed for benzo(a)pyrene and dibenzo(a,h)anthracene. The maximum detected benzo(a)pyrene concentration (9 mg/kg) was in sample WHF-148SC-SS-3101. The toxicity of PAHs is typically assumed to be additive, so evaluating PAH toxicity in soil by examining total PAH concentrations is especially useful when, as at Site 41, several PAHs were detected. Seventeen of 53 samples were analyzed for total PAHs at Site 41. The maximum concentration of total PAHs (using one-half the detection limit to represent nondetected analytes) was 10.5 mg/kg, in sample 1485CD00401. This sample, however, had no positive detections (as did two other samples that were analyzed for total PAHs). The highest total PAH concentration in samples using only positive detections was 3.935 mg/kg in sample WHF-1485C-4201A.

Benzo(a)pyrene and total PAHs were retained as COPCs for evaluation in Step 3a for plants and invertebrates. The screening level for high molecular weight (HMW) PAHs (1.1 mg/kg) was based on risks to mammals. The HMW Eco SSL for soil invertebrates is 18 mg/kg (USEPA, 2007). All of the maximum detected concentrations of benzo(a)pyrene and total PAHs are well below this concentration. Therefore, risks to soil invertebrates are acceptable, and benzo(a)pyrene and total PAHs are not retained as COPCs for risks to soil invertebrates in surface soils at Site 41.

An Eco SSL is not available for plants. However, in Appendix III of the Canadian SQG document for benzo(a)pyrene (EC, 1999c), a No Observed Effects Concentration (NOEC) of 4,400 mg/kg was the lowest reported NOEC value for plants and was based on seedling emergence after 3 days of exposure. All of the detected concentrations of benzo(a)pyrene and total PAHs are less than this NOEC, so it does not appear likely that PAHs in the soil will adversely impact plants. Additionally, the site is only sparsely vegetated with weeds and grasses. Therefore, risks to plants are acceptable and benzo(a)pyrene and total PAHs are not retained as COPCs for risks to plants in surface soils at Site 41.

In summary, SVOCs are eliminated for further evaluation as COPCs for plants/invertebrates in surface soils at Site 41.

7.5.3.1.3 Pesticides

Maximum concentrations of nine pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, endrin, endrin ketone, alpha-chlordane, and gamma-chlordane) exceeded their ESVs.

4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected in five of seventeen, nine of fifteen, and eight of seventeen samples with maximum detected concentrations of 0.11 mg/kg, 0.13 mg/kg, and 0.33 mg/kg respectively, which all occur in sample WHF-1485C-4301. Eco-SSL values were not available for plants or invertebrates. Because the screening levels used in the conservative COPC screening are based on risks to wildlife, an alternate benchmark was used to further evaluate risks to plants and invertebrates. Canadian SQGs are not available for 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, so total DDT was used as a surrogate. The Canadian SQG for total DDT is 12 mg/kg (CCME, 2006). This value is a threshold effects concentration (TEC) that was derived based on toxicological data for vascular plants and soil invertebrates. There were sufficient toxicological data available to use the weight-of-evidence approach to derive the criterion. The TEC is considered to be protective of microbial nutrient and energy cycling processes and is used as the SQG for soil contact (EC, 1999). If the maximum concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT are summed, the concentration for total DDTs is 0.57 mg/kg. This value is well below the Canadian SQG value (12 mg/kg). Therefore, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT are eliminated for further evaluation as COPCs for plants/invertebrates in surface soils at Site 41.

Aldrin, Dieldrin, and Endrin, and Endrin Ketone

Aldrin was detected in seven of twenty-three samples at a maximum concentration of 0.0058 mg/kg. However, the only sample that exceeded the ESV was the maximum at WHF-1485C-4201A.

Dieldrin was detected in twenty of twenty-three samples at a maximum concentration of 0.34 mg/kg. The dieldrin ESV is an Eco-SSL value that is based on risks to mammals (USEPA, 2005) rather than risks to plants or soil invertebrates. Alternate benchmarks for dieldrin were not available for plants or invertebrates. The highest concentrations occur in samples WHF-1485C-4001 and WHF-1485C-4301.

Endrin and endrin ketone were both detected infrequently in two of sixteen and one of sixteen samples with maximum concentrations of 0.018 mg/kg and 0.004 mg/kg, respectively. Both endrin and endrin ketone only exceeded ESVs in one sample (WHF-1485C-4301).

Alpha- and Gamma-Chlordane

Alpha- and gamma-chlordane were detected in ten of seventeen and eight of fifteen samples with maximum concentrations of 0.61 mg/kg and 0.56 mg/kg, respectively. Both chlordanes only exceeded the ESV in the same two samples, WHF-1485C-4001 and WHF-1485C-4301.

Pesticide Summary

In summary, alternate benchmarks were not available for most of the detected pesticides. Only two samples had detections of multiple pesticides that exceeded the ESVs. Sample number WHF-1485C-4301 had exceedances for dieldrin, endrin, endrin ketone, alpha-chlordane, and gamma-chlordane. This is also the sample where the maximum concentrations of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected. However, risks were acceptable from 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT when compared to suitable alternative benchmarks. Sample number WHF-1485C-4001 had ESV exceedances for dieldrin, alpha-chlordane, and gamma-chlordane. Additionally, these two samples had the highest detected dieldrin concentrations. Sample number WHF-1485C-4201A had an exceedance of aldrin and dieldrin, but this was the only exceedance for aldrin. The multiple pesticide ESV exceedances are bound to a very small area (approximately 90 feet x 25 feet). The dieldrin ESV exceedances are more widespread (approximately 140 feet x 90 feet) based on concentrations detected in analyzed samples. However, the concentrations of all pesticides are relatively low and very little suitable ecological habitat exists at the site. Therefore, none of the pesticides initially retained as COPCs are expected to pose an unacceptable risk to plants/invertebrate receptors at Site 41.

7.5.3.1.4 Metals

Six metals (antimony, cadmium, chromium, lead, vanadium, and zinc) were retained as COPCs for exceeding their respective screening levels. The maximum detected concentrations of three metals (antimony, cadmium, and vanadium) are below the basewide background concentration (see Table F-5). Therefore, these metals are not expected to cause site-related impacts and are not retained as COPCs for further evaluation.

Chromium

Chromium was detected in all seventeen samples that were analyzed for metals at a maximum concentration of 75 mg/kg. The soil ESV (26 mg/kg) is an Eco-SSL which is based on risks to wildlife (USEPA, 2008). An Eco-SSL for plants/invertebrates is not available. However, the average chromium concentration was 13.2 mg/kg, which is well below the Eco-SSL. Furthermore, the maximum concentration is only slightly higher than the Canadian SQG for chromium (64 mg/kg) (CCME, 2006) and the average concentration is well below this value. Therefore, chromium is eliminated for further evaluation as a COPC for plants/invertebrates in surface soils at Site 41.

Lead

Lead was detected in all seventeen samples that were analyzed for metals at a maximum concentration of 345 mg/kg. The soil ESV (11 mg/kg) is an Eco-SSL which is based on risks to wildlife. The Eco-SSL value for invertebrates is 1700 mg/kg. The maximum detected concentration is well below this value. Therefore, risks to invertebrates are not expected. The Eco-SSLs value for plants is 120 mg/kg (USEPA, 2005). Although the maximum concentration is above this Eco-SSL, there is little ecological habitat and the size of the site is only one third of an acre. Therefore, risks to plants from lead at the site are expected to be minimal.

Zinc

Zinc was detected in all seventeen samples that were analyzed for metals at a maximum concentration of 139 mg/kg. Zinc was initially selected as a COPC because the maximum soil concentration exceeded the USEPA Eco SSL for birds of 46 mg/kg. Because the Eco SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, zinc concentrations were compared to the following Eco SSLs for soil invertebrates, 120 mg/kg, and plants, 160 mg/kg, (USEPA, 2007) to evaluate risks to these receptors.

The maximum detected concentration of zinc (139 mg/kg) is less than the Eco SSL for plants and only slightly greater than the Eco SSL for soil invertebrates. Furthermore, the average zinc concentration is 32.4 mg/kg, which is much less than the plant and invertebrate benchmarks. Therefore, risks to plants and invertebrates from zinc are expected to be minimal and zinc is not retained as a COPC for risks to these receptors.

In summary, none of the metals initially retained as COPCs pose an unacceptable risk to plants/invertebrate receptors at Site 41.

7.5.3.2 Potential Risk to Terrestrial Wildlife

Food-chain modeling was conducted to evaluate potential risks to representative receptors from ingested doses of chemicals detected in soil that are known to bioaccumulate or biomagnify (USEPA, 2000b). USEPA Region 4 considers bioaccumulative chemicals to consist of those so designated in USEPA's (2000b) *Appendix to Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs, Chemical-Specific Summary Tables.* The supporting information for the food-chain model including surrogate receptor profiles and the selection of toxicity reference values (TRVs) are presented in Appendix E.

Risk to terrestrial receptors as a result of exposure to COPCs in the surface soil was determined by estimating the chronic daily intake (CDI) and comparing the CDI to TRVs representing acceptable daily doses in mg/kg-day. The TRVs were developed from no observed adverse effect levels (NOAELs) and lowest observable adverse effect levels (LOAELs) obtained from wildlife studies, when available. The TRVs used in the food-chain model came from the ORNL Toxicological Benchmarks for Wildlife: 1996 Revision (Sample, et al., 1996), EPA Eco-SSLs (USEPA 2005, 2007), and other sources as cited in Appendix E.

COPC intake for wildlife exposed to the COPCs in surface soil was estimated as daily dose (mg/kg-day) using exposure equations. The contaminant concentration in surface soil was used to calculate CDI doses. The following equations present the CDI equations that were used in calculating a total daily dose for the surrogate species selected for modeling:

$$\text{Dose, surface soil (mg/kg-day)} = \frac{(SC * SI)}{BW}$$

$$\text{Dose, food (mg/kg - day)} = \frac{(FC * FI)}{BW}$$

$$\text{Dose, water (mg/L-day)} = \frac{(WC*WI)}{BW}$$

Total CDI (mg/kg-day) = [Dose(surface soil) + Dose(food) + Dose(water)] * H

Where:	FI =	Food ingestion rate (kg/day)
	FC =	Food concentration (mg/kg)
	BW =	Body weight (kg)
	SI =	Incidental soil ingestion rate (kg/day)
	SC =	surface soil concentration (mg/kg)
	WI =	Water ingestion rate

WC = Water concentration (mg/L)
H = Home Range/Contaminated Area

The contaminant concentration of prey items (e.g., invertebrates) for the wildlife species is calculated using the following equation:

FC = SC * BAF

Where: FC = Contaminant concentration in food (mg/kg) (e.g., invertebrates)
SC = Contaminant concentration in surface soil (mg/kg)
BAF= Bioaccumulation factor (unitless)

Contaminant concentrations in food items were calculated using BAFs from published sources (see Appendix E "Derivation of Bioaccumulation Factors").

The exposure assumptions (e.g., ingestion rates and body weight) were obtained from the Wildlife Exposure Factors Handbook (U.S. EPA, 1993) or other literature sources, as necessary. If only one value was available for a given exposure parameter, the value was used regardless of where the study was conducted in developing the value. The exposure parameters from U.S. EPA (1993) are wet weight values; however, the BAFs estimate the tissue concentrations in dry weight. Therefore, the exposure parameters from U.S. EPA (1993) were converted to dry weight values for the food chain model calculations. Table 7-2 presents the exposure parameters that were used in the SERA and Appendix Table E-1 presents the values that were used to calculate the exposure parameters and a discussion of how they were calculated.

The EEQ for the terrestrial wildlife model was calculated as follows:

$$EEQ = \frac{\text{Total CDI}}{\text{TRV}}$$

Where: EEQ = Ecological effects quotient (unitless)
Total CDI = Total daily intake dose (mg/kg-day)
TRV = Toxicity reference value (NOAEL or LOAEL) (mg/kg-day)

Based on maximum concentrations and conservative assumptions, food chain model NOAEL EEQs exceeded 1.0 for benzo(a)pyrene (shrew and woodcock), total PAHs (shrew and woodcock), 4,4'-DDE (shrew and woodcock), 4,4'-DDT (shrew and woodcock), dieldrin (shrew and woodcock), endrin

TABLE 7-2

EXPOSURE FACTORS FOR THE TERRESTRIAL WILDLIFE MODEL
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Species/Exposure Inputs	Conservative Inputs		Average Inputs		Source
	Values	Units	Values	Units	
Meadow Vole					
Body Weight = BW	1.700E-02	kg	3.578E-02	kg	USEPA, 1993
Food Ingestion Rate = If	1.878E-03	kg/day	1.744E-03	kg/day	USEPA, 1993
Soil Ingestion Rate - Is (3.2%, 1.2%)	6.010E-05	kg/day	2.093E-05	kg/day	USEPA, 2005
Home Range = HR	Assume 100% on site		6.593E-02	acres	USEPA, 1993
Short-Tailed Shrew					
Body Weight = BW	1.500E-02	kg	1.613E-02	kg	USEPA, 1993
Food Ingestion Rate = If	1.600E-03	kg/day	1.433E-03	kg/day	USEPA, 1993
Soil Ingestion Rate - Is (3%, 0.9%)	4.801E-05	kg/day	1.289E-05	kg/day	USEPA, 2005
Home Range = HR	Assume 100% on site		9.637E-01	acres	USEPA, 1993
American Woodcock					
Body Weight = BW	1.338E-01	kg	1.731E-01	kg	USEPA, 1993
Food Ingestion Rate = If	2.686E-02	kg/day	2.132E-02	kg/day	USEPA, 1993
Water Ingestion Rate = Iw	2.180E-02	L/day	1.731E-02	L/day	USEPA, 1993
Soil Ingestion Rate - Is(16.4%, 6.4%)	4.405E-03	kg/day	1.365E-03	kg/day	USEPA, 2005
Home Range = HR	Assume 100% on site		6.133E+01	acres	USEPA, 1993
Bobwhite Quail					
Body Weight = BW	1.540E-01	kg	1.751E-01	kg	USEPA, 1993
Food Ingestion Rate = If	2.442E-03	kg/day	2.042E-03	kg/day	USEPA, 1993
Soil Ingestion Rate - Is (13.9%, 6.1%)	3.395E-04	kg/day	1.246E-04	kg/day	USEPA, 2005
Home Range = HR	Assume 100% on site		2.466E+01	acres	USEPA, 1993

Notes:

The food and soil injestion rates are on a dry-weight basis.

The soil ingestion rates were calculated by multiplying the food ingestion rates by the following incidental soil ingestion rates:

Receptor	Conservative	Average	Source
Bobwhite Quail	13.9%	6.1%	1, 2
Meadow Vole	3.2%	1.2%	1
American Woodcock	16.4%	6.4%	1
Short-Tailed Shrew	3.0%	0.9%	1

1 - USEPA (U.S. Environmental Protection Agency), 2005. Guidance for Developing Ecological Soil Screening Levels. Office of Emergency and Remedial Response. February.

2 - Based on a Mourning Dove

(woodcock), chromium (vole, shrew, and woodcock), lead (quail, shrew, and woodcock), mercury (shrew and woodcock), and zinc (woodcock) (see Table 7-3). Avian TRVs were not available for aldrin and heptachlor epoxide and thus, food-chain avian EEQs could not be calculated for these COPCs. Although receptor species could be exposed to maximum concentrations, an average exposure scenario was more appropriately applied to the food-chain model because the site is relatively small when compared to the home ranges of surrogate receptors. In the average exposure scenario, food-chain EEQs were below 1.0 for all chemicals and receptors (see Table 7-4). Therefore, risks to wildlife from site related chemicals are not expected to pose an unacceptable risk and no chemicals were retained for further evaluation as COPCs for wildlife.

7.6 ECOLOGICAL RISK UNCERTAINTY ANALYSIS

This section discusses some of the uncertainties associated with the Site 41 ERA.

7.6.1 Problem Formulation

The extent to which wildlife forage at Site 41, and the resulting area use factor in the food chain model for the site, is uncertain. For example, home range sizes for the woodcock varied from 8 to 182 acres in a review of several studies (USEPA, 1993). Depending on the habitat quality, this species (as well as other vermivorous bird species) might forage totally within the site (with a resulting high likelihood of exposure to site contaminants), or such birds might obtain only a small portion of their diet from the site; the latter situation would result in a small or negligible exposure to site contaminants. To be conservative, this ecological risk assessment attempted to err on the side of caution by assuming that the home range of representative receptors was 100 percent within the site boundaries.

There is uncertainty in not considering groundwater discharge to surface water near the site. Contaminants from the soil can percolate to the groundwater and then discharge to surface water bodies. However, synthetic precipitation leaching procedures (SPLP) were utilized to evaluate the potential impact from site soils to groundwater (see Section 5.1.3).

7.6.2 Measurement and Assessment Endpoints

Measurement endpoints are used to evaluate the assessment endpoints selected for the SERA. For the SERA, the measures of effects are not the same as the assessment endpoints. Therefore, the measures are used to predict effects to the assessment endpoints by selecting surrogate species that were evaluated. For example, a decrease in reproduction of a shrew is used to assess a decrease in reproduction of the small mammal population. However, predicting a decrease in reproduction of a shrew

TABLE 7-3

**TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
HERBIVOROUS AND VERMIVOROUS
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA**

	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
PAHs								
Anthracene	1.0E-04	1.8E-05	4.9E-04	4.9E-05	7.0E-05	1.3E-05	4.5E-03	4.5E-04
Benzo(a)anthracene	2.3E-02	3.7E-04	1.5E-03	1.5E-04	1.3E-01	2.1E-03	7.8E-02	7.8E-03
Benzo(a)pyrene	6.3E-01	1.0E-02	4.3E-02	4.3E-03	4.1E+00	6.6E-02	2.5E+00	2.5E-01
Benzo(b)fluoranthene	3.1E-02	5.0E-04	2.0E-03	2.0E-04	1.8E-01	2.8E-03	1.1E-01	1.1E-02
Benzo(g,h,i)perylene	2.8E-02	4.5E-04	1.8E-03	1.8E-04	1.6E-01	2.6E-03	9.7E-02	9.7E-03
Benzo(k)fluoranthene	2.2E-02	3.5E-04	1.4E-03	1.4E-04	1.2E-01	1.9E-03	7.4E-02	7.4E-03
Chrysene	3.4E-02	5.4E-04	2.2E-03	2.2E-04	1.9E-01	3.1E-03	1.2E-01	1.2E-02
Dibenzo(a,h)anthracene	8.5E-03	1.4E-04	5.5E-04	5.5E-05	4.6E-02	7.3E-04	2.8E-02	2.8E-03
Fluoranthene	5.7E-03	1.1E-03	2.8E-02	2.8E-03	4.0E-03	7.4E-04	2.6E-01	2.6E-02
Indeno(1,2,3-cd)pyrene	3.1E-02	5.0E-04	2.0E-03	2.0E-04	1.8E-01	2.8E-03	1.1E-01	1.1E-02
Phenanthrene	1.6E-03	2.9E-04	7.8E-03	7.8E-04	1.1E-03	2.0E-04	7.1E-02	7.1E-03
Pyrene	4.8E-02	7.7E-04	3.2E-03	3.2E-04	2.8E-01	4.5E-03	1.7E-01	1.7E-02
Total PAHs	2.8E-01	4.6E-03	1.9E-02	1.9E-03	1.8E+00	2.9E-02	1.1E+00	1.1E-01
Pesticides/PCBs								
4,4'-DDD	2.8E-02	1.5E-02	4.3E-03	3.5E-03	5.0E-01	2.7E-01	6.2E-01	5.0E-01
4,4'-DDE	3.3E-02	1.7E-02	5.0E-03	4.0E-03	1.4E+00	7.7E-01	1.8E+00	1.4E+00
4,4'-DDT	6.9E-02	3.7E-02	1.1E-02	9.1E-03	2.3E+00	1.2E+00	2.9E+00	2.3E+00
ALDRIN	4.6E-03	9.3E-04	#VALUE!	#VALUE!	1.0E-02	2.1E-03	#VALUE!	#VALUE!
ALPHA-CHLORDANE	1.7E-03	8.4E-04	1.5E-03	3.0E-04	7.1E-02	3.6E-02	3.0E-01	5.9E-02
DIELDRIN	5.7E-01	6.7E-03	3.4E-02	3.0E-03	3.6E+01	4.2E-01	1.4E+01	1.3E+00
ENDRIN	4.9E-03	4.9E-04	1.2E-02	1.2E-03	7.6E-02	7.6E-03	1.3E+00	1.3E-01
GAMMA-CHLORDANE	1.5E-03	7.7E-04	1.4E-03	2.7E-04	6.6E-02	3.3E-02	2.7E-01	5.4E-02
HEPTACHLOR EPOXIDE	1.3E-03	1.3E-04	#VALUE!	#VALUE!	3.2E-02	3.2E-03	#VALUE!	#VALUE!
Inorganics								
ARSENIC	8.0E-02	1.8E-02	1.3E-02	6.7E-03	9.8E-02	2.2E-02	1.5E-01	7.5E-02
CADMIUM	1.6E-01	1.8E-02	1.4E-02	3.2E-03	9.4E-01	1.0E-01	9.4E-01	2.2E-01
CHROMIUM	1.2E+00	5.0E-02	1.6E-01	2.7E-02	1.1E+00	4.6E-02	2.7E+00	4.5E-01
COPPER	2.5E-01	1.7E-02	6.2E-02	7.2E-03	1.6E-01	1.1E-02	5.2E-01	6.0E-02
LEAD	8.5E-01	2.1E-02	1.1E+00	3.9E-02	2.3E+00	5.7E-02	1.8E+01	6.6E-01
MERCURY	8.0E-01	1.6E-01	5.9E-01	5.9E-02	1.0E+00	2.0E-01	9.6E+00	9.6E-01
NICKEL	1.0E-01	1.2E-02	7.7E-03	2.8E-03	5.5E-01	6.3E-02	2.9E-01	1.1E-01
ZINC	2.3E-01	5.8E-02	4.5E-02	1.7E-02	6.2E-01	1.6E-01	1.4E+00	5.3E-01

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient
#VALUE! - Value not available

TABLE 7-4

**TERRESTRIAL FOOD CHAIN MODEL - AVERAGE SCENARIO
HERBIVOROUS AND VERMIVOROUS
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA**

Chemical	Herbivorous Receptors EEQs				Insectivorous Receptors EEQs			
	Meadow Vole		Bobwhite Quail		Short-Tailed Shrew		American Woodcock	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
PAHs								
Anthracene	1.7E-05	3.1E-06	1.3E-04	1.3E-05	1.5E-05	2.8E-06	7.1E-04	7.1E-05
Benzo(a)anthracene	5.2E-03	8.3E-05	4.7E-04	4.7E-05	4.7E-03	7.5E-05	2.5E-03	2.5E-04
Benzo(a)pyrene	9.8E-03	1.6E-04	9.0E-04	9.0E-05	8.9E-03	1.4E-04	4.8E-03	4.8E-04
Benzo(b)fluoranthene	6.6E-03	1.1E-04	6.0E-04	6.0E-05	5.9E-03	9.5E-05	3.2E-03	3.2E-04
Benzo(g,h,i)perylene	5.7E-03	9.1E-05	5.1E-04	5.1E-05	5.1E-03	8.2E-05	2.7E-03	2.7E-04
Benzo(k)fluoranthene	4.8E-03	7.7E-05	4.4E-04	4.4E-05	4.4E-03	7.0E-05	2.3E-03	2.3E-04
Chrysene	6.1E-03	9.8E-05	5.6E-04	5.6E-05	5.5E-03	8.8E-05	3.0E-03	3.0E-04
Dibenzo(a,h)anthracene	3.1E-03	5.0E-05	2.8E-04	2.8E-05	2.8E-03	4.5E-05	1.5E-03	1.5E-04
Fluoranthene	8.7E-04	1.6E-04	7.0E-03	7.0E-04	7.9E-04	1.5E-04	3.7E-02	3.7E-03
Indeno(1,2,3-cd)pyrene	6.1E-03	9.7E-05	5.5E-04	5.5E-05	5.5E-03	8.7E-05	2.9E-03	2.9E-04
Phenanthrene	3.9E-04	7.1E-05	3.1E-03	3.1E-04	3.5E-04	6.5E-05	1.6E-02	1.6E-03
Pyrene	7.8E-03	1.3E-04	7.1E-04	7.1E-05	7.1E-03	1.1E-04	3.8E-03	3.8E-04
Total PAHs	4.1E-02	6.6E-04	3.8E-03	3.8E-04	3.7E-02	5.9E-04	2.0E-02	2.0E-03
Pesticides/PCBs								
4,4'-DDD	3.1E-03	1.7E-03	5.9E-04	4.8E-04	2.8E-03	1.5E-03	3.2E-03	2.6E-03
4,4'-DDE	2.7E-03	1.4E-03	5.0E-04	4.1E-04	2.4E-03	1.3E-03	2.7E-03	2.2E-03
4,4'-DDT	5.0E-03	2.7E-03	9.6E-04	7.8E-04	4.5E-03	2.4E-03	5.2E-03	4.2E-03
ALDRIN	7.4E-04	1.5E-04	#VALUE!	#VALUE!	6.7E-04	1.3E-04	#VALUE!	#VALUE!
ALPHA-CHLORDANE	4.2E-05	2.1E-05	5.0E-05	1.0E-05	3.6E-05	1.8E-05	2.8E-04	5.5E-05
DIELDRIN	3.0E-02	3.6E-04	2.3E-03	2.1E-04	2.7E-02	3.2E-04	1.3E-02	1.1E-03
ENDRIN	1.6E-03	1.6E-04	5.2E-03	5.2E-04	1.4E-03	1.4E-04	2.8E-02	2.8E-03
GAMMA-CHLORDANE	4.5E-05	2.2E-05	5.3E-05	1.1E-05	3.8E-05	1.9E-05	2.9E-04	5.8E-05
HEPTACHLOR EPOXIDE	1.2E-04	1.2E-05	#VALUE!	#VALUE!	1.0E-04	1.0E-05	#VALUE!	#VALUE!
Inorganics								
ARSENIC	7.1E-03	1.6E-03	1.6E-03	7.8E-04	6.1E-03	1.4E-03	8.6E-03	4.3E-03
CADMIUM	2.4E-02	2.6E-03	3.0E-03	7.0E-04	2.1E-02	2.4E-03	1.6E-02	3.7E-03
CHROMIUM	2.8E-02	1.2E-03	1.2E-02	2.0E-03	2.5E-02	1.0E-03	6.4E-02	1.1E-02
COPPER	7.2E-02	4.9E-03	2.5E-02	3.0E-03	6.5E-02	4.4E-03	1.4E-01	1.6E-02
LEAD	6.1E-02	1.5E-03	7.7E-02	2.8E-03	5.3E-02	1.3E-03	4.2E-01	1.5E-02
MERCURY	3.2E-02	6.3E-03	4.1E-02	4.1E-03	2.9E-02	5.8E-03	2.2E-01	2.2E-02
NICKEL	1.4E-02	1.6E-03	1.2E-03	4.5E-04	1.2E-02	1.4E-03	6.7E-03	2.4E-03
ZINC	4.3E-02	1.1E-02	1.2E-02	4.8E-03	3.9E-02	1.0E-02	6.6E-02	2.5E-02

Cells are shaded if the value is greater than 1.0

NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
EEQ - Ecological Effects Quotient
#VALUE! - Value not available

may either underprotect or overprotect the small mammal population based on differences in ingestion rates, toxicity, food preferences, home ranges, etc. between different species.

Risks to reptiles and amphibians were not quantitatively evaluated because exposure factors are not established for most species and toxicity data are very limited. Potential risks to reptiles and amphibians cannot be evaluated in this SLERA because of a lack of toxicity and exposure data.

7.6.3 Exposure Characterization

Surface soil samples were collected over a four-year period of time and sample locations based on changing information regarding where the former building 1485C was located. Samples were not taken under the footprint of the former building. Many samples were not analyzed for total PAHs.

7.6.4 Ecological Effects Characterization

Ecological screening values and toxicity thresholds were not available for some detected chemicals. For example, ESVs for many individual PAHs were not available. Inorganics initially selected as COPCs were compared to facility background concentrations and were not retained as COPCs for further evaluation if the site concentration was below the facility background concentration.

Alternative benchmark values were used to gain a better understanding of the relationship between the maximum concentration values of chemicals to the overall ecological assessment of the site. There is some uncertainty involved when using these alternative benchmarks; however, attempts have been made to lessen the uncertainties by providing the toxicological basis of the alternate benchmarks when they were used.

Laboratory-derived NOAELs and LOAELs might not adequately represent toxicity thresholds for receptors under field conditions. In addition, NOAELs and LOAELs derived for species used in toxicity tests might not adequately represent toxicity thresholds for other species. These uncertainties may overestimate or underestimate potential risks.

Data for investigating toxicity to reptiles and amphibians from oral ingestion of contaminants are sparse. Thus, potential risks via the food chain were not evaluated for reptiles and amphibians.

Avian TRVs were not available for aldrin and heptachlor epoxide thus, food chain EEQs could not be calculated for these COPCs.

7.6.5 Exposure Assessment

The dermal exposure for upper-level receptors was not evaluated, potentially underestimating risks. However, this exposure route is usually minor.

Soil samples evaluated in this risk assessment consisted of samples no deeper than one foot below the soil surface. However, mammals such as moles could burrow deeper than one foot. Also, invertebrates, such as earthworms, may burrow deeper that one foot. With the exception of moles and earthworms, terrestrial species at the site would probably not be significantly exposed to soils deeper than one foot below the surface, so the uncertainty resulting in evaluating only surface soils is negligible.

7.6.6 Risk Characterization

Risks are possible if an EEQ is greater than or equal to 1.0 regardless of the magnitude of the EEQ. However, the magnitude of effects to ecological receptors cannot be inferred based on the magnitude of the EEQ. Rather, an EEQ greater than 1.0 simply indicates that the dose used to derive the toxicity reference value was exceeded.

There is uncertainty in how the predicted risks to a species at a site translate into risk to the population in the area as a whole.

Uncertainty in risk characterization also results from the lack of data regarding the toxicity of multiple chemicals. The extent to which these concentrations might contribute to cumulative toxicity is uncertain.

7.7 SUMMARY AND CONCLUSIONS

A SERA was performed for Site 41 – former Pesticide Storage Building 1485C. The site area is small (approximately 15,000 sq. ft.) with little ecological habitat present. In surface soil, one PAH (benzo(a)pyrene) and total PAHs, nine pesticides, and six metals were retained as COPCs because their maximum concentrations exceeded ESVs. An ESV was not available for one VOC, acetone, which was also retained as a COPC (Table 7-1). COPC concentrations were compared to facility background concentrations (for inorganics), appropriate alternate toxicity information (based on soil invertebrates and plants), spatial distribution, and frequency of exceedances for the Step 3a refinement. Based on this assessment, no chemicals were retained as COPCs for plants/invertebrates at Site 41.

Chemicals initially selected as COPCs for risks to wildlife (see Table 7-1) were evaluated in Step 3a first using conservative exposure assumptions. Under this scenario, one PAH (benzo(a)pyrene) and total PAHs, four pesticides (4,4'-DDE, 4,4'-DDT, dieldrin, and endrin) and four metals (chromium, lead, mercury, and zinc) had EEQs greater than 1.0 for various receptors (see Table 7-3) and were evaluated further using an average exposure scenario for some receptors. After the reevaluation, all of the NOAEL EEQs were less than 1.0 (see Table 7-4). Therefore, no chemicals were retained as COPCs for risks to wildlife at Site 41.

In conclusion, no chemicals were retained as COPCs for risk to plants, soil invertebrates, or wildlife at Site 41. Therefore, risks are expected to be minimal from site related chemicals at Site 41 Former Pesticide Storage Building 1485C.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The preceding sections of this RI Report have described the nature and extent of hazardous constituents in soil as well as the potential for contaminated soil to act as a source to groundwater. The risk to human health and the environment from exposure to the groundwater at Site 41 has also been examined. Conclusions and recommendations based on the information provided in this RI Report are presented in the following sections.

8.1 GENERAL AND AREA-SPECIFIC CONCLUSIONS FOR STIE 41

The general conclusions of this RI are as follows:

- SVOC contamination was found surface soil at Site 41 in several spots, including SB47, SS07, and SB41. Samples bounding these areas were not found to be contaminated with SVOCs.
- A large area of surface soil pesticide exceedances have been found in the southeast and northwest area of Site 41.
- Two areas of metal exceedances have been defined near SB37, and to the south and southwest, and also near SB43 and SB 44, to the northwest, north, and northeast.
- Lead from surface soil samples from SS01, SS04, SS05, and SS06 was the only analyte found at concentrations exceeding primary criteria in the SPLP leachate samples.
- A SVOC hot spot at SB43 has been delineated in the sense that it is bounded in all directions except to the south where the former building was located. A second area associated with locations SB31 and SB35 is well defined in all directions except to the southwest of SB35.
- A pesticide hot spot associated with SB37 has not been defined to the south or southwest. Exceedances associated with SB41 and SB43 have been laterally delineated, but the vertical limit of contamination has not been defined at SB43.
- The limits of a metals hot spot at SB43 have not been defined to the north, northeast, or east, but they have been defined to the south and the southwest.

An HHRA and SERA were conducted at Site 41 using both USEPA and State of Florida regulations and guidelines. The results are summarized in the following sections.

- Non-carcinogenic risks are below the target HI of 1.0, which meets USEPA and FDEP requirements for exposure to surface and subsurface soils.
- Carcinogenic risks for exposure to surface and subsurface soil are within the USEPA's target risk range of 10^{-4} to 10^{-6} for all receptors. Risks associated with exposure to surface soil exceed

- cPAHs and Dieldrin were identified as potential COCs for surface soils based on a comparison of maximum concentrations. cPAHs, 4,4'-DDT, Dieldrin, and TRPHs were identified as potential COCs for subsurface soils based on a comparison of maximum concentrations.
- Maximum concentrations of B(a)P, dieldrin, and chromium in surface soil were greater than the LE criteria, indicating that there is potential for contaminants detected in surface soil to adversely impact groundwater. Maximum concentrations of 4-nitroaniline, B(a)A, B(b)F, carbazole, dieldrin, antimony, cyanide, and TRPHs in subsurface soil were greater than the LE criteria.
- No chemicals were retained as COPCs for risk to plants, soil invertebrates, or wildlife at Site 41. Therefore, risks are expected to be minimal from site related chemicals at Site 41.

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APPENDICES

APPENDIX A
SOIL BORING LOGS

Tetra Tech NUS, Inc.

BORING LOG

Page 1 of 1

PROJECT NAME: NAS Whiting Field
PROJECT NUMBER: N0052
DRILLING COMPANY: AECS
DRILLING RIG: Geoprobe 6600

BORING No.: 1485CSB01
DATE: 4-13-00
GEOLOGIST: ~~Rob Hill~~ BDH
DRILLER: D. Cobb

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
1							Br. To Tan						
2							clayey Mod. sand.						
3											0		0
4	36'		36"							5			
5													
6													
7				7.0			Red & Tan sandy						
8							clay						
9													
10													
11											0		0
12			21"							0			
13													
14													
15				15.0'			Red & Tan clay						
16							& sand.						
17													
18													
19											0		0
20			18"	20.0' B.T.						0			

S-2 1345

S-3 1354

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ______

Drilling Area Background (ppm): ______

Converted to Well: Yes ______ No ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

BORING LOG

Page 1 of 1

PROJECT NAME: NAS Whiting Field
PROJECT NUMBER: Building #1485C
DRILLING COMPANY: AECS
DRILLING RIG: Geoprobe 6600

BORING No.: 1485CSB02
DATE: 4-13-00
GEOLOGIST: BDH
DRILLER: DC

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1407	1						Br. To tan med						
	2						sand Tr. of Silt						
	3										0		0
	4		32							3			
	5												
	6												
	7			7.0			Red & Yellow						
	8						sandy Clay						
	9												
	10												
S-2 1413	11										0		0
	12									0			
	13												
	14												
	15												
	16												
	17												
S-3 1422	18			18.0			Red & Yellow sand						
	19						& clay				0		0
	20			20.0						0			
				B.T.									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ______

Drilling Area Background (ppm): ______

Converted to Well: Yes ______ No ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NAS Whiting Field
PROJECT NUMBER: Building 1485C
DRILLING COMPANY: AECS
DRILLING RIG: Geoprobe 6600

BORING No.: 1485CSB03
DATE: 4-13-00
GEOLOGIST: BDH
DRILLER: DC

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	1							Br. To tan med.						
	2							sand tr. of Clay						
	3													
S-1	4			34"								0		0
1433	5				5.0			Red & Yellow			0			
	6							sandy Clay						
	7													
	8													
	9													
S-2	10													
1438	11											0		0
	12			19"							0			
	13													
	14													
	15													
	16													
	17													
S-3	18													
1447	19											0		0
	20			17"	20' B.T.						0			

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ______

Drilling Area Background (ppm): ______

Converted to Well: Yes ______ No ______ Well I.D. #: ______

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NAS Whiting Field
PROJECT NUMBER: Building #1485C
DRILLING COMPANY: AECS
DRILLING RIG: Geoprobe 6600

BORING No.: 1485CSB04
DATE: 4-13-00
GEOLOGIST: BDH
DRILLER: D. Gobb

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1455	1							Brown sand & clay						
	2							(Organic)						
	3											0		0
	4			19"							2			
	5													
	6				6.0			Red & yellow						
	7							sandy clay						
	8													
	9													
S-2 1500	10													
	11											0		0
	12			17"							0			
	13													
	14													
	15				15.0'			Red & yellow						
	16							clayey sand						
	17													
S-3	18													
	19											0		0
	20			16	20.0'						0			
					B.T.									

*When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ____

Drilling Area Background (ppm): ____

Converted to Well: Yes ____ No ____ Well I.D. #: ____

APPENDIX B

POSITION PAPER OF ALUMINUM, IRON, MANGANESE, AND VANADIUM AT NAS WHITING FIELD

INORGANICS IN SOIL AT NAS WHITING FIELD

Introduction

Soil and groundwater concentrations of aluminum, iron, manganese, and vanadium (Al, Fe, Mn, and V) exceed regulatory criteria [Florida Department of Environmental Protection (FDEP) Soil Cleanup Target Levels (SCTLs) and Groundwater Cleanup Target Levels (GCTLs)] at Naval Air Station (NAS) Whiting Field. For brevity inorganics refers to Al, Fe, Mn, and V in this paper. This paper describes the regional and local depositional history and how this depositional history accounts for the observed concentrations of inorganics in soil at NAS Whiting Field. Additionally, site specific data are graphically presented illustrating the ubiquitous even distribution of inorganic constituents in soil and groundwater.

Regional Setting

Soils

Soils of the Florida panhandle, including Whiting Field, are a product of the erosion of mountains to the north. Randazzo (1997) states "...siliclastic sediments shed from the Appalachians, the Piedmont, and inner Coastal Plain flooded into the carbonate-producing environments of southeastern North America". As a result, "the sand and gravel aquifer consists mostly of quartz, which is relatively insoluble; therefore, water in the aquifer is soft and not highly mineralized." However, "excessive iron concentrations are present locally in water from the surficial aquifer system, the sand and gravel aquifer.... Dissolved-iron concentrations locally reach objectionable levels." Please refer to Table 1 "Common Minerals in Florida Aquifer Systems and Confining Beds".

The facility stratigraphy at NAS Whiting Field is within the four county area and is described by Schmidt as consisting of alluvium of quaternary age overlying the Miocene Citronelle. The alluvium is derived in part from the Citronelle. Both alluvium and Citronelle formation are rich in Fe or limonite as described by Schmidt (1978).

> The Citronelle formation blankets the upland areas of the four-county region. It consists of quartz sand and gravel, which are commonly well sorted but may also be poorly sorted. Common secondary lithologies in the Citronelle include lenses and beds of relatively pure clay and thin beds of limonite usually overlying a clay bed.
>
> The distribution and character of the Citronelle sediments suggest that they are coalescent deposits of several early rivers that emptied into the Gulf of Mexico. For this reason, a few outcrops can be correlated as most clay lenses and gravel beds are discontinuous. Most often, some amount of silt and clay are present as a matrix in a sand unit. The varying amount of clay is gradational and difficult to predict. Uncertainties such as these make a clayey sand lithology versus a sandy clay lithology difficult to project into inaccessible areas because of this irregular distribution. (Schmidt, 1978).

Table 1

Table 13.6. Common minerals in Florida aquifer systems and confining beds

Mineral fraction	Surficial aquifer system	Intermediate aquifer system	Floridan aquifer system
silicate	**quartz** **potassium feldspar** **potassium mica** kaolinite chlorite smectite	**quartz** **potassium feldspar** **potassium mica** **palygorskite** **sepiolite** **smectite** kaolinite	quartz
carbonate	**calcite** **aragonite**	**dolomite** calcite	**calcite** **dolomite** aragonite (?)
oxyhydroxides, sulfides	**ferric hydroxide** **Goethite** Gibbsite, boehmite, diaspore, pyrite	**pyrite** ferric hydroxide Goethite	pyrite ferric hydroxide Goethite
other	**humic substancesa**	**carbonate-fluorapatite** **carbonate-hydroxylapatite** opal-A opal-CT gypsum	**gypsum** **anhydrite**

Source: Upchurch 1992.
Note: See table 13.5 for mineral compositions and weathering products. Volumetrically or chemically important minerals indicated in bold.
[a]Refers to particulate organics, including organics concentrated in peats and mucks, and disseminated in other sediments.

Groundwater

As reported in the Geology of Florida, "A major factor that affects groundwater is the chemical composition (of) rainfall. Natural rainfall is affected by reactions with atmospheric gases and particulates". Table 2 contains a summary of the chemical composition of selected sites in Florida. The pH column indicates the pH state-wide ranges from 3.0 to 7.3, but is primarily in the acidic range. "Water that has passed through the soil is characteristically acidic" (Randazzo, 1997).

> Reactions of acidic meteoric water with potassium feldspar result in the formation of common soil clay mineral kaolinite. Weathering of clay releases iron, magnesium and silica and produces kaolinite as a residue. Iron and aluminum oxyhydroxides, sulfide and sulfate minerals, and a few other minerals are weathered by different processes, which are discussed in Upchurch et al. (1992). Clay minerals and some the other oxyhydroxides are also important sites for ion exchange, which may also affect groundwater quality (Randazzo, 1997).

The NAS Whiting Field area is a recharge zone for the surficial aquifer. Typically the pH of groundwater in recharge zones remains stable, in this case acidic, because the water has not made contact with any carbonate minerals to moderate the pH (Table 3). This acidic rain water reacts with minerals and subsequently carries weathered dissolved material as it infiltrates to the groundwater table. Table 4 "Common minerals in Florida and their dissolved weathering products" (Upchurch et al., 1992) provides a list of common minerals subjected to this process and the resultant Al, Fe, Mn, and V ions leached from these minerals.

Schmidt (1978) also describes the visible result of Fe leaching in the area.

> Another notable trend readily observed in northern Escambia and Santa Rosa counties is a typical gravel-limonite-clay sequence repeated often in the Citronelle. Many hills are capped by gravel and sand, underlain by a thin bed limonite, underlain by a massive sandy clay. The limonite is post-depositional resulting from ground water migration through the sand layers. Precipitation from iron rich solutions occurs as the water migrates downward to the impermeable clay layers. Limonite, although common, is not found everywhere, but when it is present it is usually obvious. Many hillsides are littered with broken limonite because the slope of the land cuts across the local dip of the limonite beds (Schmidt, 1978).

Limonite was found frequently during installation of monitoring wells at NAS Whiting Field typically above clay or sandy clay units. Thickness varied from about 1 centimeter to 40 centimeters in thickness (TtNUS, 2003). Drilling through the thicker limonite units required considerable time and wear on drilling equipment (Appendix A, Boring Logs). Limonite is also found in several outcroppings on the facility most notably in a borrow pit adjacent to Site 2 and in a commercial borrow pit located adjacent to the west side of NAS Whiting Field.

In summary, the Sand and Gravel Aquifer consists primarily of quartz with high concentrations of Fe in both local and regional soils. Regionally acidic meteoric waters are available to weather limonite and

Table 2

Table 13.4. Summary of the chemical composition of precipitation from selected sites in Florida

Stat.	Ca (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	NH_4 (mg/L)	NO_3 (mg/L)	Cl (mg/L)	SO_4 (mg/L)	PO_4 (mg/L)	pH (field)	Conductivity (field)	Na/Cl (mole ratio)	Ratio dev. seawater
Quincy, Gadsden County													
x	0.14	0.07	0.06	0.44	0.15	1.05	0.75	1.77	0.02	4.68	17.7	0.90	0.05
s	0.17	0.08	0.18	0.53	0.24	1.05	0.89	1.84	0.09	0.41	15.9	0.22	0.22
n	179	179	179	179	179	179	179	179	179	160	162	179	179
Min.	0.01	0.01	0.00	0.03	0.00	0.00	0.06	0.10	0.00	3.57	4.0	0.40	-0.45
Max.	1.15	0.53	2.12	3.23	1.53	6.19	5.58	12.78	0.78	5.90	132.5	2.90	2.05
Austin-Cary Forest, Alachua County													
x	0.28	0.09	0.09	0.78	0.15	1.00	0.96	2.03	0.00	4.79	17.87	1.39	0.54
s	0.28	0.07	0.16	0.85	0.85	0.88	0.99	1.47	0.00	0.53	12.09	1.01	1.01
n	92	92	92	92	92	92	92	92	92	89	92	92	92
Min.	0.02	0.00	0.00	0.02	0.02	0.07	0.10	0.10	0.00	3.49	3.70	0.13	−0.73
Max.	1.33	0.39	0.95	4.87	4.87	4.70	8.88	8.88	0.00	6.70	66.70	6.04	5.19
Bradford Forest, Bradford County													
x	0.26	0.11	0.07	0.80	0.16	1.04	1.19	1.96	0.01	4.70	16.77	1.05	0.20
s	0.44	0.26	0.22	2.13	0.24	0.95	3.16	2.13	0.07	0.46	12.82	0.64	0.64
n	367	367	367	367	367	367	367	367	367	340	337	366	366
Min.	0.01	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	3.22	2.20	0.31	−0.54
Max.	5.40	4.31	3.81	29.30	1.92	6.60	52.62	22.80	1.19	6.60	99.00	6.17	5.32
Kennedy Space Center, Brevard County													
x	0.28	0.20	0.09	1.58	0.10	1.05	2.81	1.93	0.02	4.92	23.15	0.87	0.02
s	0.34	0.25	0.10	2.03	0.17	1.13	3.64	1.71	0.07	0.37	14.99	0.14	0.14
n	229	229	229	229	229	229	229	229	229	208	201–0.80	229	229
Min.	0.01	0.00	0.00	0.09	0.00	0.00	0.15	0.20	0.00	3.73	85.80	0.37	--0.48
Max.	3.28	1.70	0.80	13.82	1.18	10.12	12.81	12.81	0.58	5.72		1.91	1.06
Verna Well Field, Sarasota County													
x	0.31	0.14	0.23	0.81	0.21	1.00	1.39	1.53	0.05	4.85	15.02	0.90	0.05
s	0.42	0.25	1.40	1.50	0.63	1.15	2.62	1.47	0.39	0.54	10.70	0.22	0.22
n	202	202	202	202	202	202	202	202	202	159	177	202	202
Min.	0.02	0.01	0.00	0.07	0.00	0.00	0.14	0.15	0.00	3.39	3.00	0.51	−0.34
Max.	3.49	1.93	17.40	13.31	7.30	10.32	24.53	13.64	4.98	7.30	85.30	2.31	1.46
Everglades National Park, Dade County													
x	0.36	0.20	0.20	13.2	0.22	0.73	2.31	1.41	0.07	4.98	15.98	0.88	0.03
s	0.73	0.31	1.03	1.89	1.12	0.85	3.21	1.62	0.63	0.57	13.90	0.13	0.13
n	304	304	304	304	304	304	304	304	304	2.61	269	304	304
Min.	0.01	0.01	0.00	0.05	0.00	0.00	0.12	0.00	0.00	3.00	3.50	0.56	−0.30
Max.	7.68	2.66	12.80	15.91	17.12	8.37	26.89	15.42	9.98	7.27	141.50	2.22	1.37
Statewide													
x	0.28	0.14	0.13	1.00	0.17	0.97	1.66	1.75	0.03	4.77	17.58	0.96	0.11
s	0.48	0.25	0.74	1.80	0.61	1.01	2.98	1.80	0.34	0.50	13.80	0.47	0.47
n	1373	1373	1373	1373	1373	1373	1373	1373	1373	1217	1231	1373	1372
Min.	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	3.0	0.80	0.13	−0.73
Max.	7.68	4.31	17.4	29.3	17.2	10.32	52.62	22.8	9.98	7.3	141.5	6.17	5.32

Source: From Upchurch 1992 and based on data from the National Atmospheric Deposition Program, National Trends Network.

Note: *x* = arithmetic median; *s* = standard deviation; *n* = number of samples.

Table 3

Table 36. - Some possible criteria for identification of aquifer flow system components. Assumes that water comes in contact with carbonate minerals along the flow path.

Analyte	**Recharge Areas**	**Discharge Areas**
Temperature	Locally variable, relatively cool	Low variability, relatively warm
pH	Generally acidic, locally variable	Slightly basic, low variability
Calcium, magnesium, bicarbonate	Concentrations relatively low, highly variable	Concentrations relatively high, low variability
Iron	Concentrations relatively high	Concentrations may be low
Nitrate	May be present	Normally absent
Phosphate	May be present	Normally absent
Synthetic organics, pesticides	May be present	Normally absent
Sulfate	Low in most areas, possibly high near wetlands	High when deep flow system waters discharge in coastal areas
Sodium:chloride ratio	Near that of sea water	May differ greatly from sea water
Total organic carbon	Concentrations often high	Concentrations often low

other minerals. This weathering provides a source for dissolved Fe and other ions to groundwater. Both alluvium and the Citronelle formation are rich in Fe or limonite.

The Natural Derivation of Fe, Mn, V

The source of the NAS Whiting Field soils are the "...siliclastic sediments shed from the Appalachians" (Randazzo, 1997). The Fe present in and leaching from these soils is a product of heavy mineral suites found within these soils. These minerals would reflect naturally occurring ratios of elements combining to form these minerals. The presences of Mn and V in the regional soils and at NAS Whiting Field are the result of substitution of these ions in the formation of various Fe rich minerals. These minerals formed in the provenance area prior to weathering and transport from the source area to the coastal plain. Acidic rains caused subsequent chemical weathering and leaching.

Fe rich minerals are frequently accompanied by elements of similar size and charge. In the provenance area, ionic substitutions and element ratios are determined during mineral development. The growing crystal lattice will capture ions based on relative ionic size, charge, and availability of the substituting ion. V. M. Goldschmidt (1954) provided a set of empirical rules explaining substitution: 1) ionic radii must differ by less than 1 percent, 2) ionic charges must be nearly the same, and 3) all things being equal, the smaller ionic radius with a matching charge is preferred.

For trivalent ions, the order of preferences is Cr > V > Mn > Ti > Fe. For minerals with positions for 3+ ions Cr, V, Mn and Ti would have preference. Substitution of ions would be based on availability of the specific ion. All else being equal, a greater percentage of a particular ion would result in a higher percentage of these metal's ions being associated with Fe rich minerals (Table 5).

Table 5 shows the oxidation state and ionic radius are similar for Fe(III), Mn(III), and V(III), their charge to radius ratios (a *rough* surface charge measure) are also similar. This type of substitution is best shown in the pyromorphic series of the apatite group. Pyromorphite, $Pb_5(PO_4)_3Cl$, mimetite, $Pb_5(AsO_4)_3Cl$, and vanadinite, $Pb_5(VO_4)_3Cl$ (Dana, 1977).

Table 5

Ion	Ox. State	Crystal Radius	Ionic Radius
Cr +3	3	0.755	0.615
Fe +3	3	0.785	0.645
Mn +3	3	0.785	0.645
V +3	3	0.78	0.64

Several minerals having a range of compositions based on substitutions of ions are shown below. Soils or sediments rich in Fe have a higher probability of having elevated levels Mn and V in the soil as a result of the substitution process at the time of mineral formation presorting favorably for these elements. Subsequent weathering of the materials in the provenance area or in the coastal plain would allow distribution of these elements in various media.

This presence of post-depositional limonite is indicative of long-term leaching of Fe. The Fe leaching is associated with the leaching of Al, Mn, and V, also found in the local surface soil and groundwater. An analysis of base-wide soil data, surface and subsurface, for the presence of inorganics shows for the most part these elements are ubiquitous at NAS Whiting Field and therefore, not directly attributable to site related activities. Leachate data indicates leaching of inorganics from surface soils [0 to 5 feet (ft) below land surface (bls)]. An analysis of base-wide groundwater data for inorganics reveals the presence of these elements in a majority of the monitoring wells, many at concentrations exceeding GCTLs.

In summary, heavy mineral suites reflecting natural conditions of the area from where these minerals originated release a suite of ions. These ions reflect a preset ratio based on the minerals original composition. Table 1 lists common minerals found in the surficial aquifer system of Florida. A comparison of Tables 1 and 2 provides a list of many common minerals with resultant ions produced during chemical weathering. Fe is a primary constituent of the weathering process. It can be assumed in many cases Mn and V have been substituted in the mineral lattice in place of Fe.

Fe, Mn, and V have similar ionic characteristics allowing substitutions during mineral formation. Natural processes distribute these elements evenly or in concentrated patterns in soil and groundwater depending on local conditions. As an example, at NAS Whiting Field, a relatively even distribution of Fe occurs in sandy soils, but Fe is frequently concentrated as limonite in layers immediately above clays. This natural uneven distribution is reflected in the data presented in this report. Conversely, no natural process concentrates Al and so it is evenly distributed across NAS Whiting Field.

Inorganics in NAS Whiting Field Soils

Aluminum and Iron

Al and Fe are ubiquitous in soils across the facility. Concentration values of these constituents range from 37 to 59,000 milligrams per kilogram (mg/kg) and 30 to 146,000 mg/kg respectively. Concentrations in soil are not depth dependant indicating their presence is a result of natural occurrences (see NAS Whiting Field Specific Data Charts for Al in the body of this report and Soil Chart Series for Fe, Mn, and V in Appendix B). The same is true of groundwater. Table 4 lists common minerals and their dissolved weathering products.

Many of the common minerals listed in Table 4 weather producing Al and Fe ions. No soil "hotspots" (areas where the distribution of the element is higher than typically found) related to facility activities have been found for these elements indicating the occurrence of random elevated detections are natural.

Manganese

Mn in the tenth most abundant element in the earth's crust and second only to Fe as the most common heavy metal; on average, crustal rocks contain about 0.1 percent Mn. Geochemically, Mn behaves like Fe partitioning into minerals forming in the early stages of magmatic crystallization. Concentrations of Mn detected in NAS Whiting Field soils range from 0.21 to 898 mg/kg within the range of averaged values for heavy metals in soil Table 6 (Alloway, 1990).

Table 6

Metal Concentrations in Soil

Element	Range	Average value
Ag	0.01 - 8	0.005
As	0.1 - 50	1 – 20
Au	0.001 – 0.02	-
Cd	0.01 – 2.4	0.2 – 1
Co	1 - 40	10
Cr	5 – 1500	70 – 100
Cu	2 – 250	20 -30
Hg	0.01 – 0.3	0.03 – 0.06
Mn	20 – 10000	1000
Mo	0.2 – 5	1 – 2
Ni	2 – 1000	50
Pb	2 – 300	10 – 30 rural 30 – 100 urban
Sb	0.05 – 260	2
Sc	0.01 – 2	0.5
Sn	1 – 200	4
Ti	0.03 – 10	-
U	0.7 – 9	<2
V	3 – 500	90
W	0.5 – 83	1.5
Zn	10 - 300	50

From *Heavy Metals in Soil* (Alloway 1990)
Concentrations of heavy metals in soils (mg/kg)
Data from Bowen (1979) and Mathews (1984)

Additional guidance on the range of concentrations typically found in various soil types for four elements is found in the attached Table 7 from "EPA-Naturally Occurring Background Concentrations of Inorganic Elements in Surface Soils in the United States" (USEPA, 1995). A review of the USGS chemical analyses methods indicate they are comparable or equivalent to current USEPA methods, and therefore, relatively equivalent data.

The soil type corresponding to conditions at NAS Whiting Field is alluvial. The concentration range for Mn in alluvial soils is 150 to 1500 mg/kg with a mean of 405 mg/kg. Only three soil samples from NAS Whiting Field exceed the mean and the highest concentration of Mn in soil is 898 mg/kg, within the reported range and below the average Mn value. The average Mn detection for all soil samples for the facility is 52 mg/kg, well below the average. This data may indicate Mn found in NAS Whiting Field soil is within the naturally occurring range as illustrated in Table 6. The distribution of Mn is not depth-dependant and "hotspots" are not apparent.

Table 7

EPA-NATURALLY OCCURRING BACKGROUND CONCENTRATIONS OF INORGANIC ELEMENTS IN SURFACE SOILS IN THE UNITED STATES

SOIL TYPE	CHEMICAL(a)							
	Arsenic		Copper		Manganese		Lead	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Sandy Soils And Lithosols On Sandstones	<0.1-30.0	5.1	1-70	14	7-2000	345	<10-70	17
Light Loamy Soils	0.4-31.0	7.3	3-70	25	50-1000	480	<10-50	20
Loess And Soils On Silt Deposits	1.9-16.0	6.6	7-100	25	50-1500	525	10-30	19
Clay And Clay Loamy Soils	1.7-27.0	7.7	7-70	29	50-2000	580	10-70	22
Alluvial Soils	2.1-22.0	8.2	5-50	27	150-1500	405	10-30	18
Soils Over Granites And Gneisses	0.7-15.0	3.6	7-70	24	150-1000	540	10-50	21
Soil Over Volcanic Rocks	2.1-11.0	5.9	10-150	41	300-3000	840	10-70	20
Soils Over Limestones And Calcareous Rocks	1.5-21.0	7.8	7-70	21	70-2000	470	10-50	22
Soils On Glacial Till And Drift	2.1-12.0	6.7	15-50	21(b)	200-700	475	1 0-30	17(b)
Light Desert Soils	1.2-18.0	6.4	5-100	24	150-1000	360	10-70	23
Silty Prairie Soils	2.0-12.0	5.6	10-50	20(b)	200-1000	430	10-30	21(b)
Chernozems And Dark Prairie Soils	1.9-23.0	8.8	10-70	27	100-2000	600	10-70	19
Organic Light Soils	<0.1-48.0	5.0	1-100	15	7-1500	260	10-50	24
Forest Soils	1.5-16.0	6.5	7-150	17(b)	150-1500	645	10-50	20(b)
Various Soils	<1.0-93.2	7.0	3-300	26	20-3000	490	<10-70	26

(a) In mg/kg

(b) Data For Whole Soil Profile

Table adapted from EPA 1995. *Determination Of Background Concentrations Of Inorganics In Soils And Sediments At Hazardous Waste Sites.* EPA/540/S-96/500. December 1995.

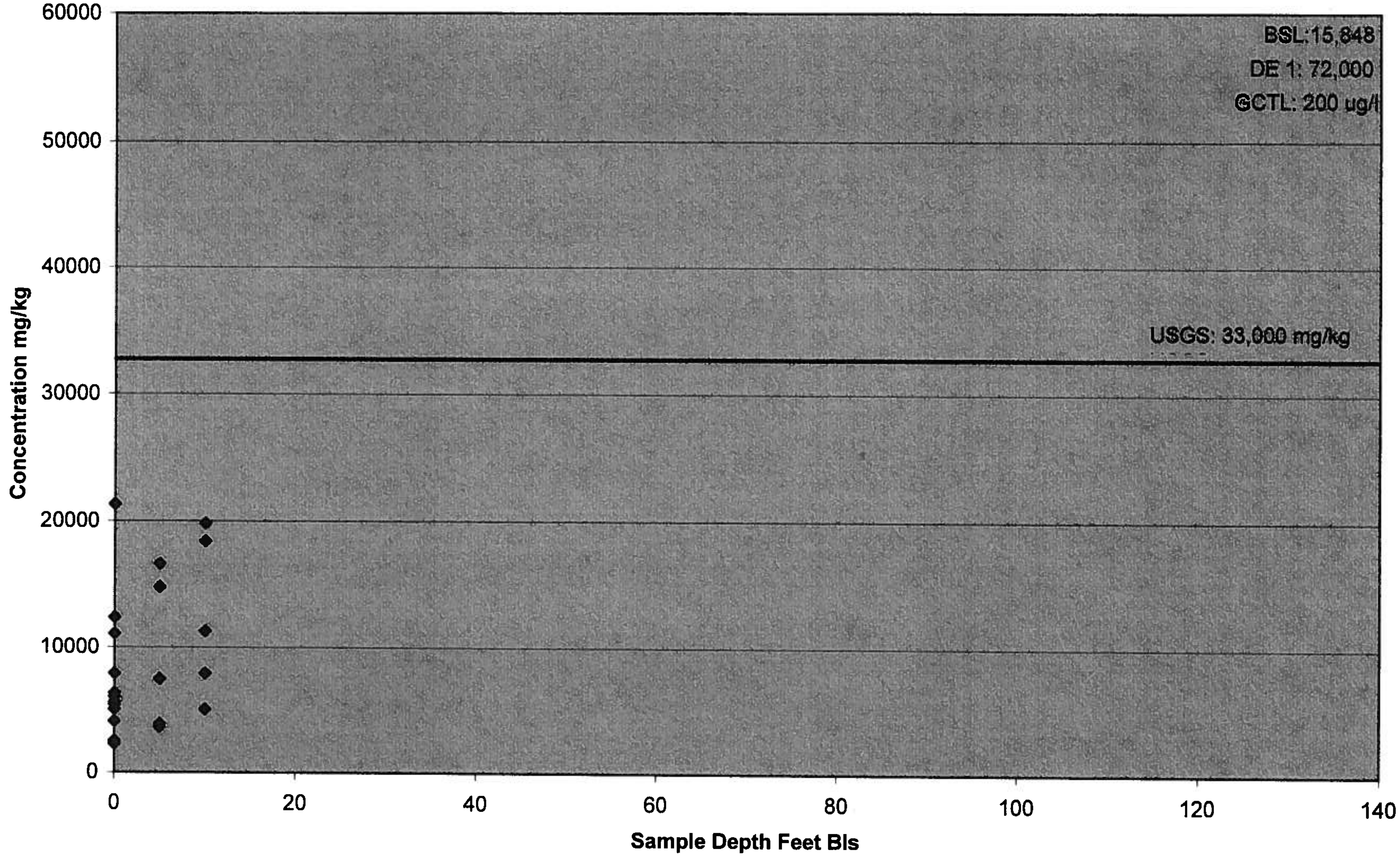
Vanadium

V values shown in Table 6 are within the range of V values found in soils at NAS Whiting Field. The highest V concentration detected at NAS Whiting Field was in a subsurface soil sample WHF-29-SB-05 at 513 mg/kg. This concentration slightly exceeds the 3 to 500 mg/kg range and the average concentration of 90 mg/kg; however, this is the highest detection of V and was collected from the 10 to 12 ft bls interval. The next highest detection was 77 mg/kg in sample WHF-03-SB-02 collected from the 5 to 7 ft bls interval, within the Table 6 range and below the average. The average V detection for all soil samples for the facility is 19 mg/kg.

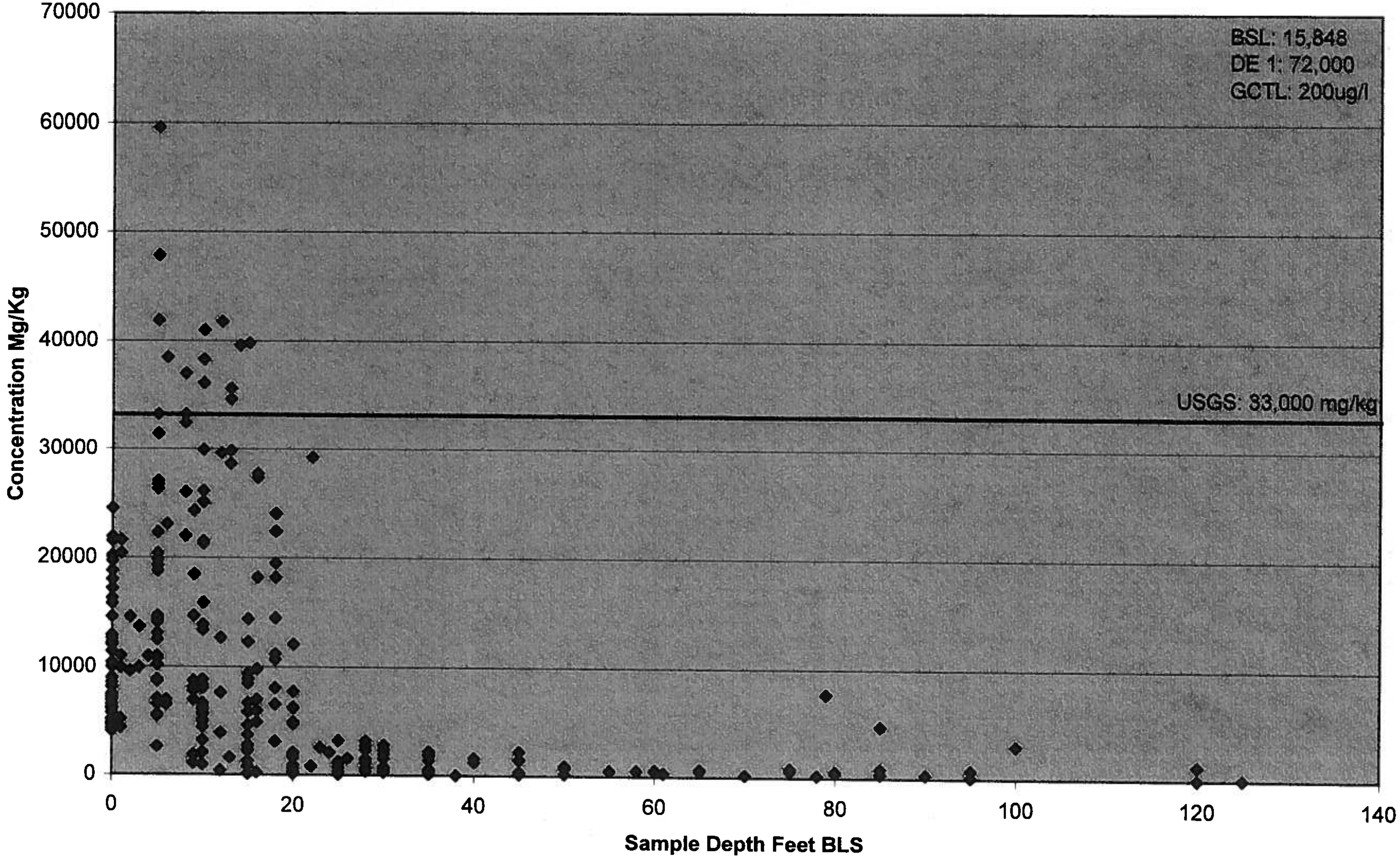
V is ubiquitous across the facility and the observed distributions are not depth-dependant. "Hotspots" are not evident. The argument V is present in soil as a product of V use in high tech engine parts, such as chrome-V steel, is unlikely. When used in steel as a strengthener V is typically at 0.01 percent by weight. This would not be a significant source for V in the facility's soil.

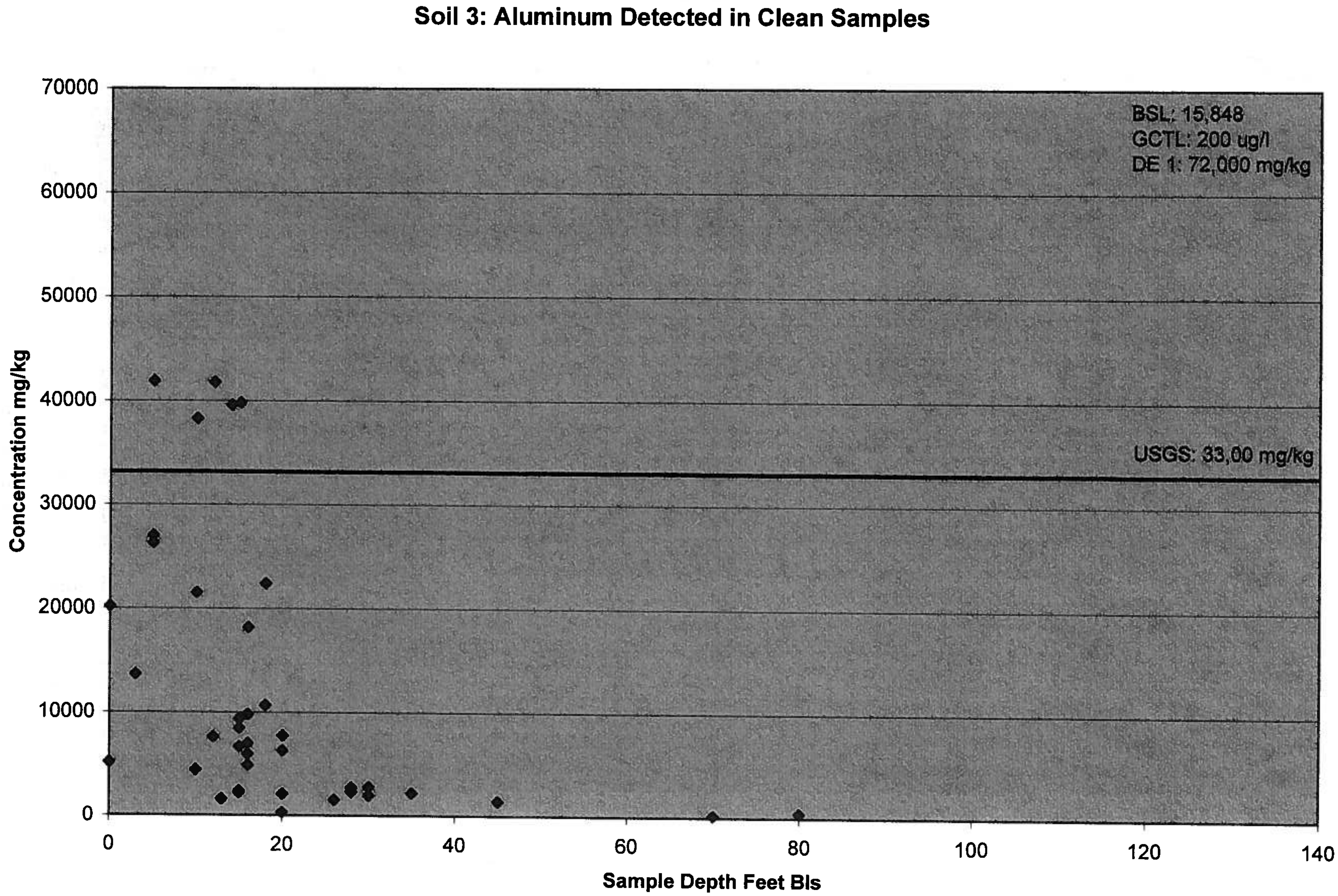
The observance of Al, Fe, Mn, and V indicate the elements are: ubiquitous in NAS Whiting Field soils, generally fall within regional values, and appear evenly distributed without obvious "hotspots". These observations are consistent with naturally occurring conditions for these inorganics.

Soil 1: Aluminum Background

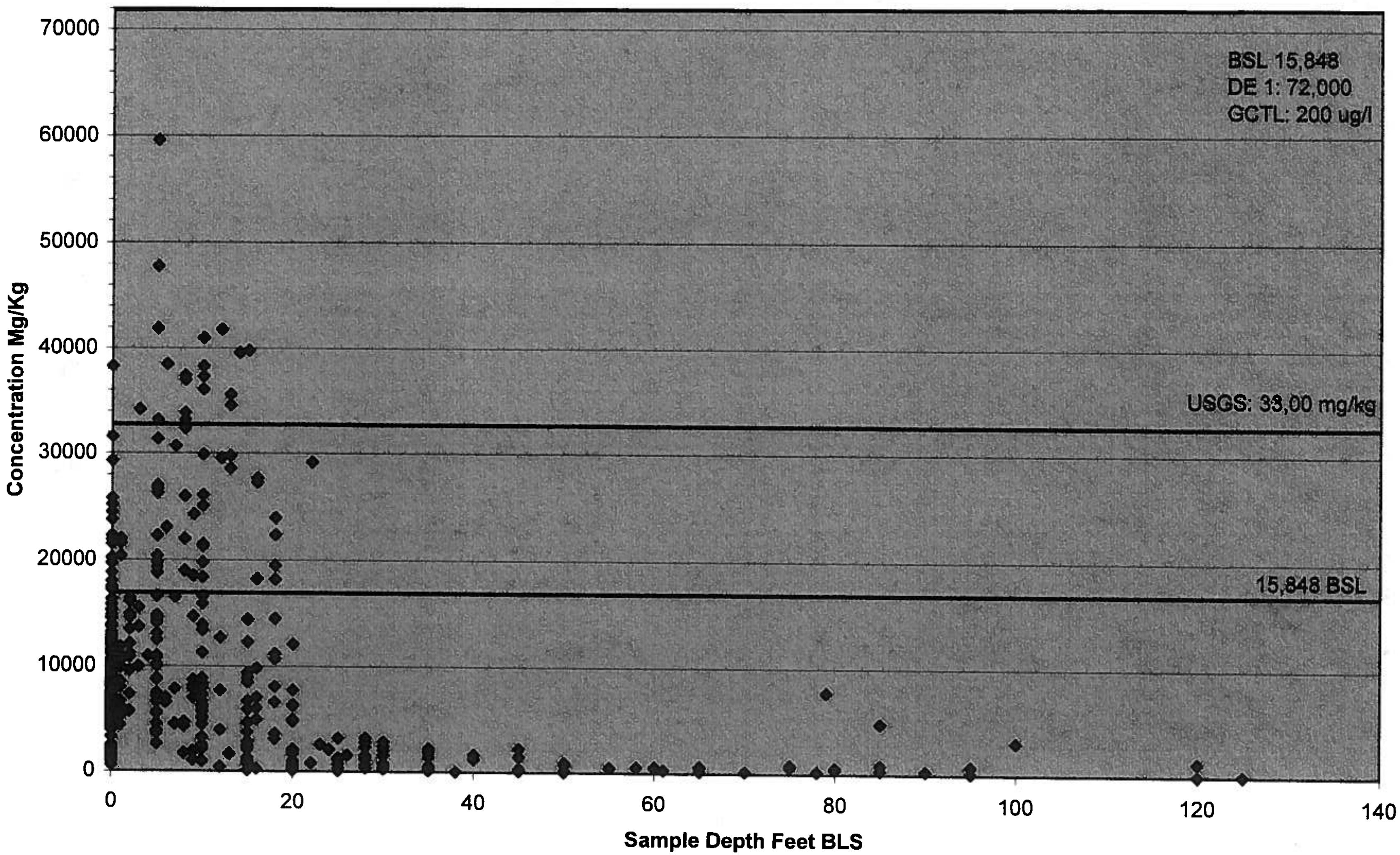


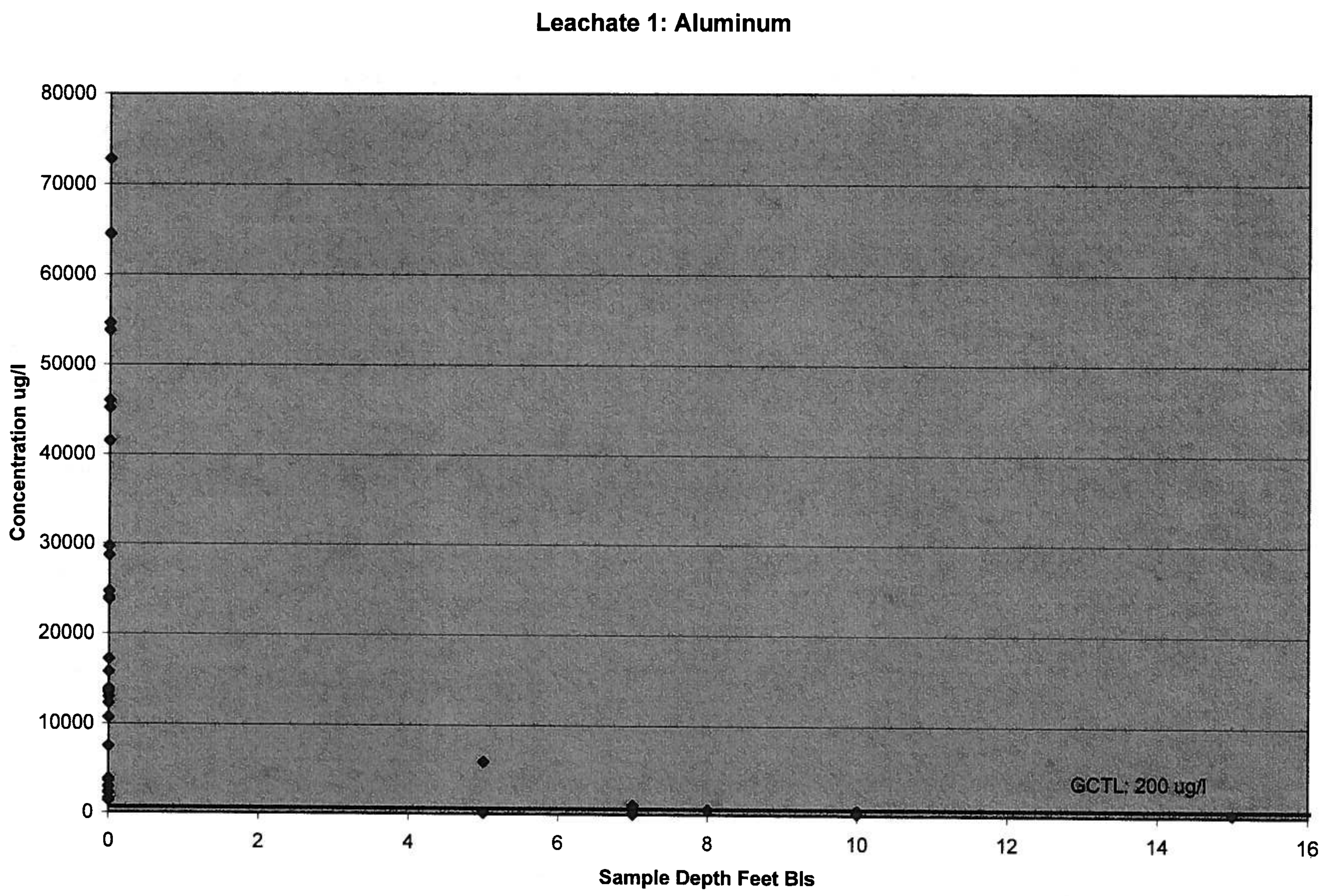
Soil 2: Aluminum Specific Sites



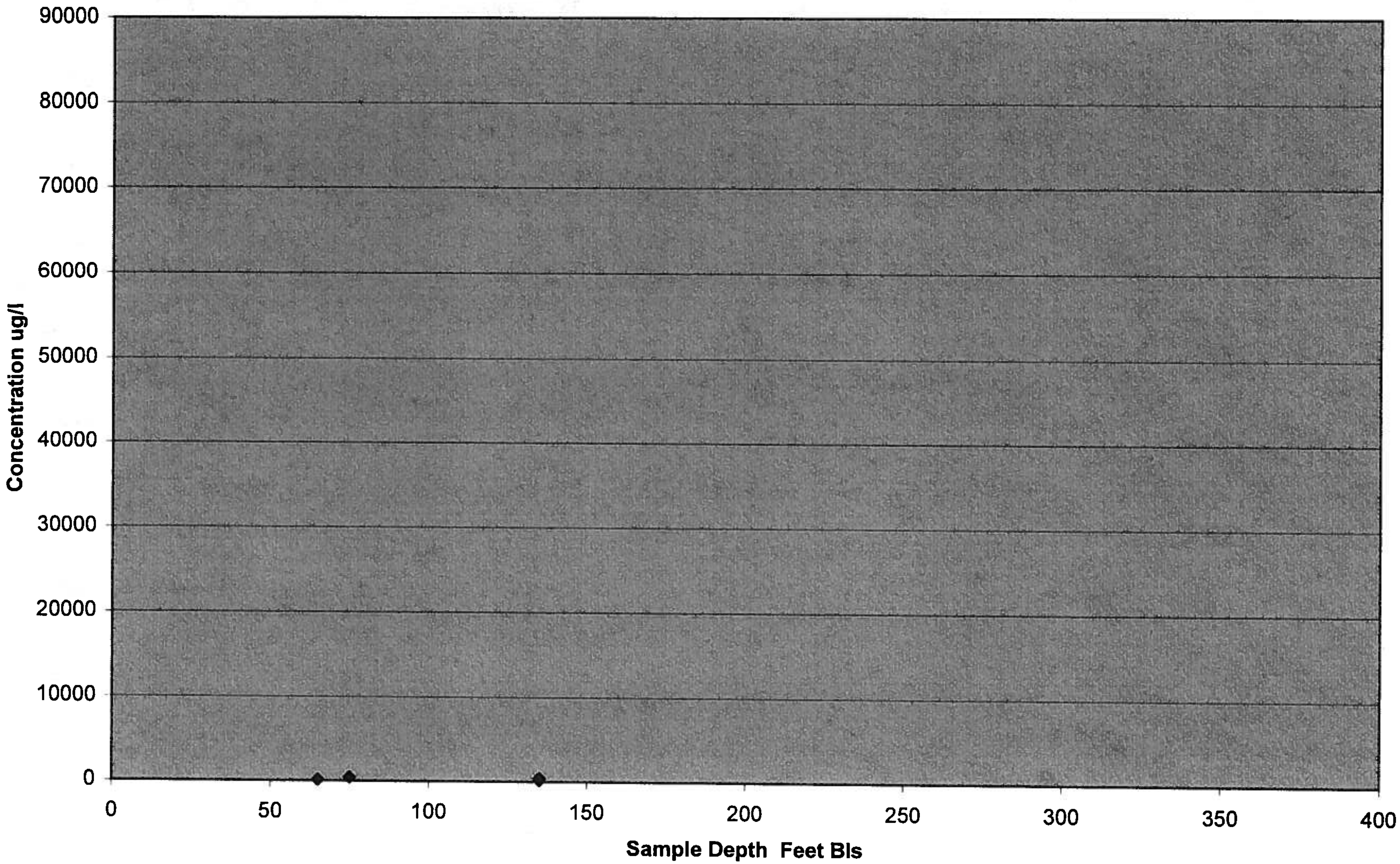

Soil 3: Aluminum Detected in Clean Samples
70000
60000
50000
40000
30000
20000
10000
0
Concentration mg/kg
BSL: 15,848
GCTL: 200 ug/l
DE 1: 72,000 mg/kg
USGS: 33,00 mg/kg
0
20
40
60
80
100
120
140
Sample Depth Feet Bls

Soil 4: Basewide Aluminum

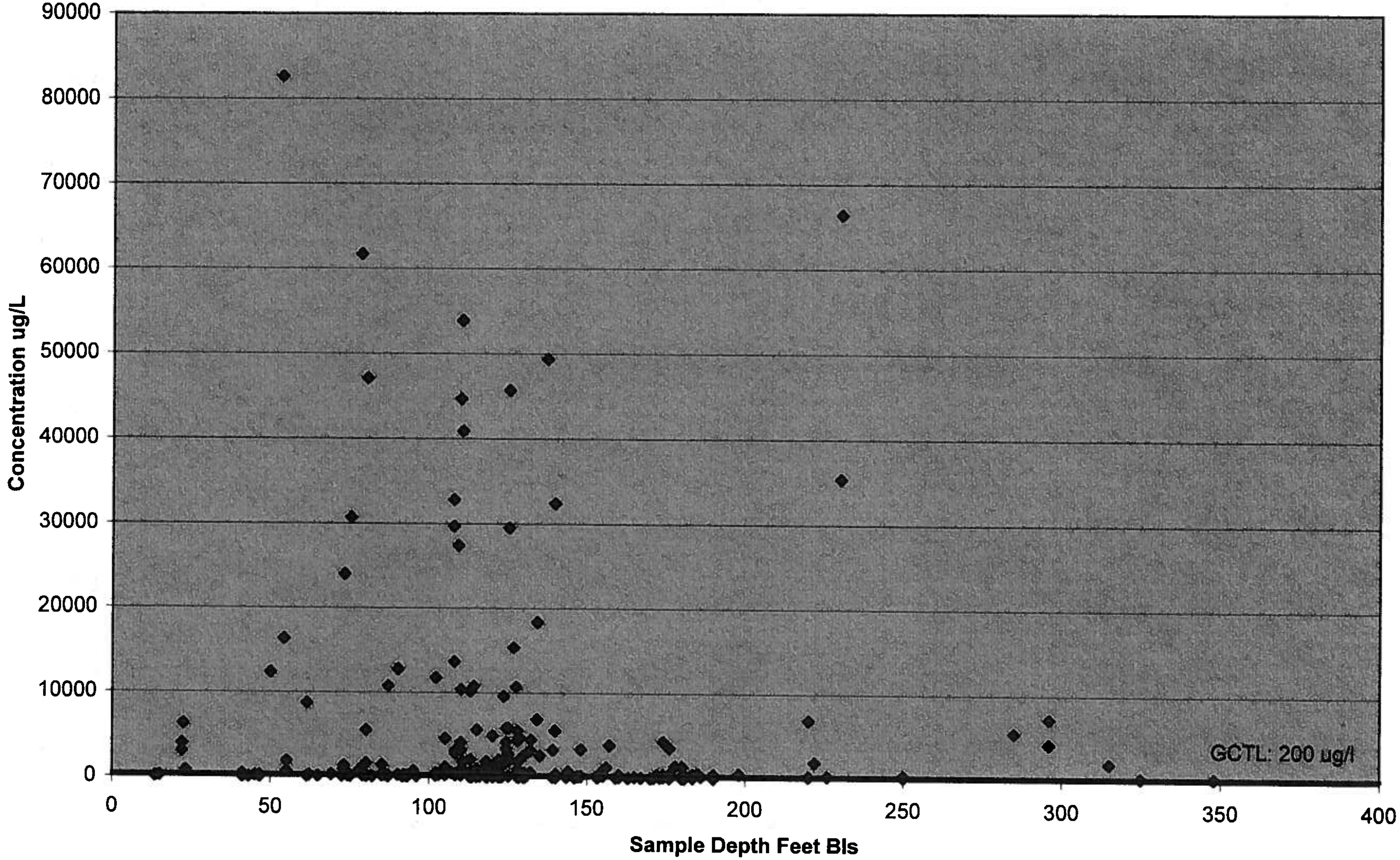



Leachate 1: Aluminum
Concentration ug/l
80000
70000
60000
50000
40000
30000
20000
10000
0
0
2
4
6
8
10
12
14
16
Sample Depth Feet Bls
GCTL: 200 ug/l

Groundwater 1: Aluminum in Background Groundwater



Groundwater 2: Aluminum in Groundwater Basewide



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United States Environmental Protection Agency, 1995, Determination Of Background Concentrations Of Inorganics In Soils And Sediments At Hazardous Waste Sites. EPA/540/S-96/500. December 1995.

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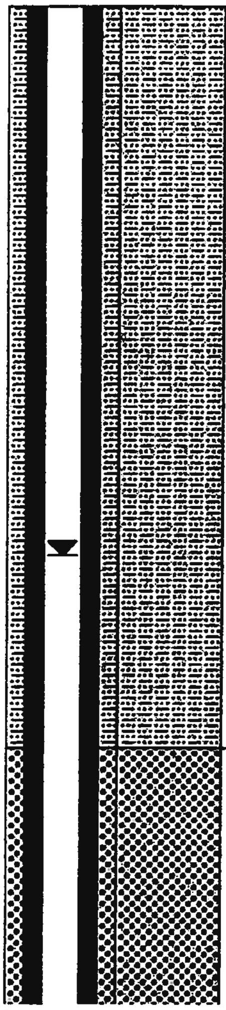
Monitoring Well No.	WHF-15-MW-8D3	Project No.:	N0052
Facility:	NAS Whiting Field	Site No.:	15
Contractor:	Kelly Environmental Drilling	Date Started:	6/18/00
Logged By:	Gary Davis	Method:	Mud-Rotary
Well Development Date:	7/28/00	Total Depth (ft bls):	130'
Protection Level: D	Monitor Instru.: FID	Depth to Water (ft bls):	44.56'
Casing Diam. (in): NA	TOC Elev.: 78.38'	Screened Interval:	120'-130'
Riser Diam. (in) 4"		Page 1 of 2	



Depth (ft)	Well Column	Lithologic Symbol	Lithologic Description	USCS	Recovery	FID (ppm) Borehole	FID (ppm) Sample
0–60			CLAYEY SAND: Reddish brown silty clayey sand, fine- to medium grained, loose to medium dense, sub-rounded to sub-angular, ~20-30%	SC		NA	NA
60–80			SAND: Light brown fine- to medium-grained sand, some gravel, some clay lenses	SW			

Depth scale: 0, 10, 20, 30, 40, 50, 60, 70, 80

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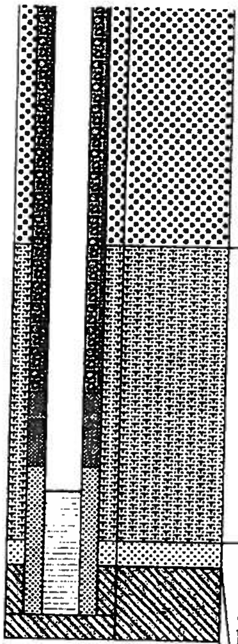
Monitoring Well No. WHF-15-MW-8D3

Project No.: N0052



Depth (ft)	Well Column	Lithologic Symbol	Description	USCS	Recovery	FID Borehole	FID Sample
-80							
-90							
-100			SILTY SAND: Light brown fine- to medium-grained silty sand w/ occasional streak of silty sandy clay	SM			
-110							
-120					24"/ 24"		
			FERRUGINOUS CEMENTED SANDSTONE: Dark reddish brown ferruginous cemented sand, very hard, iron concretion, or hard pan iron-cemented sandstone	CL			
-130			CLAY: Dark gray plastic clay with trace muscovite				

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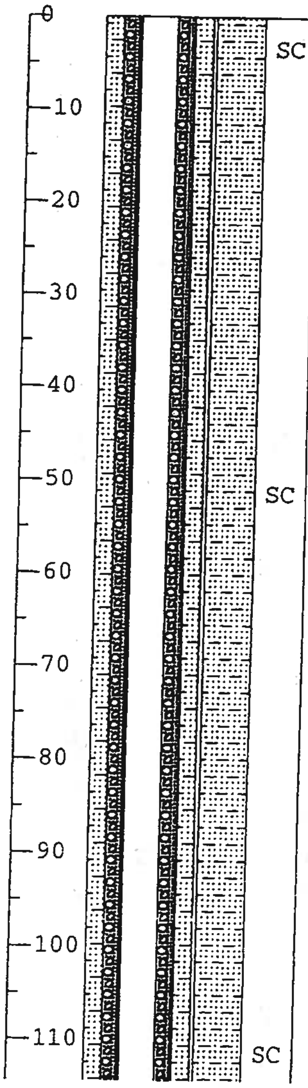
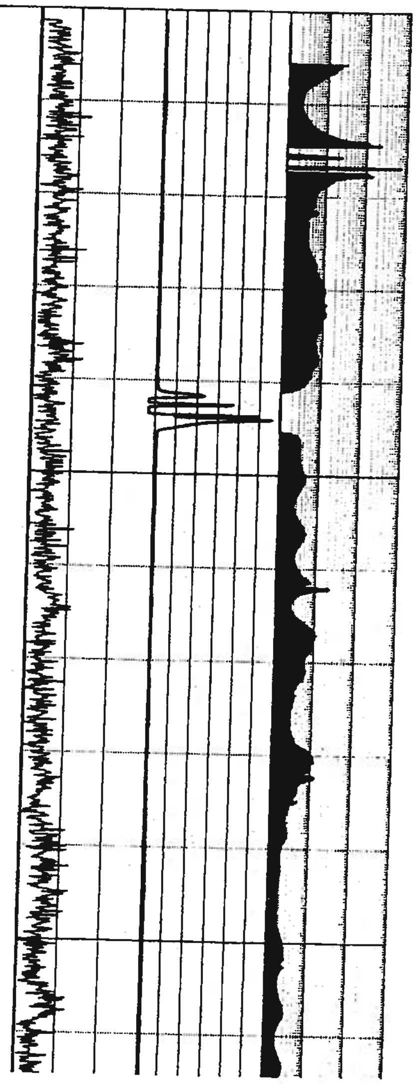
Facility: NAS Whiting Field	Monitoring Well No. WHF-1466-B25D4
Contractor: Kelly Environmental Drilling	Project No.: N0052
Logged By: Garry Davis	Site No.: 1466
Well Development Date: No Well Installed	Date Started: 6/28/00
Protection Level: D / Monitor Instru.: FID	Method: Mud-Rotary
Casing Diam. (in): 8 / TOC Elev.: ~ 135	Total Depth (ft bls): 338
Riser Diam. (in) 4	Depth to Water (ft bls): NA
	Screened Interval: not screened
	Page 1 of 3

Depth (ft)	Well Column	Lithologic Symbol	USCS	Site Map / Lithologic Description	Natural Gamma (0 – 150)	Conductivity (-500 – -7,000)	Resistivity (1.0 – 10,000)
0–110			SC	SILTY CLAYEY SAND: 20 to 30% Silty Clay, Fine to Coarse quartz grains with lithic and feldspathic fragments and/or pea gravel, ocher grading to light grey			





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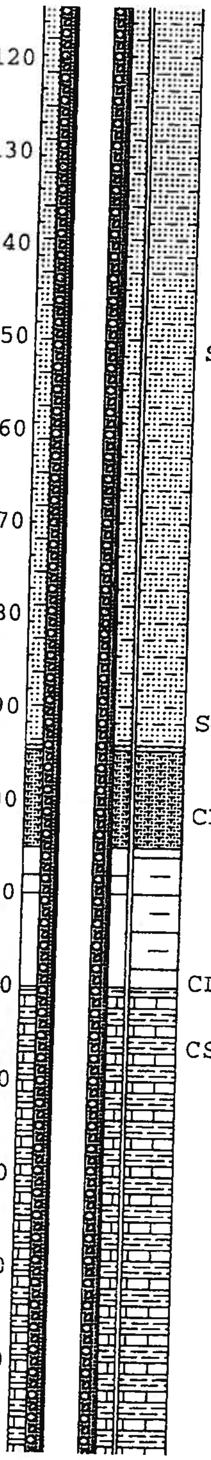
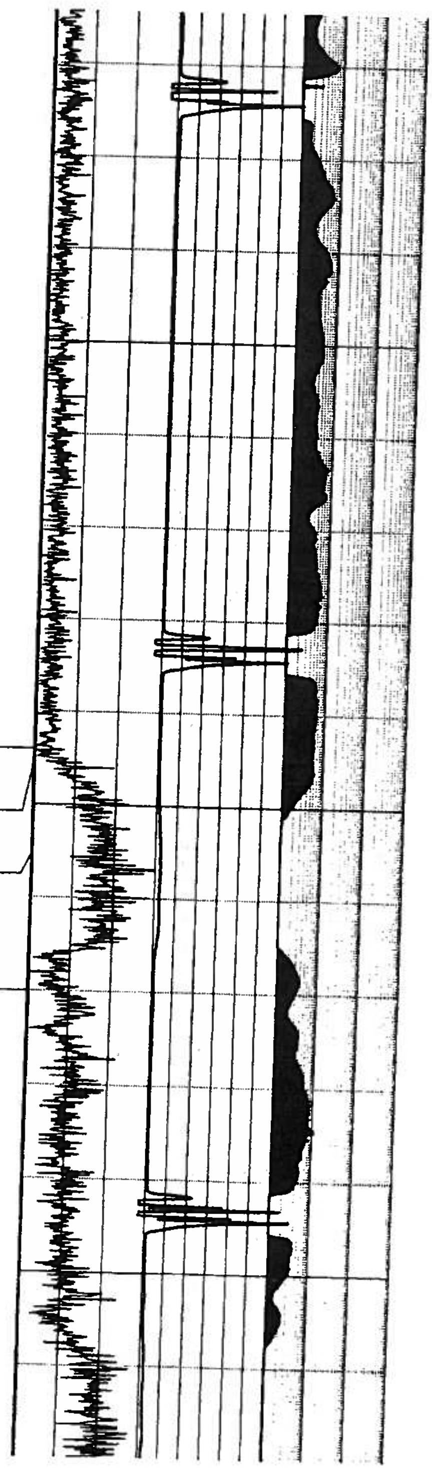
Monitoring Well No. WHF-1466-B25D4

Project No.: N0052

Depth (ft)	Well Column	Lithologic Symbol	USCS	Site Map / Lithologic Description	Natural Gamma (0 – 150)	Conductivity (-50 – 5,000)	Resistivity (10 – 10,000)
120			SC				
130							
140							
150			SC				
160							
170							
180							
190			SC				
200			CL	SANDSTONE: Ferruginous Cemented Sandstone			
				SILTY SAND: Clay Silty with trace mica, light grey.			
210				SILTY SANDY CLAY: 10% medium to coarse grained quartz Sand with carbonaceous material (wood?)			
220			CL	SILTY CLAY: As Above Brown Grey incresing in clay content with depth.			
			CS/				
230							
240							
250							
260							
270							





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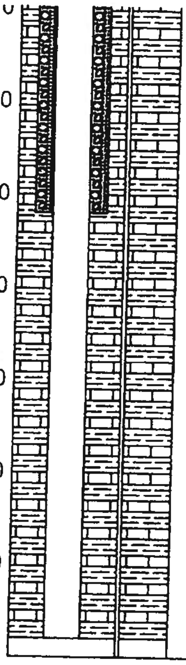
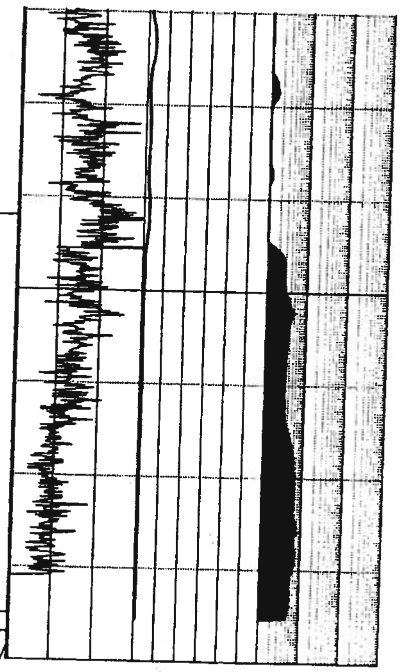
Monitoring Well No. WHF-1466-B25D4

Project No.: N0052

Depth (ft)	Well Column	Lithologic Symbol	USCS	Site Map / Lithologic Description	Natural Gamma (0 – 150)	Conductivity (-50 – 5,000)	Resistivity (10 – 10,000)
270							
280			CS/				
			CS/				
290			CL	SILTY CLAY: Increasing amonunts of silts and fine sands.			
300							
310							
320							
330							
340				Boring Terminated -338			





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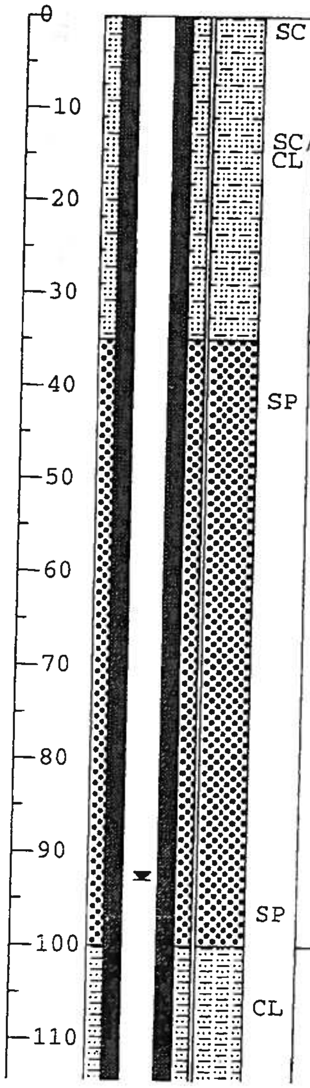
Facility: NAS Whiting Field	Monitoring Well No. WHF-1467-MW-14D3
Contractor: Kelly Environmental Drilling	Project No.: N0052
Logged By: Louis Knight/Bill Olson	Site No.: 1467
Well Development Date: 10/27/00	Date Started: 8/16/00
Protection Level: D / Monitor Instru.: FID	Method: Mud-Rotary
Casing Diam. (in): 8 / TOC Elev.: 180	Total Depth (ft bls): 255'
Riser Diam. (in) 4	Depth to Water (ft bls): 93'
	Screened Interval: 235' to 250'

Depth (ft)	Well Column	Lithologic Symbol	USCS	Lithologic Description	Natural Gamma (0 – 150)	Conductivity (-500 – -7,000)	Resistivity (1.0 – 10,000)

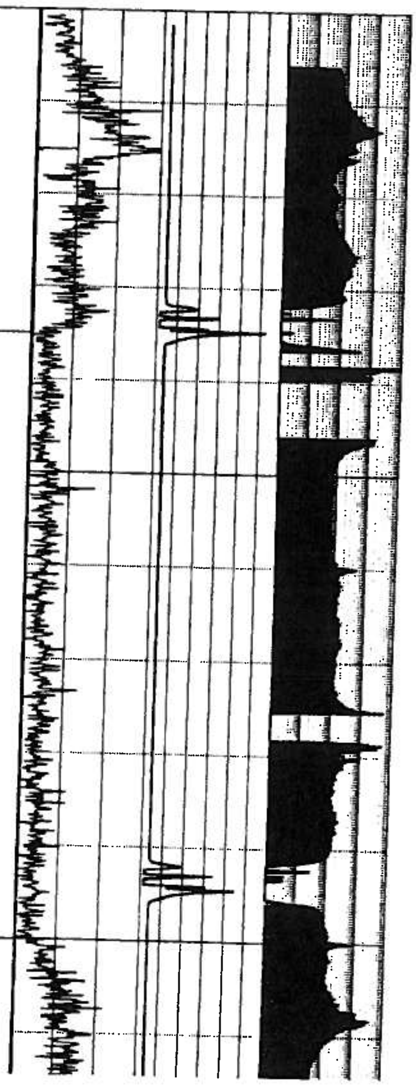
Site Map



SILTY CLAYEY SAND: Fine to medium grain sand in various percentages in silty clay ocher to white.

SAND: Fine to medium grained ocher to pink to white.

CLAYEY SAND: Fine to medium grain sand in various percentages in silty clay ocher to white.



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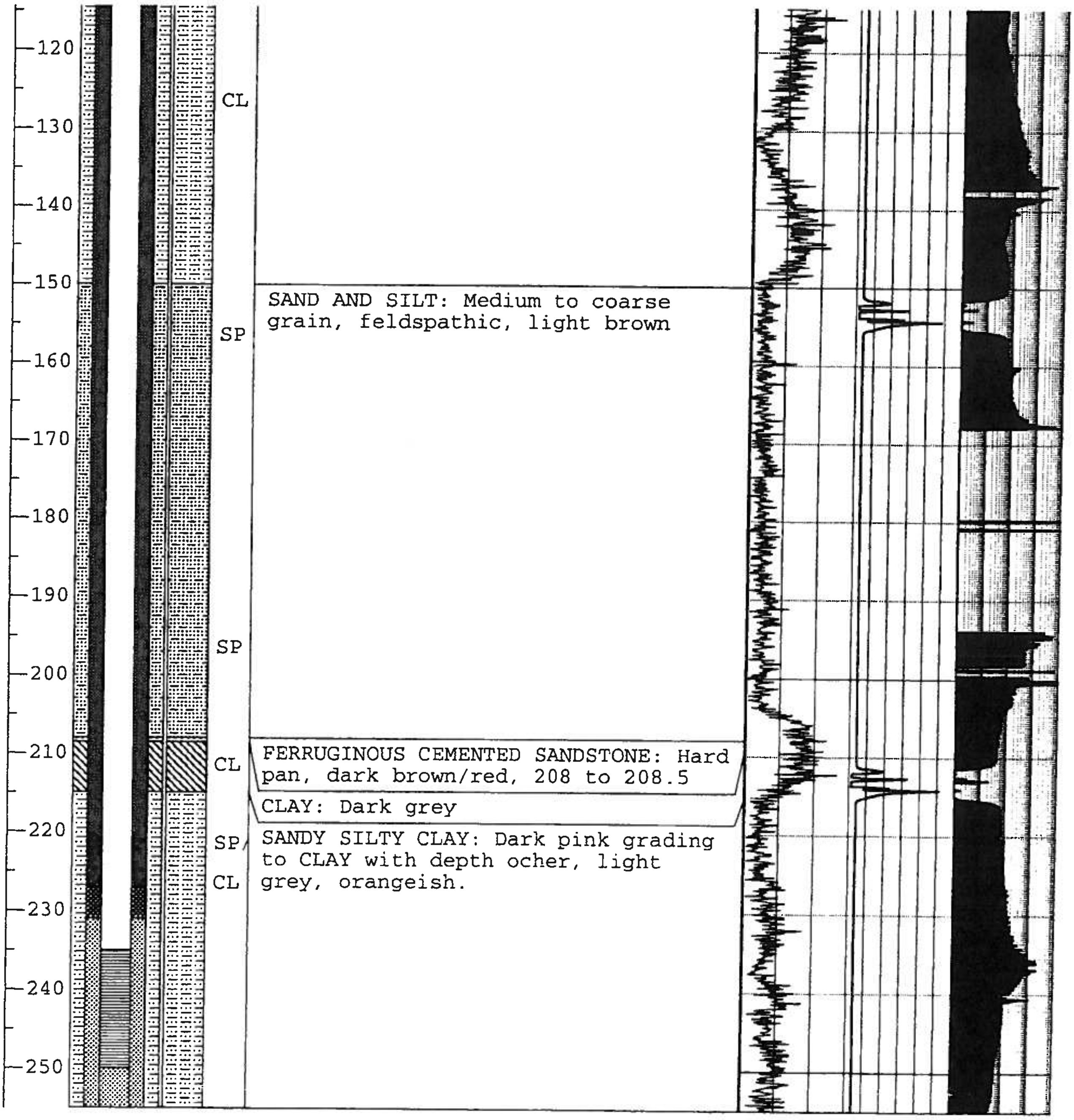
Monitoring Well No. WHF-1467-MW-14D3

Project No.: N0052

Depth (ft)	Well Column	Lithologic Symbol	USCS	Site Map / Lithologic Description	Natural Gamma (0 – 150)	Conductivity (-500 – 7,000)	Resistivity (1.0 – 10,000)



SAND AND SILT: Medium to coarse grain, feldspathic, light brown

FERRUGINOUS CEMENTED SANDSTONE: Hard pan, dark brown/red, 208 to 208.5

CLAY: Dark grey

SANDY SILTY CLAY: Dark pink grading to CLAY with depth ocher, light grey, orangeish.

APPENDIX B

SOIL CHART SERIES Al, Fe, Mn, AND V

Soil Chart Series Al, Fe, Mn, and V

A review of available Fe, Mn, and V data is presented in a graphical form in the following chart series. Charted Al data is presented in the body of the report. The data is from the current comprehensive NAS Whiting Field EGIS's database except where noted. Relevant reference information has been provided for comparison.

Soil 1: Soil Background; Figures Soil 1 Series
The Soil 1 series shows concentrations of Al, Fe, Mn, and V detected in eleven background soil samples collected on the surface, and at 5 and 10 foot intervals below land surface (bls).

Soil 2: Soil from Selected Non-Landfill Sites; Figures Soil 2 Series
The Soil 2 series shows concentrations of Al, Fe, Mn, and V detected in soil samples from sites where activities and process would not contribute these inorganics to soil. These Sites are: 3, 4, 6, 7, 29, 30, 32, 33, 35 and 38.

Interpretation: The majority of soil analytical results are collected from the 0 to 20 foot depth interval, however, the samples collected below 20 feet also show exceedences. All Al detections exceeding the background screening level are in the 0 to 20 foot zone. Only Fe exceeds DE 1 above 20 ft bls.

Soil 3: Select Basewide Soil; Figures Soil 3 Series
The Soil 3 series shows concentrations of Al, Fe, Mn, and V detected in soil samples basewide from sample locations where no VOCs, SVOCs, pesticides or TRPH were detected in association with the inorganic detections.

Soil 4: Basewide Soil; Figures Soil 4 Series
The Soil 4 series shows concentrations from all sites of Al, Fe, Mn, and V detected in soil samples basewide. DE 1, DE 2, and the back ground screening levels are shown as values and heavy lines for reference. The GCTL is noted.

Interpretation: The majority of soil analytical results are collected from the 0 to 20 foot depth interval, however, the samples collected below 20 feet also show exceedences. All Al detections exceeding the background screening level are in the 0 to 20 foot zone. Only Fe exceeds DE 1 above 20 ft bls.

Interpretation: Again the majority of soil samples have been collected from the 0 to 20 foot depth interval. The pattern in the Case 3 plot is very nearly a replication of the plot of all samples – Case2 - albeit with fewer samples plotted due to the smaller selected population. The similarity of these patterns would indicate there is no site specific impact on near surface soils at the facility but rather there is a ubiquitous distribution of these elements. Forty percent of the aluminum detected in soil unassociated with non-inorganic contaminants exceeds the background screening level (bls).

Conclusion: The distribution of inorganics in the charts is similar in each selected set with the exception of density of population. The select set from site where no activities or processes would be thought to cause contamination matches the sample set selected where no other organic contaminants are present. Both of these sets match the basewide all inclusive set.

Leachate 1: Basewide SPLP and TCLP Leachate; Figures Leachate 1 Series

The leachate 1 series shows concentrations of Al, Fe, Mn, and V detected in leachate from all basewide soil SPLP and TCLP leachate samples. The chart shows the majority of soil samples have been collected from the 0 to 1 foot depth interval. The pattern in the chart shows all elevated leachate detections are confined to surface samples. A horizontal bar indicating the GCTL on the Al figure is noted showing most soil samples are leaching Al in exceedance of GCTLs.

Interpretation: The highest leachate values are found in the 0 to 1 foot bls surficial soils. This results in high concentrations of elements in leachate infiltrating to the groundwater. Removal of surface soils basewide to 1 bls would eliminate most if not all inorganic leaching to groundwater. Note the X-axis maximum value is 16 feet bls for this data set.

The few examples are provided below illustrate the relationship of inorganics detection in surface soils with accompanying SPLP and TCLP leachate exceedences coupled with groundwater concentrations exceeding GCTLs from monitoring wells located hydraulically downgradient of the location of the surface soil exceedences.

Surface Soils	**Leachate (SPLP & TCLP)**	**Groundwater**
WHF-38-SS-01 through 10		
Aluminum (range)		
3,600 to 46,000 mg/kg	4,820 to 8,140 ug/l	821 to 11,800 ug/l
Iron (range)		
1,900 to 22,500 mg/kg	2,960 to 5,250 ug/l	607 to 32,400 ug/l
WHF-29-SS-1 through 6		
Aluminum (range)		
13,700 to 29,700	6,910 to 17,200	3,320 to 49,400
Iron (range)		
6,900 to 13,000	4,880 to 12,000	4,130 to 104,000

Groundwater 1: **Groundwater Background; Figures Groundwater 1 Series**

These charts present concentrations of Al, Fe, Mn, and V detected in seven background groundwater samples collected in the surficial aquifer, at various intervals bls as shown on the X-axis. Samples obtained in 1993 were collected using bailers, a process typically causing high sample turbidity typically resulting in falsely elevated inorganic concentrations. Therefore, these samples were not included in the dataset. Note all X-axis have a maximum value of 400 feet bls.

Groundwater 2: **Basewide Groundwater; Figures Groundwater 2 Series**

These charts present concentrations of Al, Fe, Mn, and V detected in groundwater samples basewide - all sites and/or monitoring wells with no exceptions, all available data is presented. The GCTLs values are noted with heavy lines for reference.

Interpretation: The majority of the high concentrations detections are clustered around the 80 to 150 foot interval with a string of higher concentrations at the 110 to 130 foot interval both corresponding to the shallow surficial aquifer. A second string of high detections corresponds with the screened interval at approximately 225 feet bls where wells were installed to monitor the bottom of the surficial aquifer or the top of the Pensacola Clay typically found around 230 to 240 feet bls.

It should be noted the patterns are biased by screened interval locations. Aside from this restriction, the concentrations are balanced in distribution relative to elevation. The minor cluster pattern found in the deep aquifer (225 feet bls) is the result of increase concentrations of Al, Fe, and Mg just above the Pensacola Clay. This corresponds to the zone where iron cementation has historically occurred and likely occurs now.

The Site 40 report describes lateral distribution of iron exceedences in shallow groundwater in relation to exceedences of trichloroethene and BETX concentrations. The presence of elevated levels of dissolved iron in these defined plumes in the north and south field area are the result of natural attenuation processes. These levels will return to normal background levels after natural attenuation processes are complete.

The GCTL is exceeded in almost all instances of Al, Fe, Mg, and V detections.

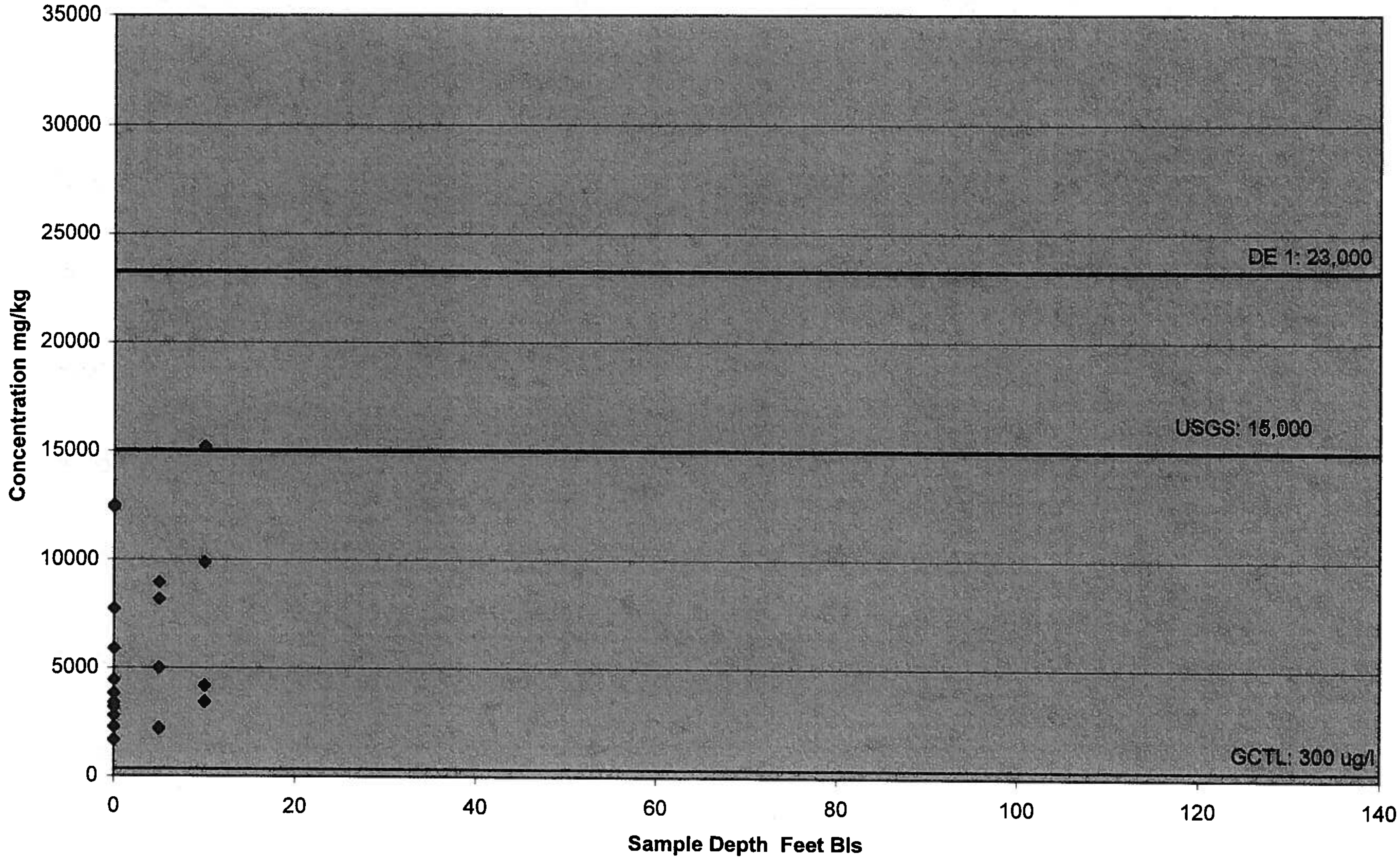
Summary

In summary, Al, Fe, Mn, and V are evenly distributed in facility soils typically below generally accepted regional values. Hot spots where anthropogenic effects should be apparent they are not found.

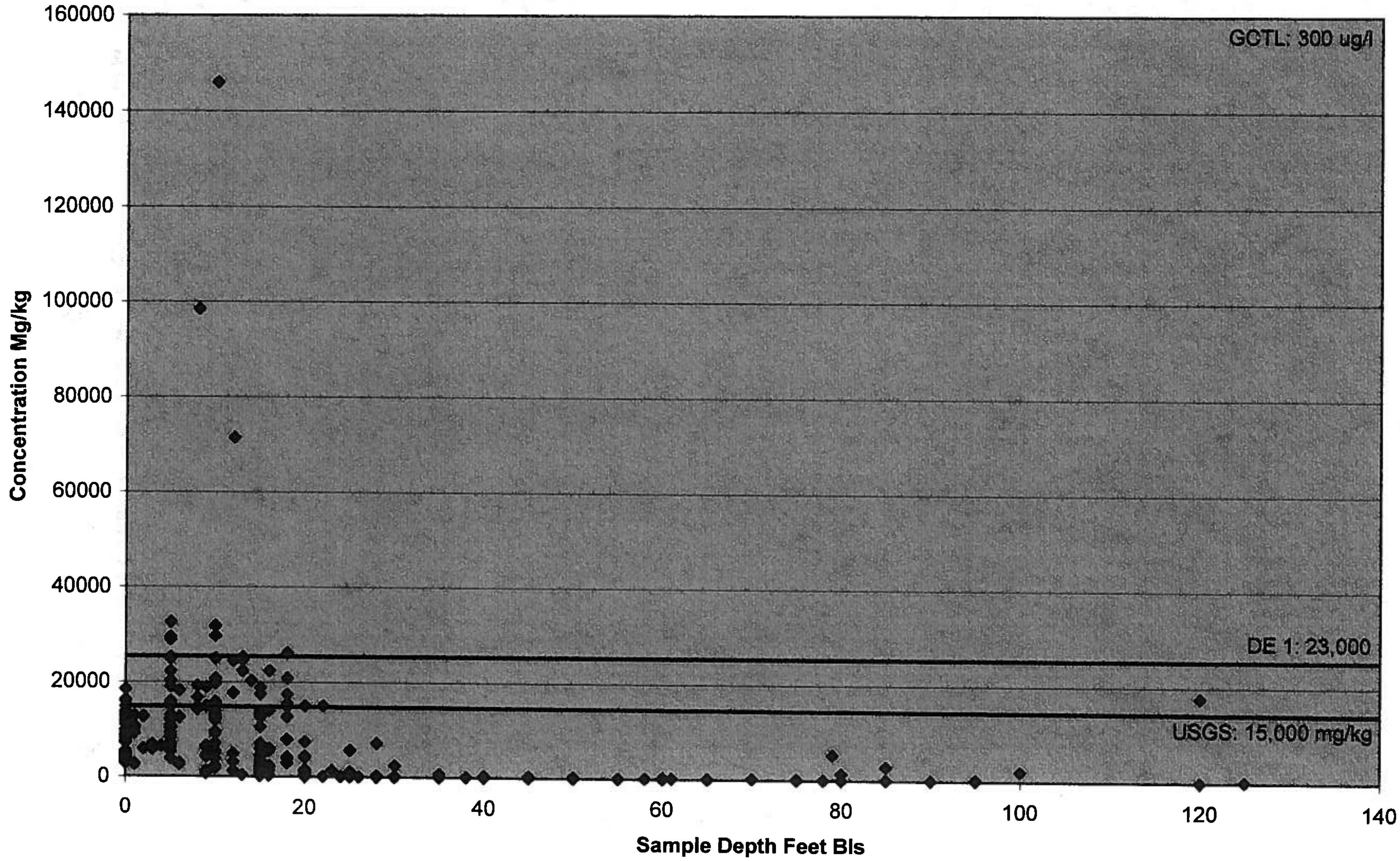
Leaching of Al, Fe, Mn, and V from soils at greater than GCTLs is apparent. However, as stated previously these elements are not found in hot spots but are rather evenly distributed. There is no background leachate data available, but leachate data from many sites was collected from non-disturbed locations and is "background equivalent".

Al, Fe, Mn, and V are evenly distributed in facility groundwater except where Fe is impacted by organic contaminants in the north and south plume areas. These elements are detected in groundwater at typical concentrations due to leaching and natural processes.

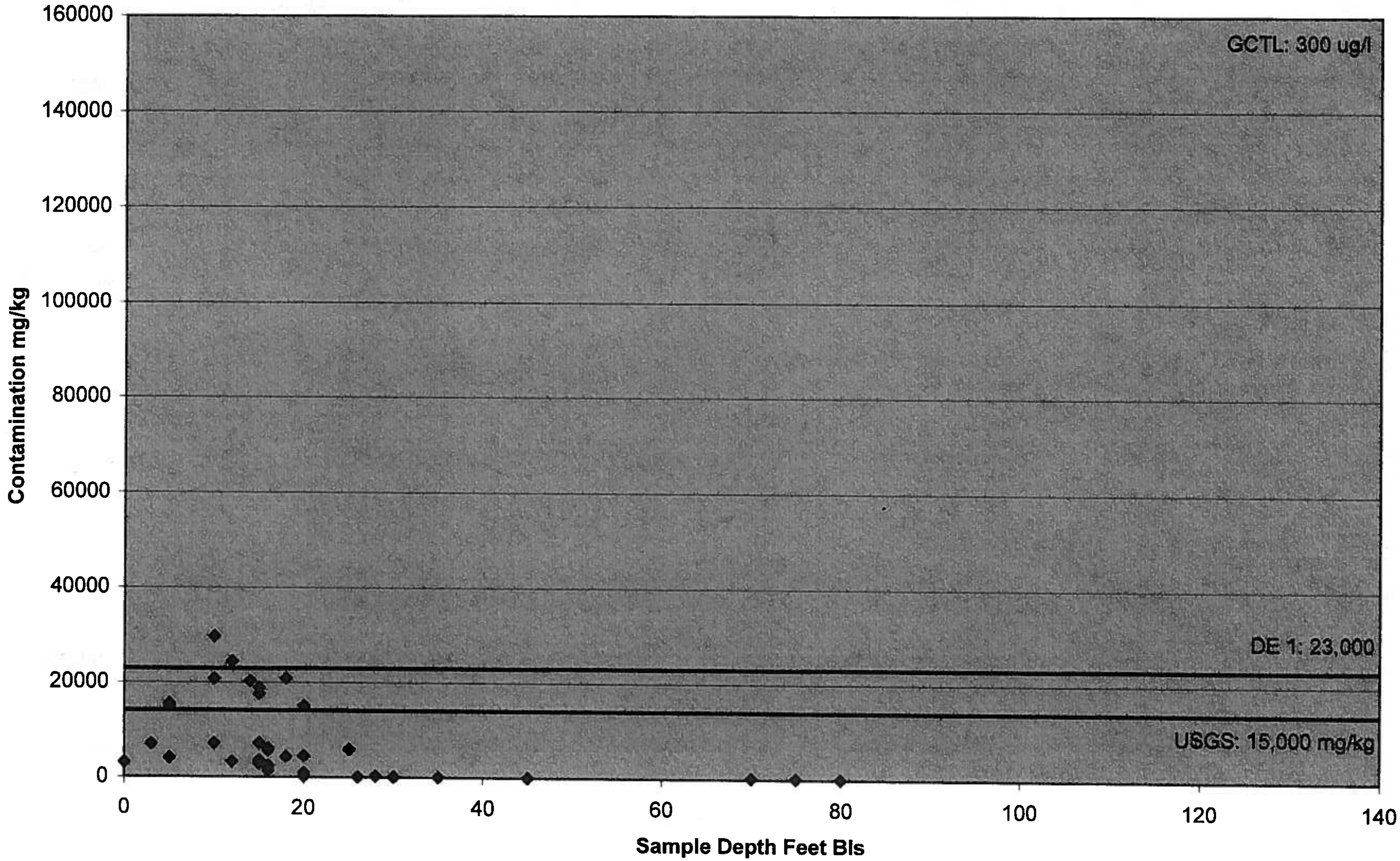
Soil 1: Iron Background



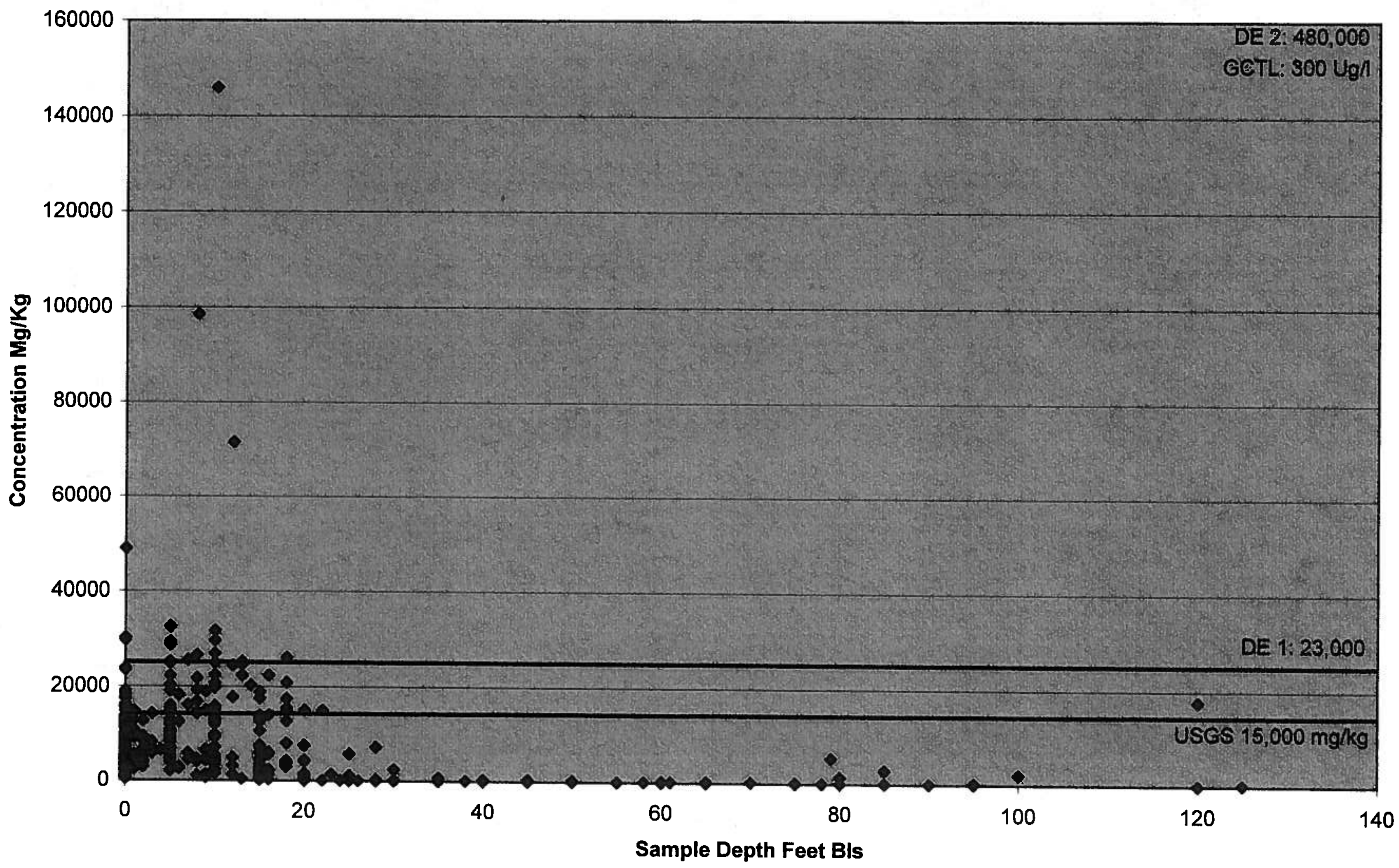
Soil 2: Iron Specific Sites



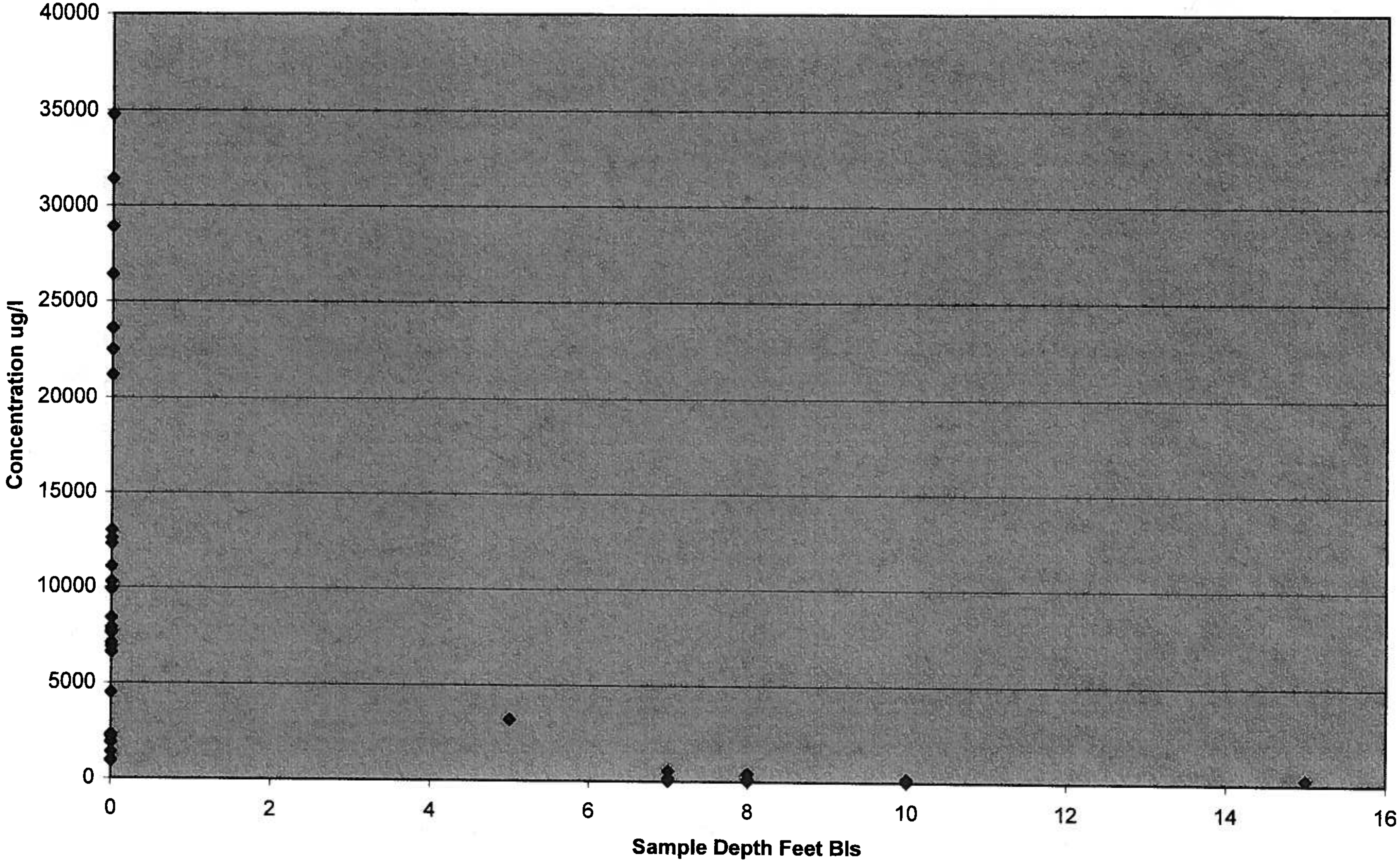
Soil 3: Iron Detected in Clean Samples



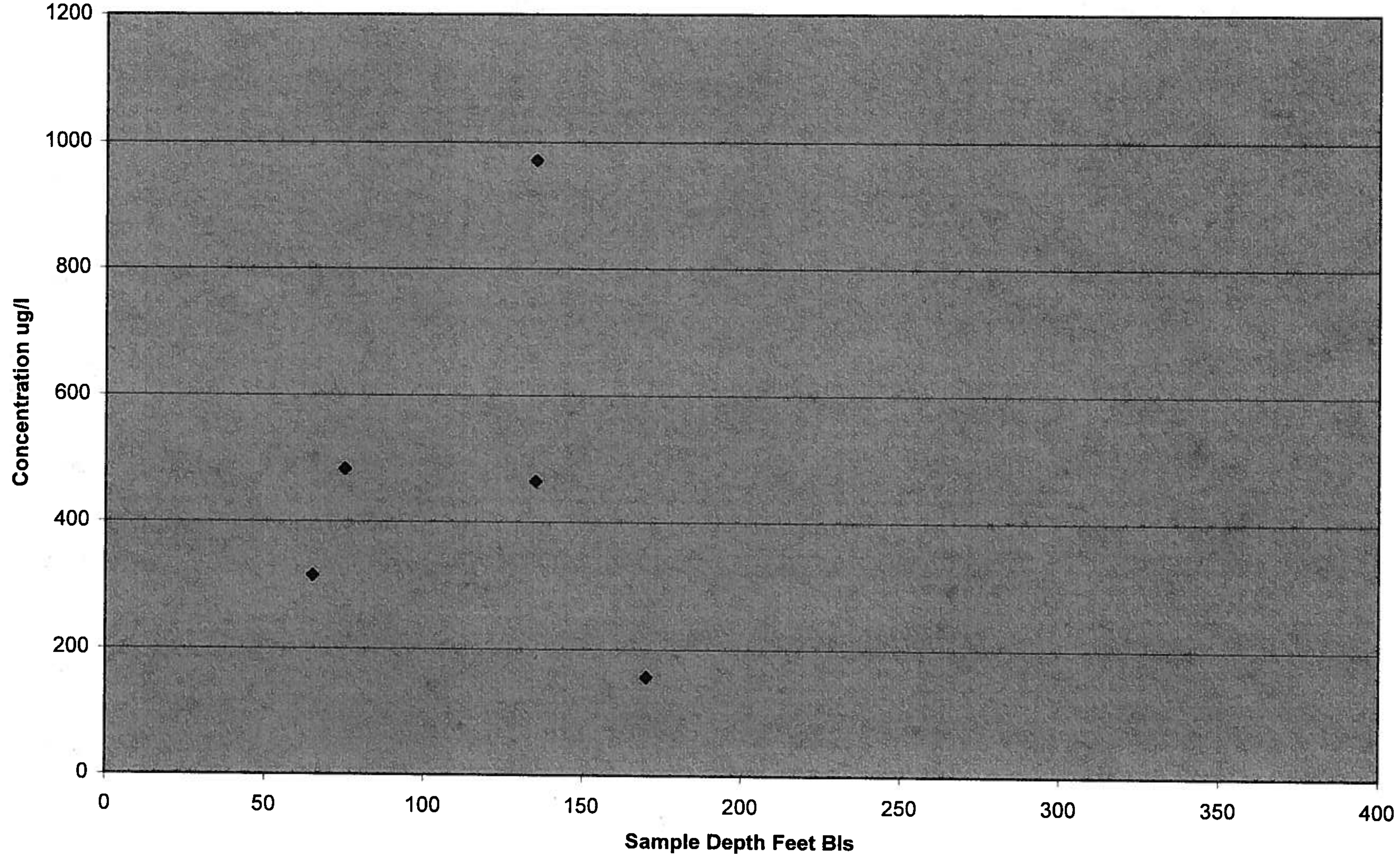
Soil 4: Basewide Iron



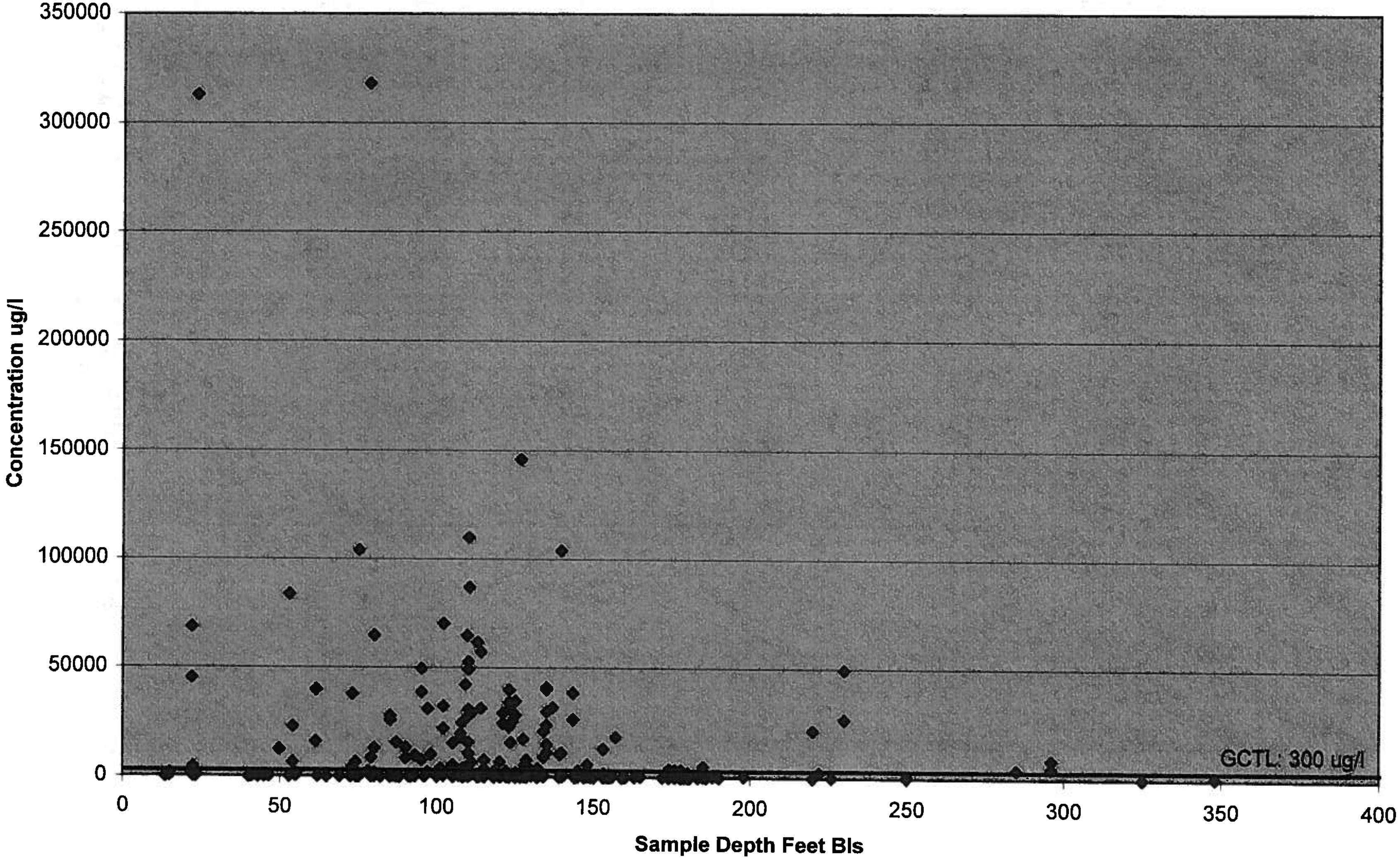
Leachate 1: Iron



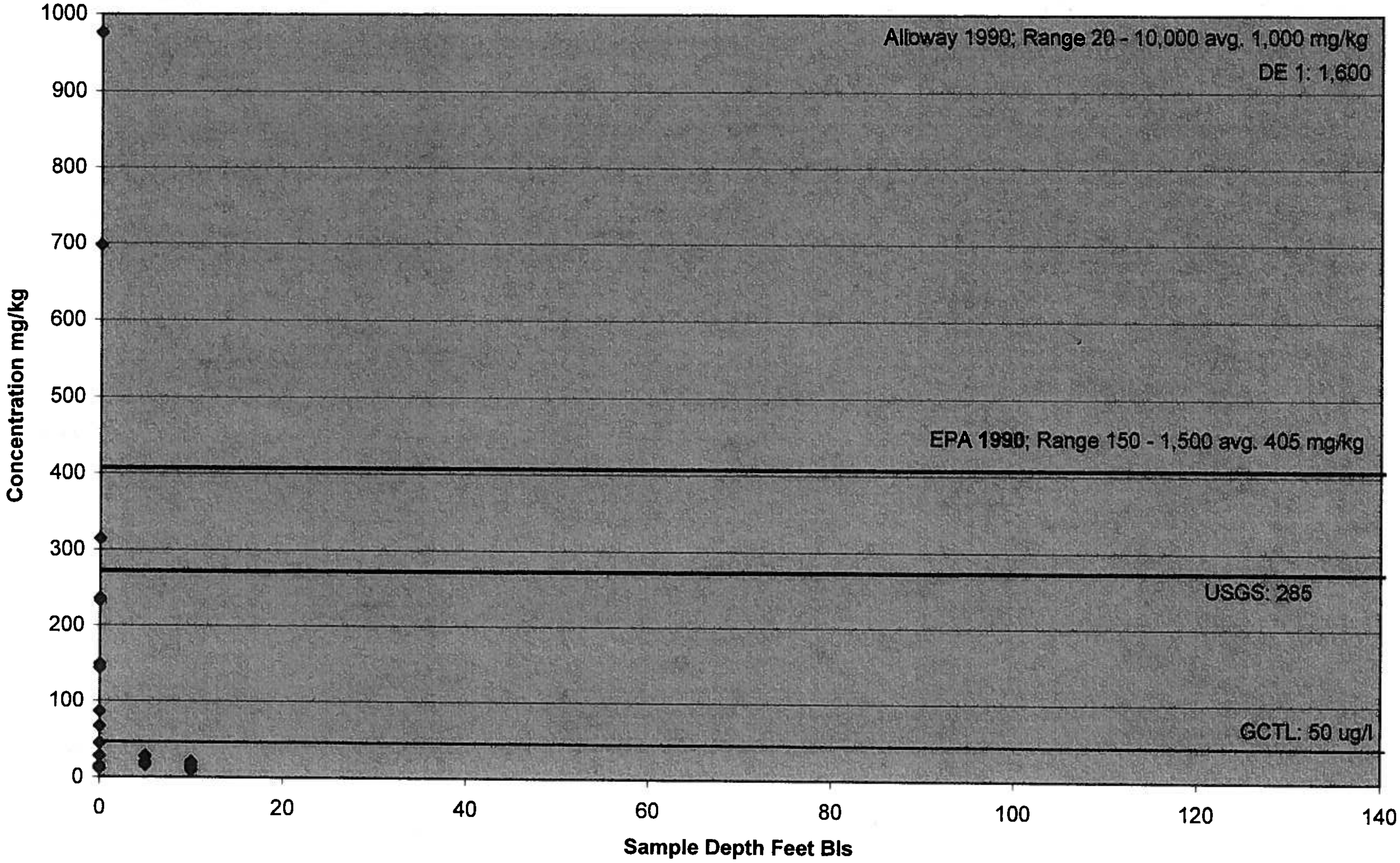
Groundwater 1: Iron in Background Groundwater



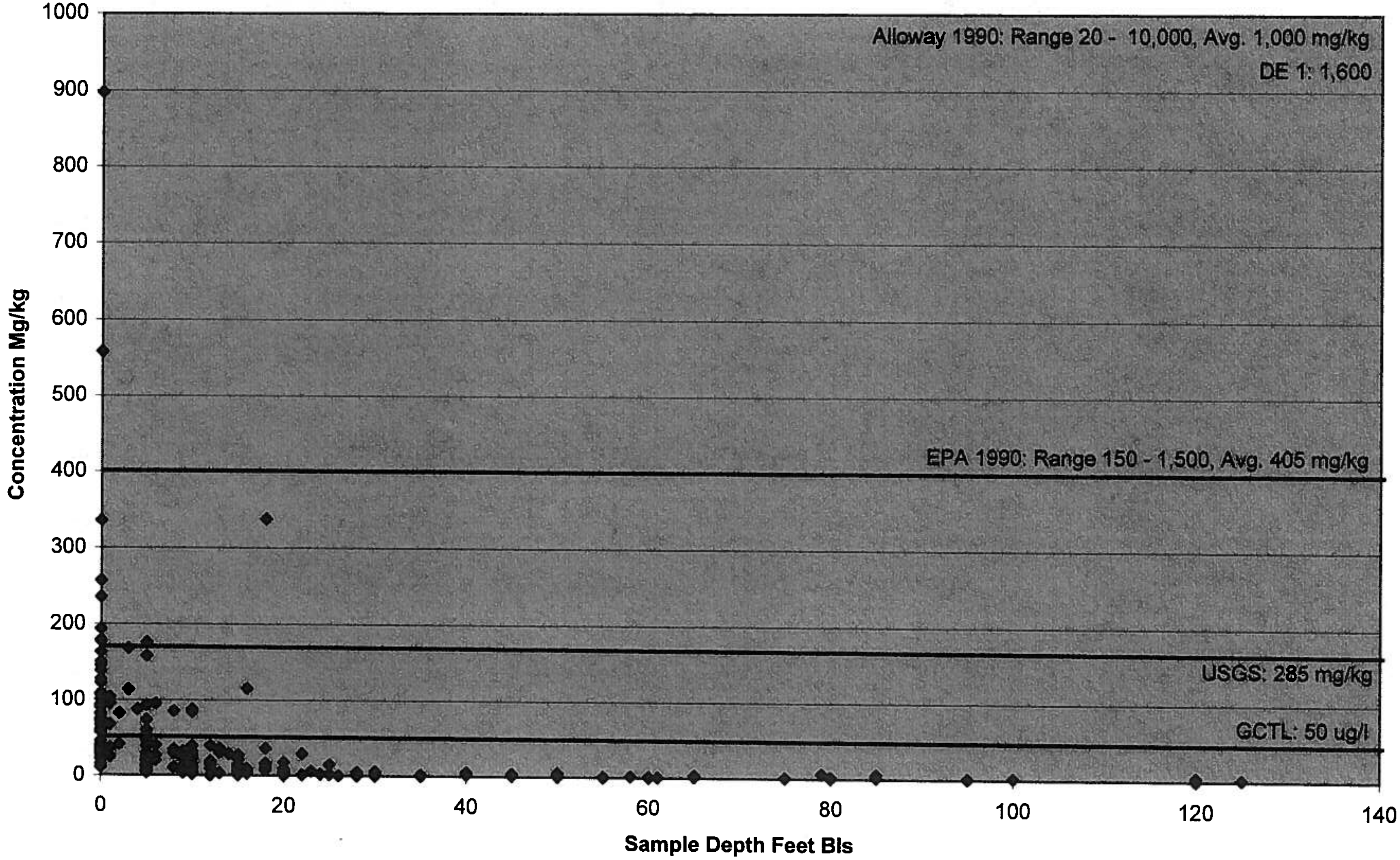
Groundwater 2: Iron in Groundwater Basewide



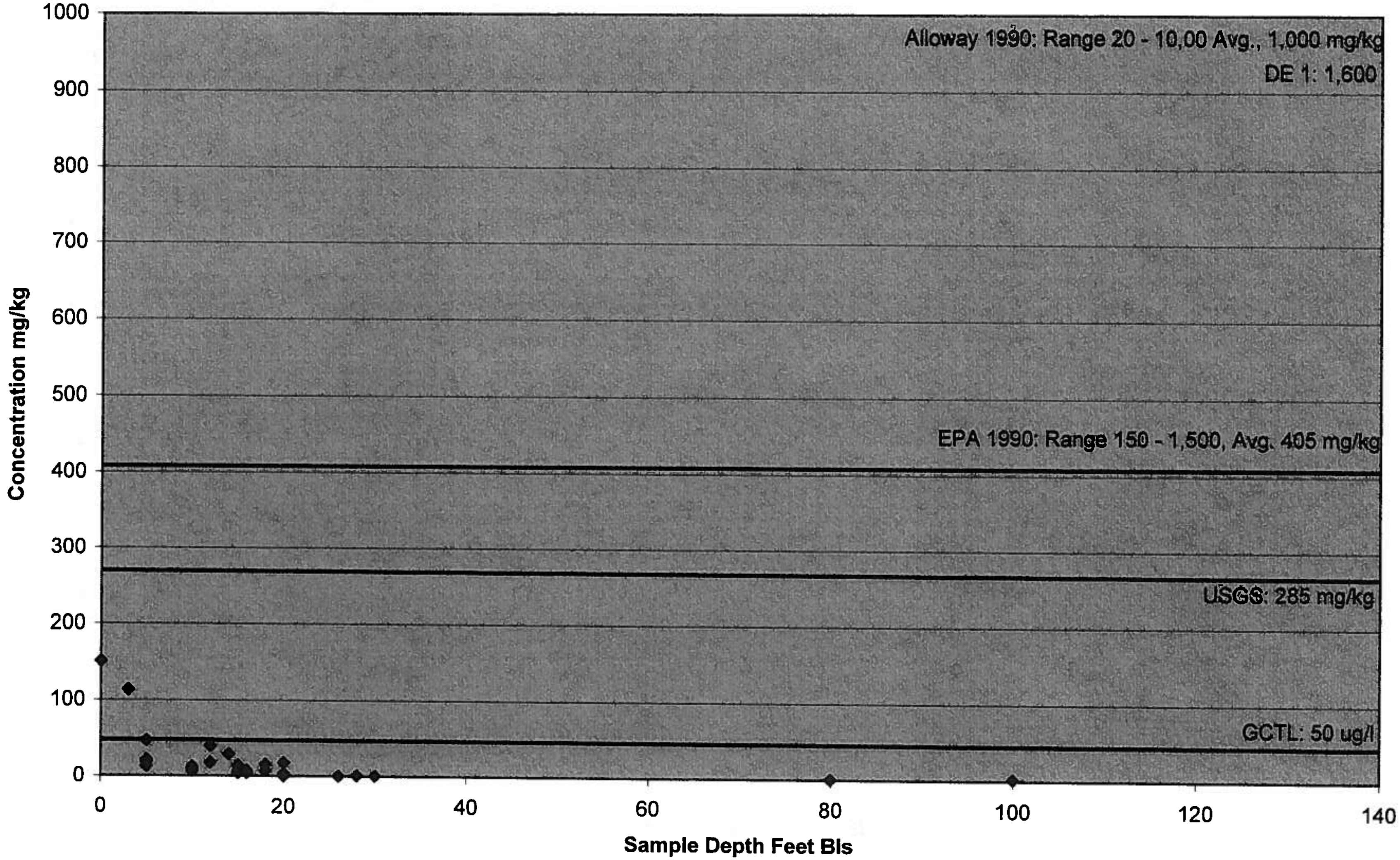
Soil 1: Manganese Background



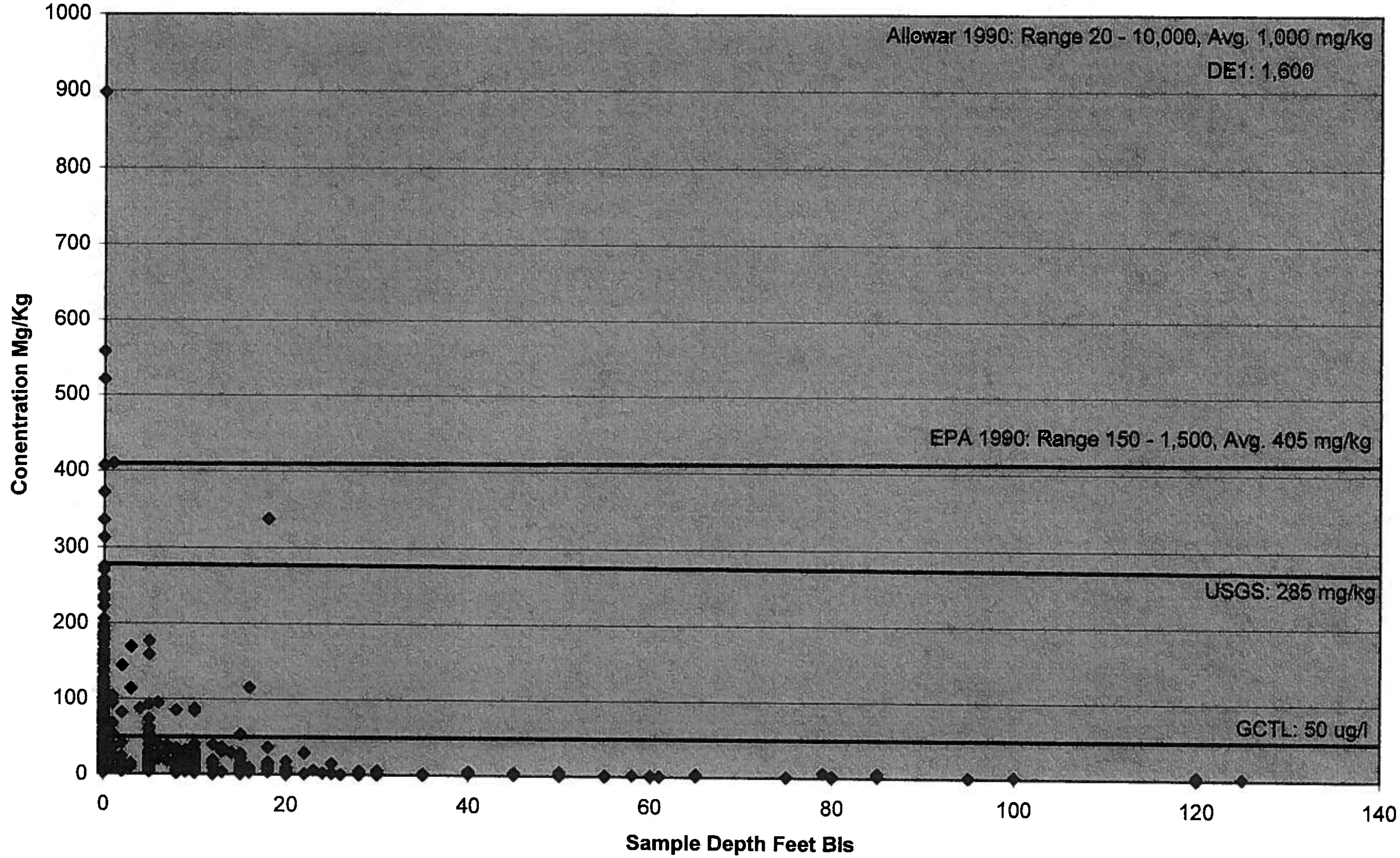
Soil 2: Manganese Specific Sites



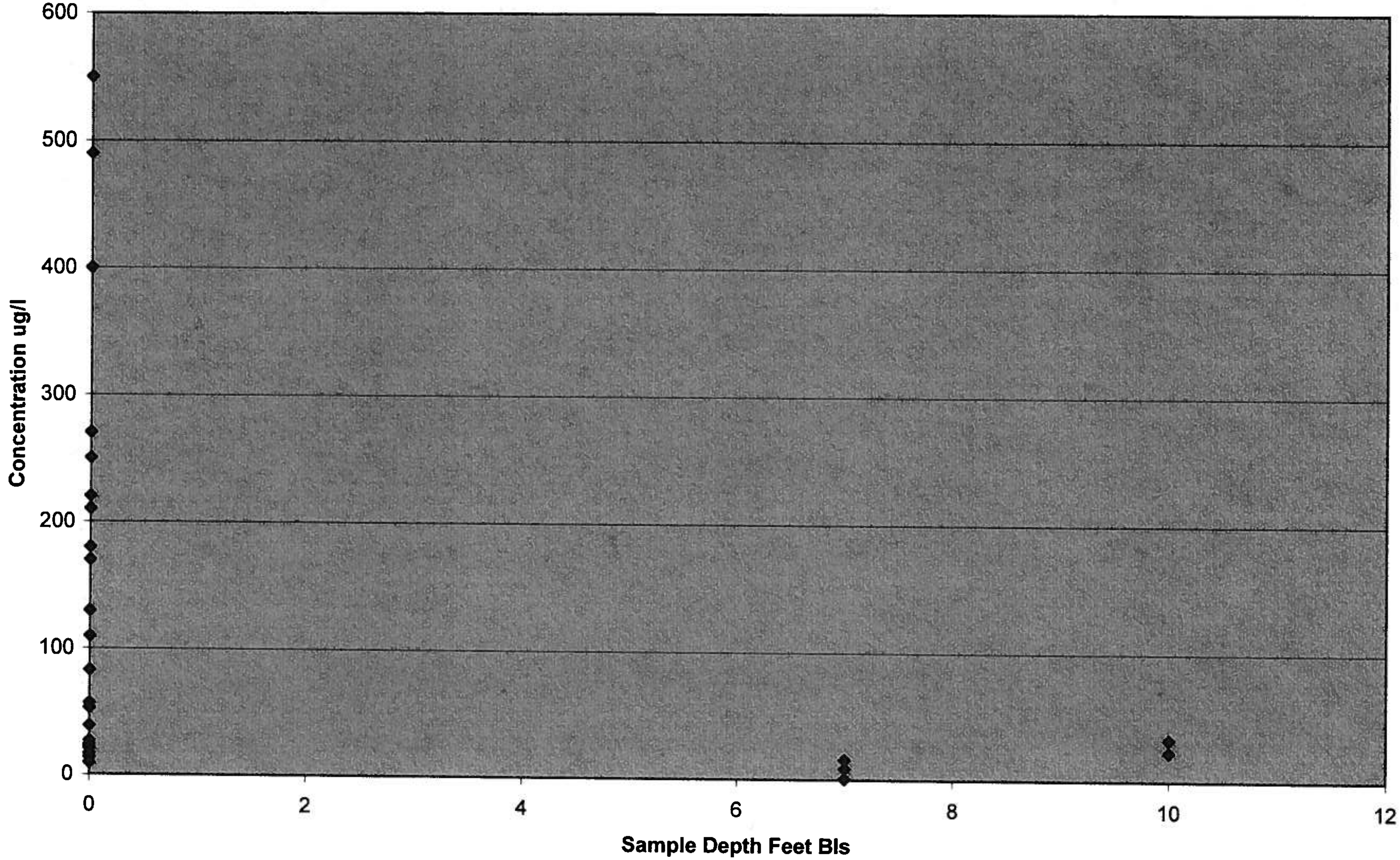
Soil 3: Manganese Detected in Clean Samples



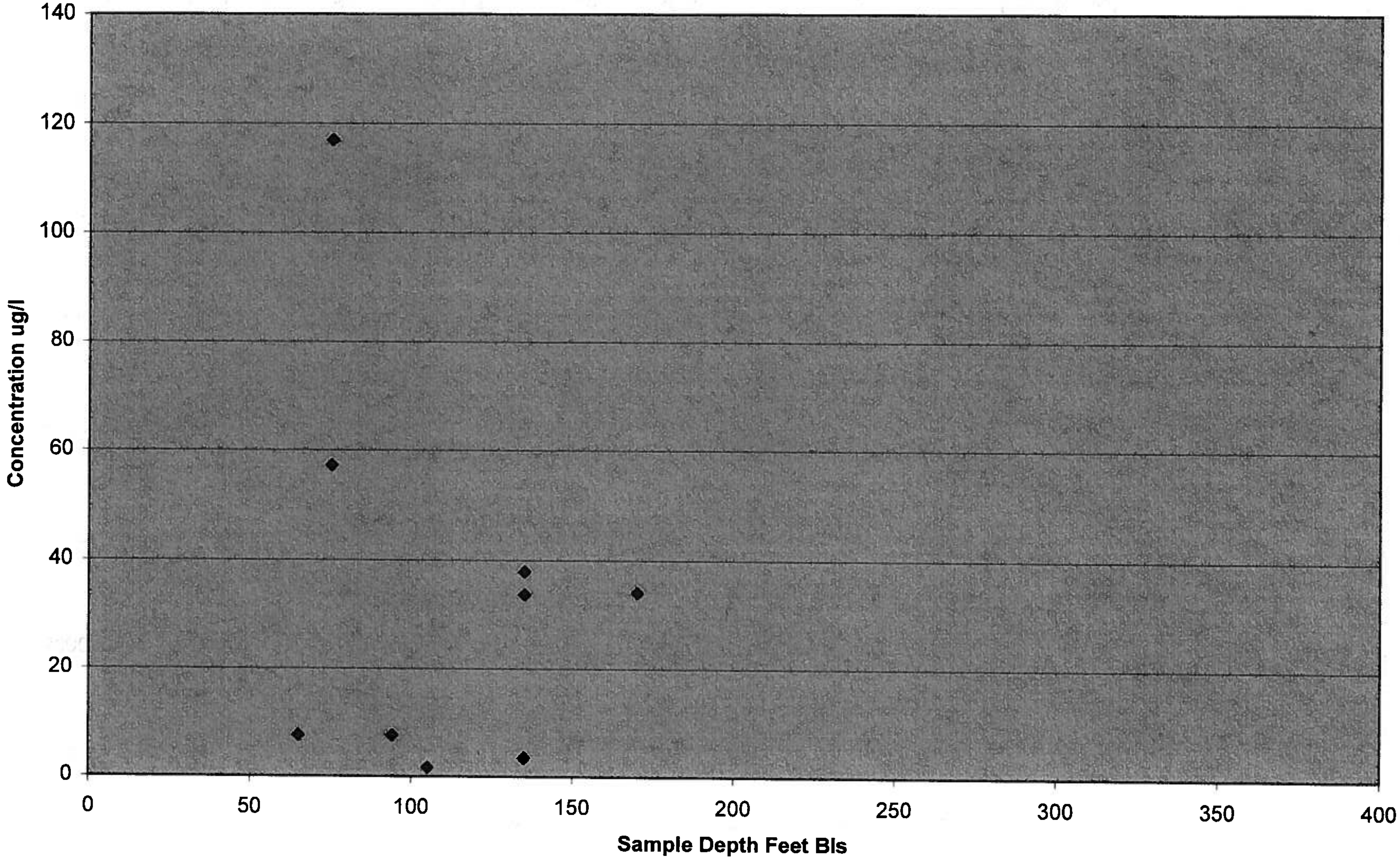
Soil 4: Basewide Manganese



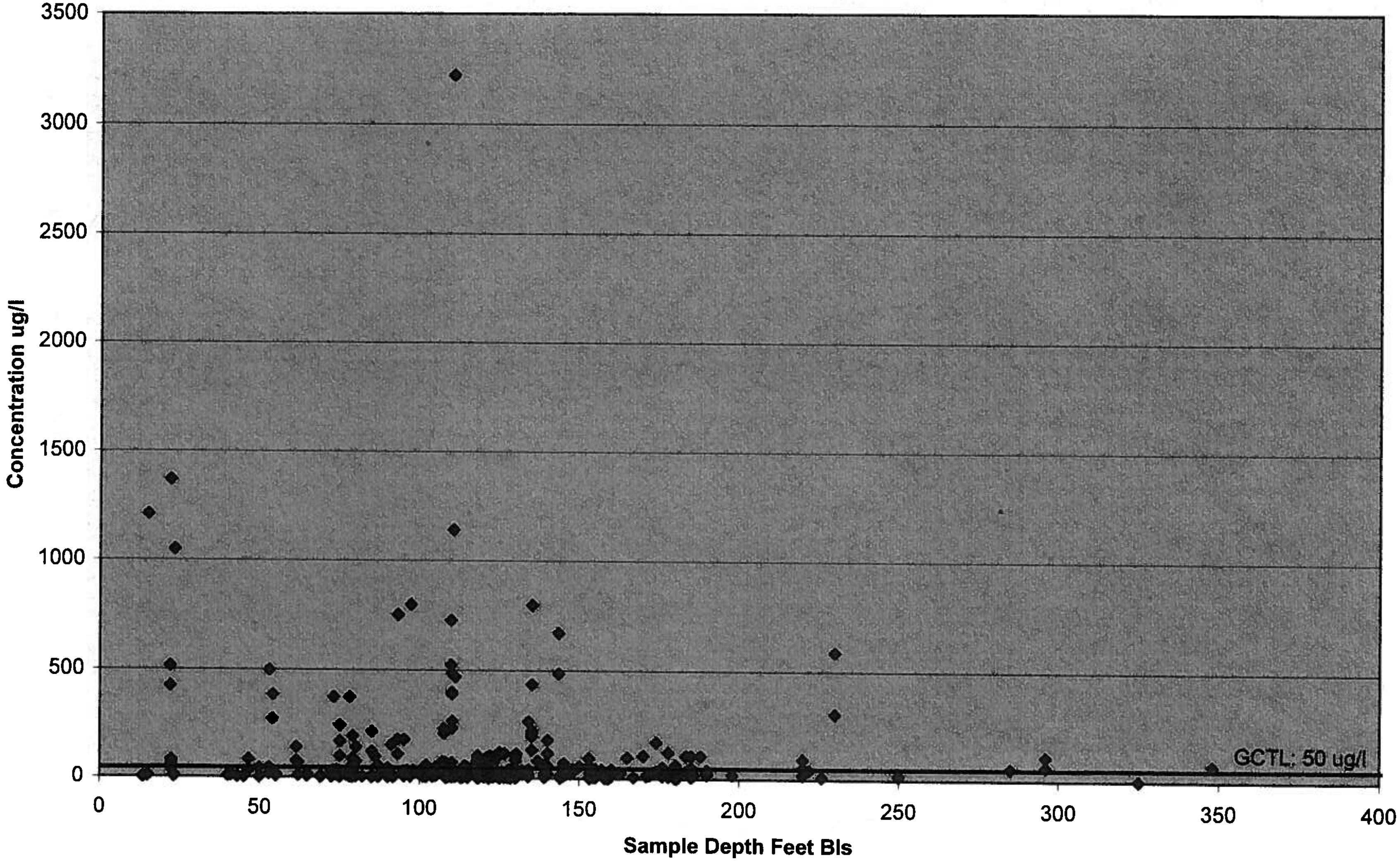
Leachate 1: Manganese



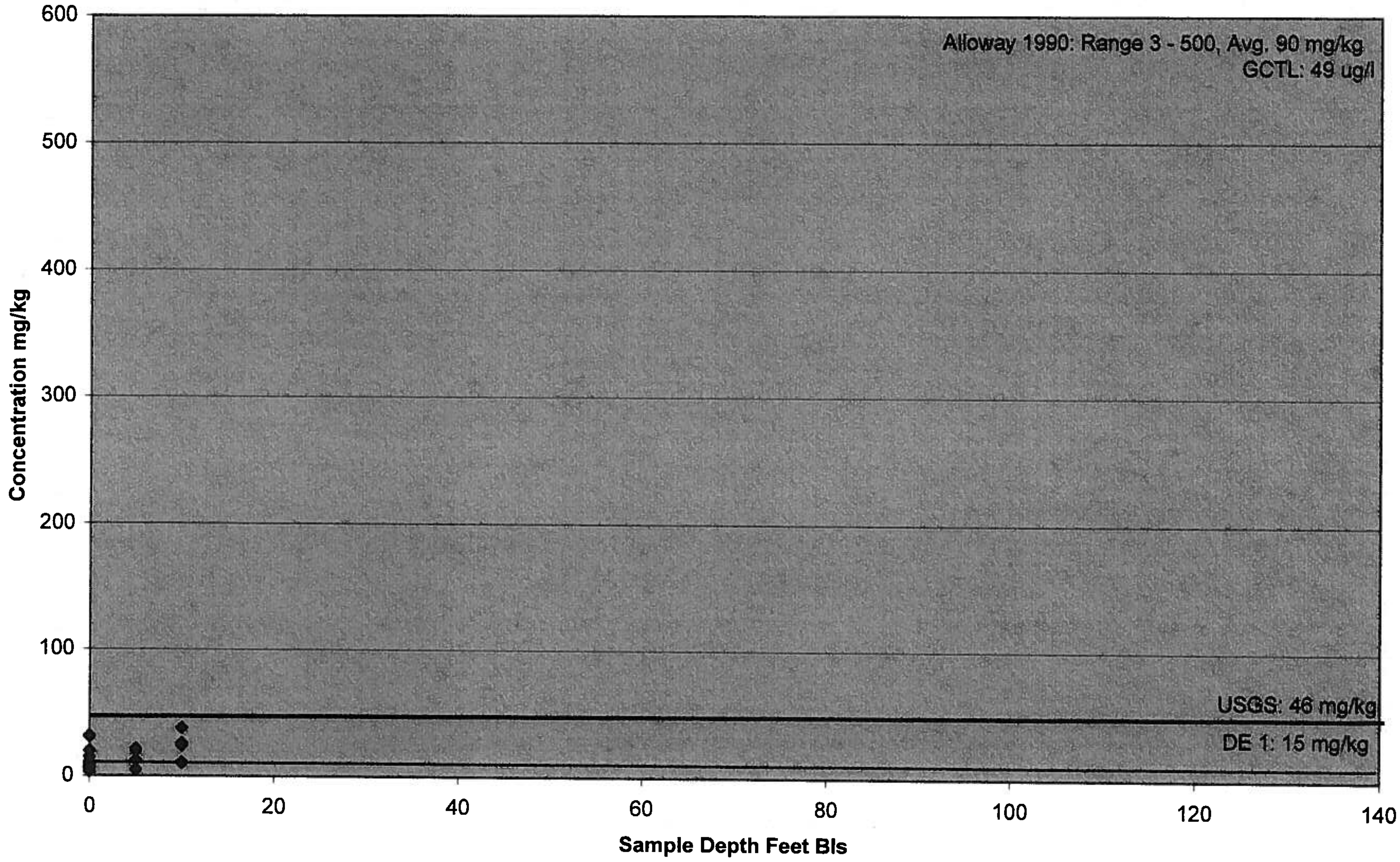
Groundwater 1: Manganese in Background Groundwater



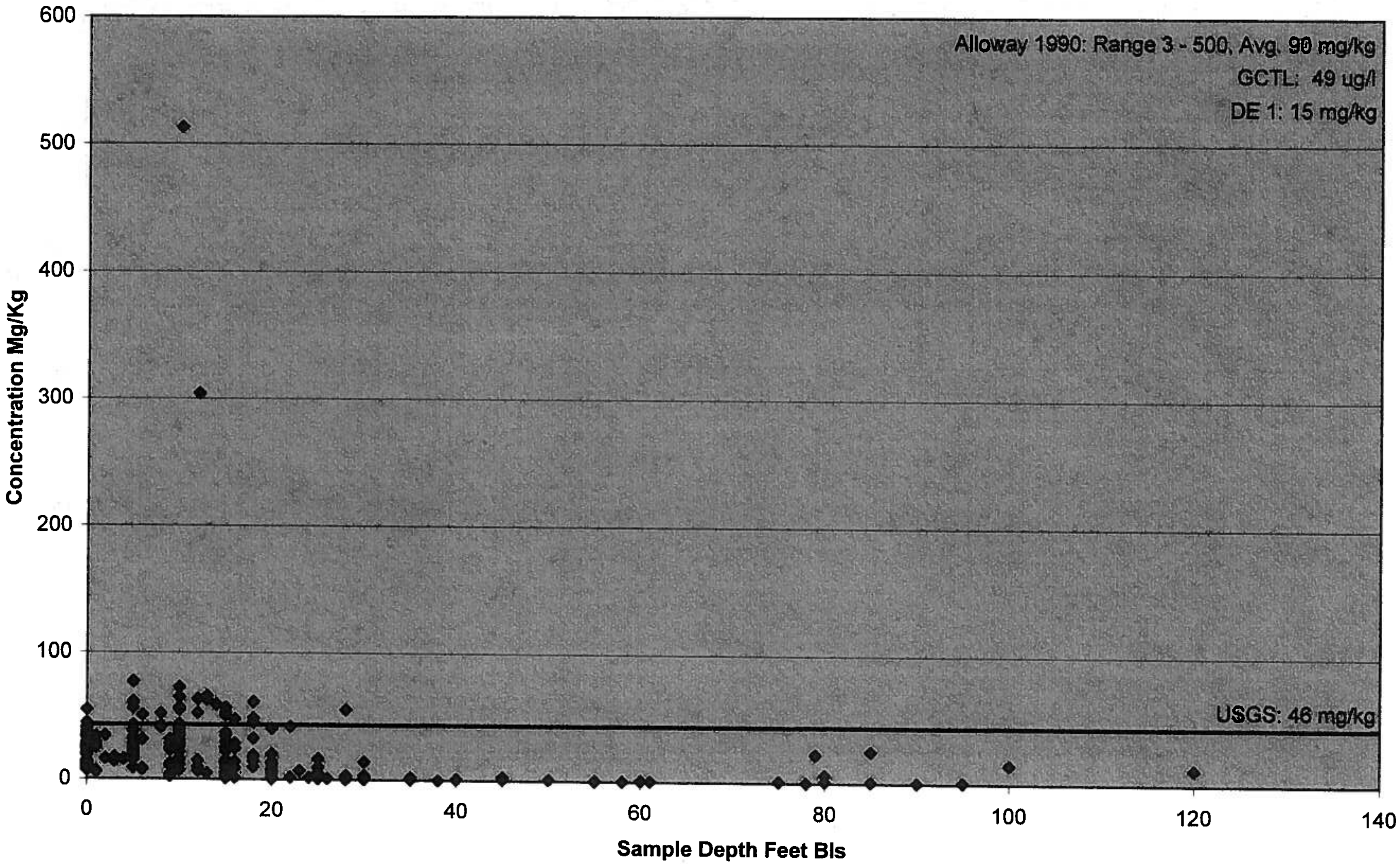
Groundwater 2: Manganese in Groundwater Basewide



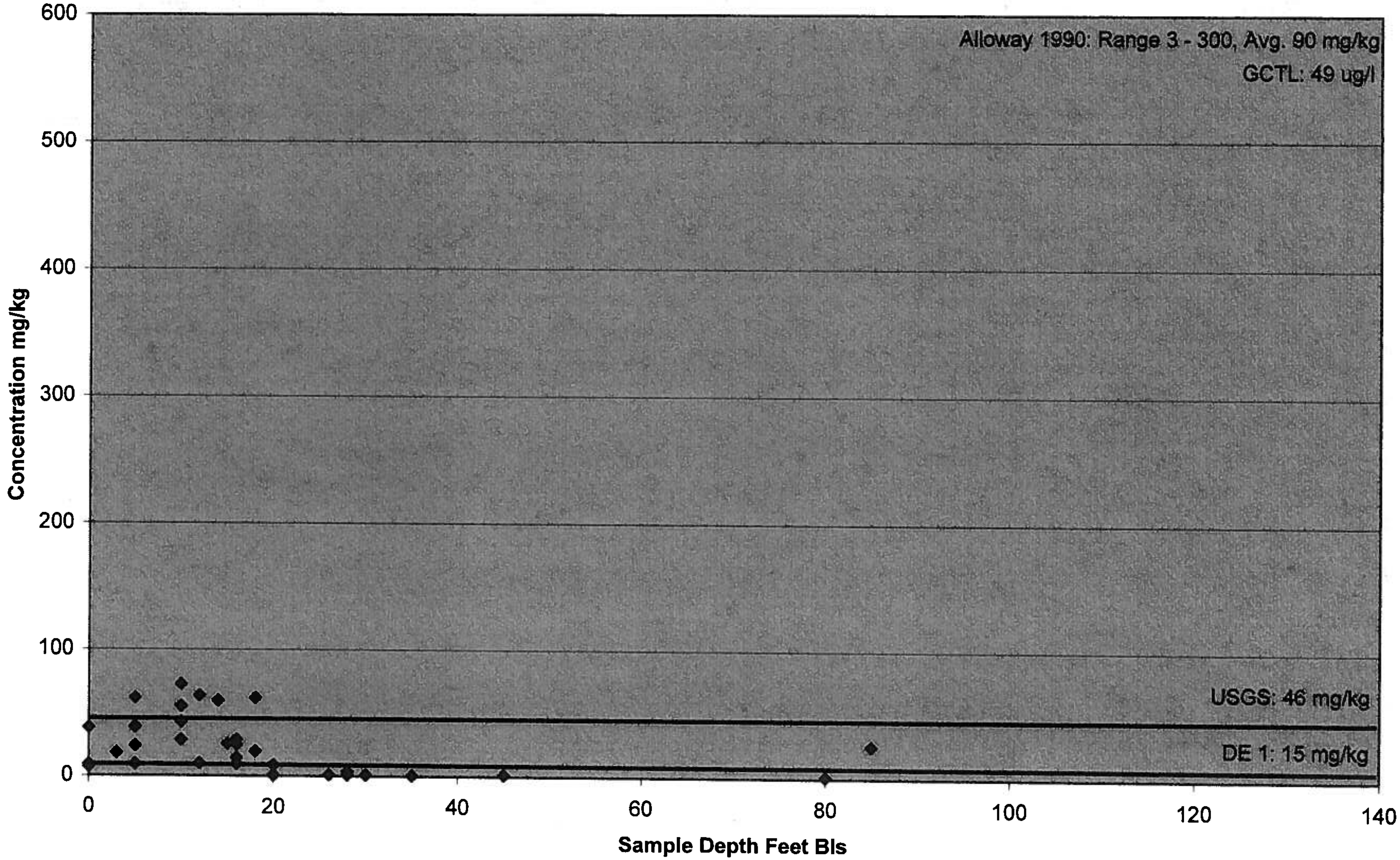
Soil 1: Vanadium Background



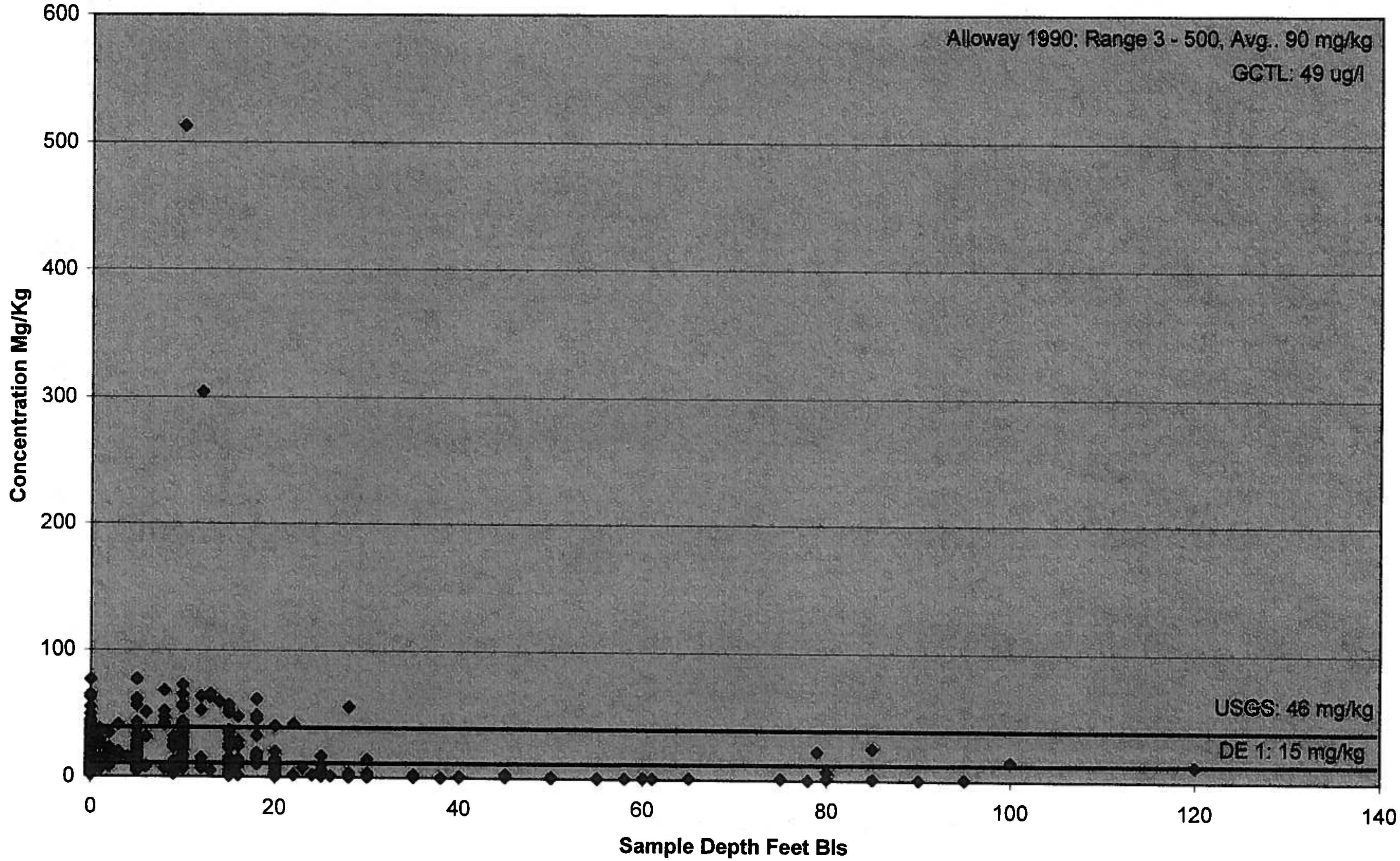
Soil 2: Vanadium Specific Sites



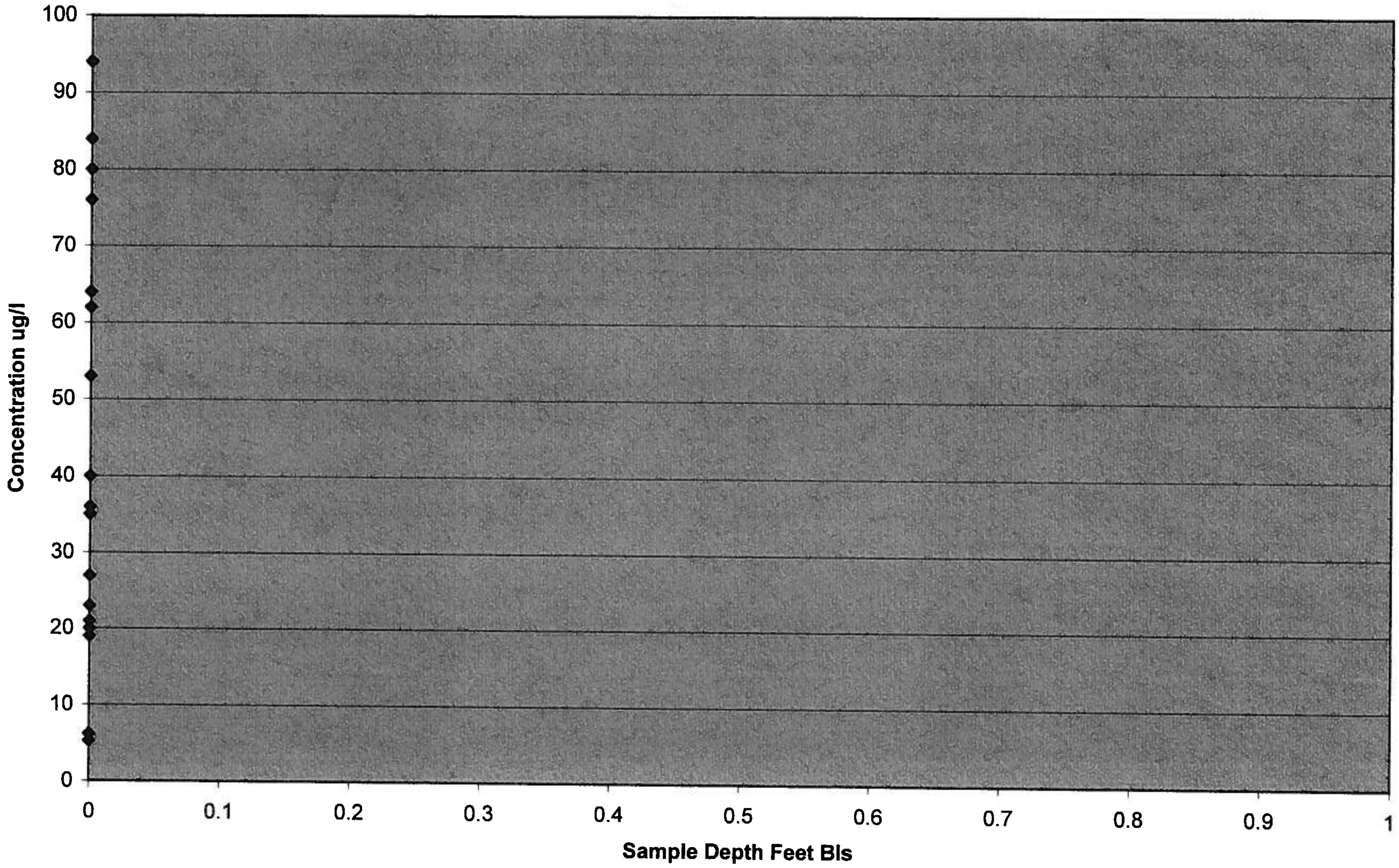
Soil 3: Vanadium Detected in Clean Samples



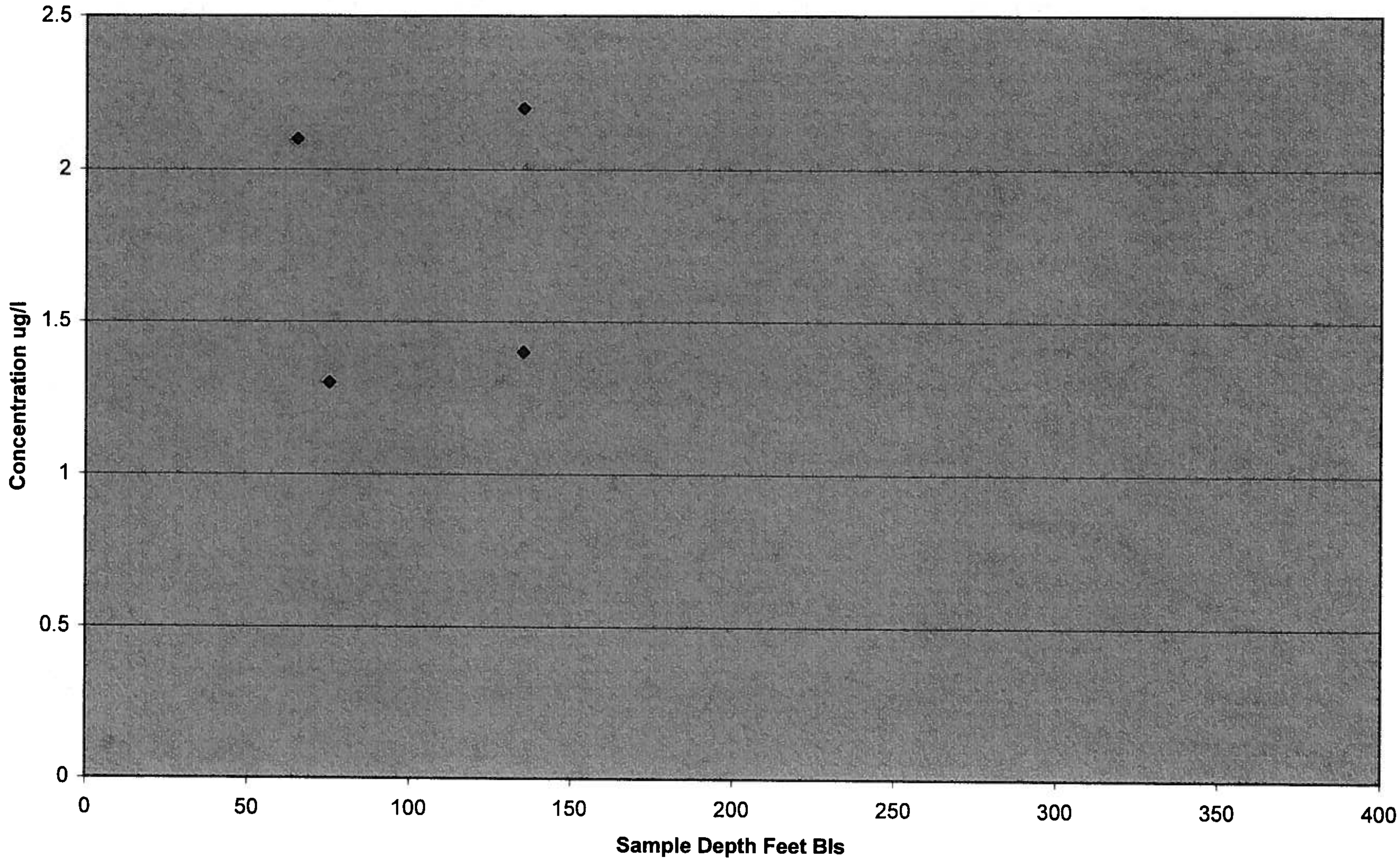
Soil 4: Basewide Vanadium



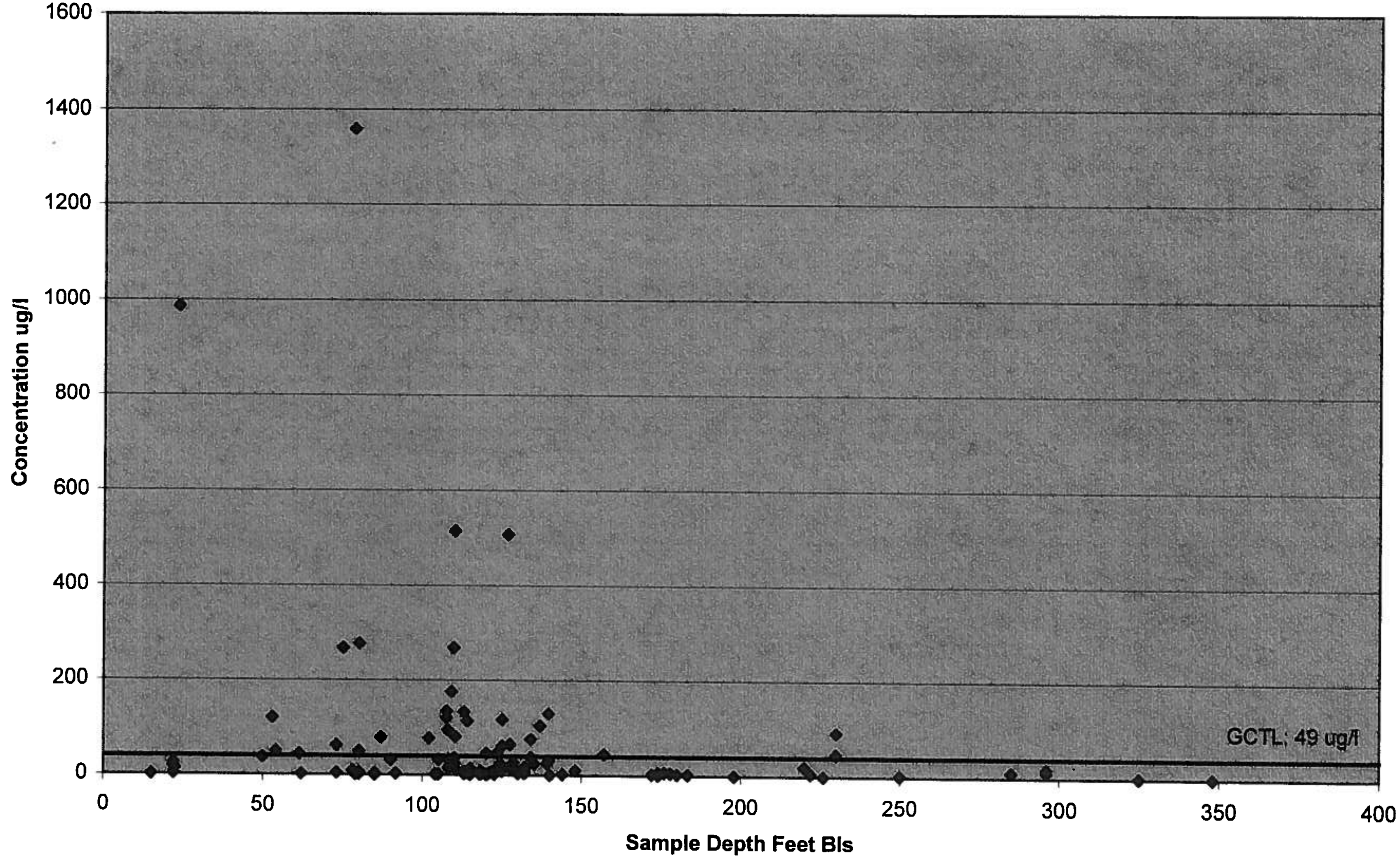
Leachate 1: Vanadium



Groundwater 1: Vanadium in Background Groundwater



Groundwater 2: Vanadium in Groundwater Basewide



APPENDIX C

VALIDATED DETECTIONS ANALYTICAL REPORT

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CD00510	1485CD00605	1485CD00705	1485CD00810	WHF-1485C-3104	WHF-41-SS-31-4	WHF-41-SS-31-5	WHF-41-SS-31-6	WHF-41-SS-43-4
sample_dat	20000605	20000605	20000605	20000605	20031111	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	8	3	3	8	3	3	4	5	3
bottom depth	10	5	5	10	4	4	5	6	4
Volatile Organics (mg/kg)									
2-BUTANONE	0.011 U	0.01 U	0.0093 U	0.011 U					
ACETONE	0.053 U	0.052 U	0.046 U	0.054 U					
Semivolatile Organics (mg/kg)									
4-NITROANILINE	0.40 U	0.37 U	0.38 U	0.41 U					
ANTHRACENE	0.40 U	0.37 U	0.38 U	0.41 U					
BAP EQUIVALENT	0.4 U	0.37 U	0.38 U	0.41 U	0.02	0.0152	0.0128	0.0071	0.0078 U
BENZO(A)ANTHRACENE	0.40 U	0.37 U	0.38 U	0.41 U					
BENZO(A)PYRENE	0.40 U	0.37 U	0.38 U	0.41 U	0.02	0.011	0.0094 J	0.0021 J	0.0078 U
BENZO(B)FLUORANTHENE	0.40 U	0.37 U	0.38 U	0.41 U					
BENZO(G,H,I)PERYLENE	0.40 U	0.37 U	0.38 U	0.41 U					
BENZO(K)FLUORANTHENE	0.40 U	0.37 U	0.38 U	0.41 U					
CARBAZOLE	0.40 U	0.37 U	0.38 U	0.41 U					
CHRYSENE	0.40 U	0.37 U	0.38 U	0.41 U					
DIBENZO(A,H)ANTHRACENE	0.40 U	0.37 U	0.38 U	0.41 U		0.0042 J	0.0034 J	0.01 U	0.0078 U
FLUORANTHENE	0.40 U	0.37 U	0.38 U	0.41 U					
FLUORENE	0.40 U	0.37 U	0.38 U	0.41 U					
INDENO(1,2,3-CD)PYRENE	0.40 U	0.37 U	0.38 U	0.41 U					
PHENANTHRENE	0.40 U	0.37 U	0.38 U	0.41 U					
PYRENE	0.40 U	0.37 U	0.38 U	0.41 U					
Pesticides/PCBs (mg/kg)									
4,4'-DDD	0.004 U	0.0037 U	0.0038 U	0.0041 U					
4,4'-DDE	0.004 U	0.0037 U	0.0038 U	0.0041 U					
4,4'-DDT	0.004 U	0.0037 U	0.0038 U	0.0041 U					
ALDRIN	0.002 U	0.0018 U	0.0019 U	0.0021 U					
ALPHA-CHLORDANE	0.004 U	0.0037 U	0.0038 U	0.0041 U		0.00206 U	0.0026 U	0.00256 U	0.00196 U
BETA-BHC	0.002 U	0.0018 U	0.0019 U	0.0021 U					
DIELDRIN	0.002 U	0.0018 U	0.0019 U	0.0021 U					
ENDOSULFAN II	0.004 U	0.0037 U	0.0038 U	0.0041 U		0.00411 U	0.0052 U	0.00512 U	0.0148 J
ENDRIN	0.004 U	0.0037 U	0.0038 U	0.0041 U					
ENDRIN KETONE	0.004 U	0.0037 U	0.0038 U	0.0041 U					
GAMMA-CHLORDANE	0.004 U	0.0037 U	0.0038 U	0.0041 U					
HEPTACHLOR EPOXIDE	0.002 U	0.0018 U	0.0019 U	0.0021 U					
Inorganics (mg/kg)									
ALUMINUM	33900	15500	34200	37400					
ANTIMONY	0.32 U	0.28 U	0.26 UJ	0.28 UJ					
ARSENIC	5.6	1	1.7	3.6					
BARIUM	4.6	9.9	22.2	7.2					
CADMIUM	0.04 UJ	0.04 U	0.04 UJ	0.04 UJ					
CALCIUM	445	116	376	132					
CHROMIUM	27.6	12.4	26.7	37.3					
COBALT	0.24 U	0.41 U	0.50 U	0.28 U					
COPPER	7.5	5.6	10.3	9.3					
IRON	21800	8270	14300	26700					
LEAD	1.1 J	2.4	4.3 J	1.8 J					
MAGNESIUM	31.2	116	192	43.7					
MANGANESE	1.8 J	14	10.3	4.7 J					
MERCURY	0.03 U	0.02 U	0.09 U	0.08 U					
NICKEL	0.70 U	1.7	2.8 J	0.92 J					
POTASSIUM	100 U	160	289	133 U					

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CD00510	1485CD00605	1485CD00705	1485CD00810	WHF-1485C-3104	WHF-41-SS-31-4	WHF-41-SS-31-5	WHF-41-SS-31-6	WHF-41-SS-43-4
sample_dat	20000605	20000605	20000605	20000605	20031111	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	8	3	3	8	3	3	4	5	3
bottom depth	10	5	5	10	4	4	5	6	4
SELENIUM	2.7 U	1.8 U	4.8 J	2.6 U					
SODIUM	97.4 J	95.7	99.5 J	115 J					
VANADIUM	47.2	19.9	41.3	68.1					
ZINC	4.3	8.1	10.7	4.5					
Miscellaneous Parameters (mg/kg)									
CYANIDE	0.60 U	0.55 U	0.57 U	1.8 J					
PERCENT SOLIDS (%)					76.6 %	81 %	64 %	65 %	85 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS	9.9 U	9.2 U	9.4 U	10 U					
SPLP Inorganics (ug/L)									
ALUMINUM	30 U	30 U	30 U	30 U					
BARIUM	2.5 U	1.2 U	2 U	1.1 U					
CALCIUM	3100	1000 U	2800	650 U					
CHROMIUM	0.64 U	0.64 U	0.64 U	0.64 U					
COPPER	0.75 U	0.75 U	0.75 U	0.75 U					
IRON	32 U	32 U	32 U	32 U					
LEAD	1.6 U	1.6 U	1.6 U	1.6 U					
MAGNESIUM	120 U	180 U	95 U	120 U					
MANGANESE	0.16 U	2.9 U	0.28 U	2.3 U					
MERCURY	1.3	0.60 U	0.72	0.60 U					
NICKEL	1 U	1 U	1 U	1.6 U					
POTASSIUM	820 U	1800 U	1300 U	1100 U					
SODIUM	310 U	480 U	290 U	540 U					
VANADIUM	0.72 U	0.72 U	0.72 U	0.72 U					
ZINC	0.83 U	0.83 U	0.83 U	0.83 U					

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-43-5	WHF-41-SS-43-6	WHF-148SC-SS-0902	WHF-148SC-SS-2101	WHF-148SC-SS-2102	WHF-148SC-SS-2201	WHF-148SC-SS-2202	WHF-148SC-SS-2301
sample_dat	20040831	20040831	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	4	5	1	0	1	0	1	0
bottom depth	5	6	2	1	2	1	2	1
Volatile Organics (mg/kg)								
2-BUTANONE								
ACETONE								
Semivolatile Organics (mg/kg)								
4-NITROANILINE								
ANTHRACENE								
BAP EQUIVALENT	0.00715	0.0064	0.0071 U	0.019	0.008	0.024	0.0071 U	0.0082
BENZO(A)ANTHRACENE								
BENZO(A)PYRENE	0.0032 J	0.004 J	0.0071 U	0.019	0.008	0.024	0.0071 U	0.0082
BENZO(B)FLUORANTHENE								
BENZO(G,H,I)PERYLENE								
BENZO(K)FLUORANTHENE								
CARBAZOLE								
CHRYSENE								
DIBENZO(A,H)ANTHRACENE	0.0079 U	0.0024 J						
FLUORANTHENE								
FLUORENE								
INDENO(1,2,3-CD)PYRENE								
PHENANTHRENE								
PYRENE								
Pesticides/PCBs (mg/kg)								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
ALDRIN	0.00198 U	0.00245 U						
ALPHA-CHLORDANE								
BETA-BHC								
DIELDRIN	0.0156	0.154						
ENDOSULFAN II								
ENDRIN								
ENDRIN KETONE								
GAMMA-CHLORDANE								
HEPTACHLOR EPOXIDE								
Inorganics (mg/kg)								
ALUMINUM								
ANTIMONY								
ARSENIC								
BARIUM								
CADMIUM								
CALCIUM								
CHROMIUM								
COBALT								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-43-5	WHF-41-SS-43-6	WHF-148SC-SS-0902	WHF-148SC-SS-2101	WHF-148SC-SS-2102	WHF-148SC-SS-2201	WHF-148SC-SS-2202	WHF-148SC-SS-2301
sample_dat	20040831	20040831	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	4	5	1	0	1	0	1	0
bottom depth	5	6	2	1	2	1	2	1
SELENIUM								
SODIUM								
VANADIUM								
ZINC								
Miscellaneous Parameters (mg/kg)								
CYANIDE								
PERCENT SOLIDS (%)	84 %	68 %	94.7 %	93.1 %	92.9 %	93.8 %	93.7 %	93.5 %
Petroleum Hydrocarbons (mg/kg)								
TOTAL PETROLEUHYDROCARBONS								
SPLP Inorganics (ug/L)								
ALUMINUM								
BARIUM								
CALCIUM								
CHROMIUM								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								
SODIUM								
VANADIUM								
ZINC								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-2302	WHF-148SC-SS-2401	WHF-148SC-SS-2402	WHF-148SC-SS-2501	WHF-148SC-SS-2502	WHF-148SC-SS-2601	WHF-148SC-SS-2602	WHF-148SC-SS-2701
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	0	1	0	1	0	1	0
bottom depth	2	1	2	1	2	1	2	1
Volatile Organics (mg/kg)								
2-BUTANONE								
ACETONE								
Semivolatile Organics (mg/kg)								
4-NITROANILINE								
ANTHRACENE								
BAP EQUIVALENT	0.0071 U	0.03	0.0072 U	0.034	0.0071 U	0.11	0.0054	0.076
BENZO(A)ANTHRACENE								
BENZO(A)PYRENE	0.0071 U	0.03	0.0072 U	0.034	0.0071 U	0.11	0.0054 J	0.076
BENZO(B)FLUORANTHENE								
BENZO(G,H,I)PERYLENE								
BENZO(K)FLUORANTHENE								
CARBAZOLE								
CHRYSENE								
DIBENZO(A,H)ANTHRACENE								
FLUORANTHENE								
FLUORENE								
INDENO(1,2,3-CD)PYRENE								
PHENANTHRENE								
PYRENE								
Pesticides/PCBs (mg/kg)								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
ALDRIN								
ALPHA-CHLORDANE								
BETA-BHC								
DIELDRIN								
ENDOSULFAN II								
ENDRIN								
ENDRIN KETONE								
GAMMA-CHLORDANE								
HEPTACHLOR EPOXIDE								
Inorganics (mg/kg)								
ALUMINUM								
ANTIMONY								
ARSENIC								
BARIUM								
CADMIUM								
CALCIUM								
CHROMIUM								
COBALT								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-2302	WHF-148SC-SS-2401	WHF-148SC-SS-2402	WHF-148SC-SS-2501	WHF-148SC-SS-2502	WHF-148SC-SS-2601	WHF-148SC-SS-2602	WHF-148SC-SS-2701
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	0	1	0	1	0	1	0
bottom depth	2	1	2	1	2	1	2	1
SELENIUM								
SODIUM								
VANADIUM								
ZINC								
Miscellaneous Parameters (mg/kg)								
CYANIDE								
PERCENT SOLIDS (%)	94.2 %	92.1 %	93.2 %	93.8 %	94.7 %	93.8 %	94.8 %	93.7 %
Petroleum Hydrocarbons (mg/kg)								
TOTAL PETROLEUHYDROCARBONS								
SPLP Inorganics (ug/L)								
ALUMINUM								
BARIUM								
CALCIUM								
CHROMIUM								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								
SODIUM								
VANADIUM								
ZINC								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-2702	WHF-148SC-SS-2801	WHF-148SC-SS-2802	WHF-148SC-SS-2901	WHF-148SC-SS-2902	WHF-148SC-SS-3001	WHF-148SC-SS-3002	WHF-148SC-SS-3101
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	0	1	0	1	0	1	0
bottom depth	2	1	2	1	2	1	2	1
Volatile Organics (mg/kg)								
2-BUTANONE								
ACETONE								
Semivolatile Organics (mg/kg)								
4-NITROANILINE								
ANTHRACENE								
BAP EQUIVALENT	0.0057	0.029	0.0026	0.24	0.007 U	0.29	0.011	9
BENZO(A)ANTHRACENE								
BENZO(A)PYRENE	0.0057 J	0.029	0.0026 J	0.24 J	0.007 U	0.29	0.011	9
BENZO(B)FLUORANTHENE								
BENZO(G,H,I)PERYLENE								
BENZO(K)FLUORANTHENE								
CARBAZOLE								
CHRYSENE								
DIBENZO(A,H)ANTHRACENE								
FLUORANTHENE								
FLUORENE								
INDENO(1,2,3-CD)PYRENE								
PHENANTHRENE								
PYRENE								
Pesticides/PCBs (mg/kg)								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
ALDRIN								
ALPHA-CHLORDANE								
BETA-BHC								
DIELDRIN								
ENDOSULFAN II								
ENDRIN								
ENDRIN KETONE								
GAMMA-CHLORDANE								
HEPTACHLOR EPOXIDE								
Inorganics (mg/kg)								
ALUMINUM								
ANTIMONY								
ARSENIC								
BARIUM								
CADMIUM								
CALCIUM								
CHROMIUM								
COBALT								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-2702	WHF-148SC-SS-2801	WHF-148SC-SS-2802	WHF-148SC-SS-2901	WHF-148SC-SS-2902	WHF-148SC-SS-3001	WHF-148SC-SS-3002	WHF-148SC-SS-3101
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031016
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	0	1	0	1	0	1	0
bottom depth	2	1	2	1	2	1	2	1
SELENIUM								
SODIUM								
VANADIUM								
ZINC								
Miscellaneous Parameters (mg/kg)								
CYANIDE								
PERCENT SOLIDS (%)	94.5 %	93.9 %	95 %	93.5 %	95.2 %	93.8 %	94.6 %	90.3 %
Petroleum Hydrocarbons (mg/kg)								
TOTAL PETROLEUHYDROCARBONS								
SPLP Inorganics (ug/L)								
ALUMINUM								
BARIUM								
CALCIUM								
CHROMIUM								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								
SODIUM								
VANADIUM								
ZINC								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-3102	WHF-148SC-SS-3103	WHF-148SC-SS-3201	WHF-148SC-SS-3202	WHF-148SC-SS-3301	WHF-148SC-SS-3302	WHF-148SC-SS-3303	WHF-1485C-3401
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	0	1	2	0
bottom depth	2	3	1	2	1	2	3	1
Volatile Organics (mg/kg)								
2-BUTANONE								
ACETONE								
Semivolatile Organics (mg/kg)								
4-NITROANILINE								
ANTHRACENE								
BAP EQUIVALENT	0.4	0.26	0.88	0.02	0.057	0.092	0.018	0.034
BENZO(A)ANTHRACENE								
BENZO(A)PYRENE	0.4	0.26	0.88	0.02	0.057	0.092	0.018	0.034
BENZO(B)FLUORANTHENE								
BENZO(G,H,I)PERYLENE								
BENZO(K)FLUORANTHENE								
CARBAZOLE								
CHRYSENE								
DIBENZO(A,H)ANTHRACENE								
FLUORANTHENE								
FLUORENE								
INDENO(1,2,3-CD)PYRENE								
PHENANTHRENE								
PYRENE								
Pesticides/PCBs (mg/kg)								
4,4'-DDD								
4,4'-DDE								
4,4'-DDT								
ALDRIN								
ALPHA-CHLORDANE								
BETA-BHC								
DIELDRIN								
ENDOSULFAN II								
ENDRIN								
ENDRIN KETONE								
GAMMA-CHLORDANE								
HEPTACHLOR EPOXIDE								
Inorganics (mg/kg)								
ALUMINUM								
ANTIMONY								
ARSENIC								
BARIUM								
CADMIUM								
CALCIUM								
CHROMIUM								
COBALT								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-148SC-SS-3102	WHF-148SC-SS-3103	WHF-148SC-SS-3201	WHF-148SC-SS-3202	WHF-148SC-SS-3301	WHF-148SC-SS-3302	WHF-148SC-SS-3303	WHF-1485C-3401
sample_dat	20031016	20031016	20031016	20031016	20031016	20031016	20031016	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	0	1	2	0
bottom depth	2	3	1	2	1	2	3	1
SELENIUM								
SODIUM								
VANADIUM								
ZINC								
Miscellaneous Parameters (mg/kg)								
CYANIDE								
PERCENT SOLIDS (%)	95.1 %	94.7 %	91.8 %	94.2 %	94.6 %	95 %	94.5 %	94.8 %
Petroleum Hydrocarbons (mg/kg)								
TOTAL PETROLEUHYDROCARBONS								
SPLP Inorganics (ug/L)								
ALUMINUM								
BARIUM								
CALCIUM								
CHROMIUM								
COPPER								
IRON								
LEAD								
MAGNESIUM								
MANGANESE								
MERCURY								
NICKEL								
POTASSIUM								
SODIUM								
VANADIUM								
ZINC								

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-3402	WHF-1485C-3403	WHF-1485C-3501	WHF-1485C-3502	WHF-1485C-3503	WHF-1485C-3601	WHF-1485C-3602	WHF-1485C-3603	WHF-1485C-3701
sample_dat	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031110
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	2	1
Volatile Organics (mg/kg)									
2-BUTANONE									0.0069 UJ
ACETONE									0.027 UJ
Semivolatile Organics (mg/kg)									
4-NITROANILINE									1.7 U
ANTHRACENE									0.007 U
BAP EQUIVALENT	0.071	0.044	0.036	0.19	0.11	0.018	0.026	0.032	0.057629
BENZO(A)ANTHRACENE									0.02 J
BENZO(A)PYRENE	0.071	0.044	0.036	0.19	0.11	0.018	0.026	0.032	0.036
BENZO(B)FLUORANTHENE									0.038
BENZO(G,H,I)PERYLENE									0.031 J
BENZO(K)FLUORANTHENE									0.02
CARBAZOLE									0.34 U
CHRYSENE									0.029
DIBENZO(A,H)ANTHRACENE									0.012 J
FLUORANTHENE									0.052 J
FLUORENE									0.007 U
INDENO(1,2,3-CD)PYRENE									0.036
PHENANTHRENE									0.016
PYRENE									0.053 J
Pesticides/PCBs (mg/kg)									
4,4'-DDD									0.0018 U
4,4'-DDE									0.0028
4,4'-DDT									0.0021
ALDRIN									0.0018 U
ALPHA-CHLORDANE									0.0018 J
BETA-BHC									0.0018 U
DIELDRIN									0.019
ENDOSULFAN II									0.0018 U
ENDRIN									0.0018 U
ENDRIN KETONE									0.0018 U
GAMMA-CHLORDANE									0.0017 J
HEPTACHLOR EPOXIDE									0.0018 U
Inorganics (mg/kg)									
ALUMINUM									7930
ANTIMONY									0.52
ARSENIC									1.7
BARIUM									11.9
CADMIUM									0.22
CALCIUM									690
CHROMIUM									75 J
COBALT									0.57
COPPER									7
IRON									4850
LEAD									345
MAGNESIUM									179
MANGANESE									57.5
MERCURY									0.035 U
NICKEL									2.1
POTASSIUM									70.9

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-3402	WHF-1485C-3403	WHF-1485C-3501	WHF-1485C-3502	WHF-1485C-3503	WHF-1485C-3601	WHF-1485C-3602	WHF-1485C-3603	WHF-1485C-3701
sample_dat	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031110
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	2	1
SELENIUM									0.24 U
SODIUM									25.5 U
VANADIUM									11.7
ZINC									89.3 J
Miscellaneous Parameters (mg/kg)									
CYANIDE									0.31
PERCENT SOLIDS (%)	95.2 %	94.8 %	94.3 %	94.4 %	94.4 %	94.9 %	95 %	94.5 %	96 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS									9 J
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-3702	WHF-1485C-3703	WHF-1485C-3801	WHF-1485C-3802	WHF-1485C-3803	WHF-1485C-3901	WHF-1485C-3902	WHF-1485C-3903	WHF-1485C-4001
sample_dat	20031110	20031110	20031110	20031110	20031110	20031110	20031110	20031110	20031110
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	3	1
Volatile Organics (mg/kg)									
2-BUTANONE	0.0056 UJ	0.0061 UJ	0.0061 UJ	0.0053 UJ	0.0049 UJ	0.0064 UJ	0.0052 UJ	0.0048 UJ	0.0057 UJ
ACETONE	0.022 U	0.031 U	0.024 UJ	0.021 UJ	0.02 UJ	0.025 UJ	0.021 UJ	0.019 UJ	0.023 UJ
Semivolatile Organics (mg/kg)									
4-NITROANILINE	1.7 U	1.7 UJ	1.7 U	1.7 U	1.7 UJ	1.9 UJ	1.7 U	1.8 UJ	1.7 U
ANTHRACENE	0.0071 U	0.0071 U	0.0073 U	0.007 U	0.0071 U	0.008 U	0.0072 U	0.0074 U	0.0072 U
BAP EQUIVALENT	0.007863	0.006833	0.033148	0.01243	0.0071 U	0.068988	0.006808	0.00827	0.080934
BENZO(A)ANTHRACENE	0.0071 U	0.0071 U	0.011	0.0088	0.0071 U	0.026	0.0072 U	0.0074 U	0.031
BENZO(A)PYRENE	0.0071 U	0.0022 J	0.022	0.008	0.0071 U	0.044	0.0023 J	0.0074 U	0.053
BENZO(B)FLUORANTHENE	0.0021 J	0.0032 J	0.022	0.011	0.0071 U	0.047	0.0029 J	0.0028 J	0.055
BENZO(G,H,I)PERYLENE	0.0017 J	0.0055 J	0.021 J	0.0059 J	0.0071 U	0.034 J	0.0023 J	0.0019 J	0.045 J
BENZO(K)FLUORANTHENE	0.0071 U	0.0015 J	0.013 J	0.0057 J	0.0071 U	0.025	0.0072 U	0.0074 U	0.029
CARBAZOLE	0.35 U	0.35 UJ	0.36 U	0.35 U	0.35 UJ	0.40 UJ	0.35 U	0.36 UJ	0.36 U
CHRYSENE	0.0071 U	0.0031 J	0.018	0.013	0.0071 U	0.038	0.002 J	0.0074 U	0.044
DIBENZO(A,H)ANTHRACENE	0.0071 U	0.0071 U	0.0057 J	0.0017 J	0.0071 U	0.013 J	0.0072 U	0.0074 U	0.014 J
FLUORANTHENE	0.0022 J	0.0051 J	0.041 J	0.021	0.0071 U	0.068	0.0032 J	0.0016 J	0.097
FLUORENE	0.0071 U	0.0071 U	0.0073 U	0.007 U	0.0071 U	0.008 U	0.0072 U	0.0074 U	0.0072 U
INDENO(1,2,3-CD)PYRENE	0.0016 J	0.0039 J	0.02	0.0068 J	0.0071 U	0.044	0.0022 J	0.0018 J	0.05
PHENANTHRENE	0.0071 U	0.0016 J	0.0088	0.004 J	0.0071 U	0.016	0.0072 U	0.0074 U	0.024
PYRENE	0.0017 J	0.0036 J	0.032 J	0.02	0.0071 U	0.065	0.0031 J	0.0074 U	0.079
Pesticides/PCBs (mg/kg)									
4,4'-DDD	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.0017 J	0.0018 U	0.0019 U	0.37 U
4,4'-DDE	0.0002 J	0.0018 U	0.0023	0.0018 U	0.0018 U	0.023	0.00034 J	0.0019 U	0.056 R
4,4'-DDT	0.0018 U	0.0018 U	0.0024	0.0018 U	0.0018 U	0.0049	0.0018 U	0.0019 U	0.37 U
ALDRIN	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.00043 J	0.0018 U	0.0019 U	0.37 U
ALPHA-CHLORDANE	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.015	0.0018 U	0.0019 U	0.61
BETA-BHC	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.002 U	0.0018 U	0.0019 U	0.37 U
DIELDRIN	0.0025	0.0018 U	0.0013 J	0.0018 U	0.0018 U	0.036	0.0018 U	0.0019 U	0.34 J
ENDOSULFAN II	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.002 U	0.0018 U	0.0019 U	0.37 U
ENDRIN	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.0004 J	0.0018 U	0.0019 U	0.37 U
ENDRIN KETONE	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.002 U	0.0018 U	0.0019 U	0.37 U
GAMMA-CHLORDANE	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.0087 R	0.0018 U	0.0019 U	0.56
HEPTACHLOR EPOXIDE	0.0018 U	0.0018 U	0.0019 U	0.0018 U	0.0018 U	0.0028 J	0.0018 U	0.0019 U	0.10 R
Inorganics (mg/kg)									
ALUMINUM	6120	7320	9740	5480	5670	9670	8550	16400	9100
ANTIMONY	0.22 U	0.22 U	0.23 U	0.22 U	0.22 U	0.25 U	0.23 U	0.23 U	0.26
ARSENIC	1.1	1.3	1.6	0.98	0.99	2	1.2	2.9	1.8
BARIUM	10.8	11.1	13.3	9.8	9.5	14.1	11.4	12.7	62.2
CADMIUM	0.04 U	0.041 U	0.041 U	0.04 U	0.04 U	0.047	0.041 U	0.042 U	0.075
CALCIUM	355	320	1510	409	238	1230	613	423	1480
CHROMIUM	5.1 J	6.6 J	8.9 J	4.4 J	4.9 J	9.4 J	6.7 J	14.6 J	12.1 J
COBALT	0.45 U	0.36 U	0.39 U	0.41 U	0.30 U	0.30 U	0.31 U	0.37 U	0.38 U
COPPER	2.8	2.4	3.4	2.1	1.6	4.3	3.1	3.8	5.8
IRON	3040	3800	4980	2530	2950	5950	3650	9510	5310
LEAD	5	3.6	8.2	2.3	2.2	21.2	2.8	3.2	34
MAGNESIUM	140	151	290	118	139	159	156	164	357
MANGANESE	25.6	9.5	93	36.6	8	70.3	36.3	10.8	52.5
MERCURY	0.028 U	0.035 U	0.042 U	0.038 U	0.029 U	0.038 U	0.032 U	0.036 U	0.038 U
NICKEL	1.8	2	1.9	1.8	1.9	1.8	2.8	2.7	2.1
POTASSIUM	88.9	120	55.4	47.1	75.9	80.5	112	140	199

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-3702	WHF-1485C-3703	WHF-1485C-3801	WHF-1485C-3802	WHF-1485C-3803	WHF-1485C-3901	WHF-1485C-3902	WHF-1485C-3903	WHF-1485C-4001
sample_dat	20031110	20031110	20031110	20031110	20031110	20031110	20031110	20031110	20031110
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	3	1
SELENIUM	0.24 U	0.25 U	0.25 U	0.24 U	0.24 U	0.28 U	0.25 U	0.25 U	0.25 U
SODIUM	26 U	26.1 U	26.7 U	25.8 U	25.9 U	29.4 U	26.3 U	26.9 U	26.4 U
VANADIUM	8.3	10.5	14.9	7.3	8.1	20	10.8	22.9	13.9
ZINC	13.2 J	8.5 J	12.2 J	6.4 J	7.8 J	15.1 J	10 J	18.5 J	21.9 J
Miscellaneous Parameters (mg/kg)									
CYANIDE	0.53 U	0.53 U	0.55 U	0.53 U	0.53 U	0.60 U	0.54 U	0.55 U	0.54 U
PERCENT SOLIDS (%)	94.4 %	93.8 %	91.7 %	95.1 %	94.5 %	83.4 %	93 %	91.1 %	92.8 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS	4.9 U	4.6 U	10 J	4.8 U	4.2 U	12	4.8 U	5 U	34
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4002	WHF-1485C-4003	WHF-1485C-4101	WHF-1485C-4101A	WHF-1485C-4102	WHF-1485C-4102A	WHF-1485C-4103	WHF-1485C-4103A	WHF-1485C-4201
sample_dat	20031110	20031110	20031111	20031110	20031111	20031110	20031111	20031110	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	0	1	1	2	2	0
bottom depth	2	3	1	1	2	2	3	3	1
Volatile Organics (mg/kg)									
2-BUTANONE	0.0052 UJ	0.005 UJ		0.013 UJ		0.0057 UJ		0.0052 UJ	
ACETONE	0.021 UJ	0.02 UJ		0.052 UJ		0.023 UJ		0.021 UJ	
Semivolatile Organics (mg/kg)									
4-NITROANILINE	1.7 UJ	1.8 UJ		1.8 U		1.7 UJ		1.8 UJ	
ANTHRACENE	0.0072 U	0.0074 U		0.014 J		0.0072 U		0.0074 U	
BAP EQUIVALENT	0.006898	0.073277		0.57343		0.032937		0.0074 U	
BENZO(A)ANTHRACENE	0.0023 J	0.028		0.26		0.013 J		0.0074 U	
BENZO(A)PYRENE	0.0025 J	0.049		0.38		0.02		0.0074 U	
BENZO(B)FLUORANTHENE	0.0022 J	0.043		0.39		0.024		0.0074 U	
BENZO(G,H,I)PERYLENE	0.0045 J	0.032 J		0.30 J		0.019 J		0.0074 U	
BENZO(K)FLUORANTHENE	0.0072 U	0.024		0.21		0.012		0.0074 U	
CARBAZOLE	0.35 UJ	0.36 UJ		0.36 U		0.36 UJ		0.36 UJ	
CHRYSENE	0.002 J	0.037		0.33		0.017		0.0074 U	
DIBENZO(A,H)ANTHRACENE	0.0072 U	0.013 J		0.091 J		0.007 J		0.0074 U	
FLUORANTHENE	0.0055 J	0.066		0.8		0.034 J		0.0074 U	
FLUORENE	0.0072 U	0.0074 U		0.074 U		0.0019 J		0.0074 U	
INDENO(1,2,3-CD)PYRENE	0.0031 J	0.039		0.35		0.021		0.0074 U	
PHENANTHRENE	0.0038 J	0.014		0.2		0.0079		0.0074 U	
PYRENE	0.0036 J	0.061		0.61		0.027		0.0074 U	
Pesticides/PCBs (mg/kg)									
4,4'-DDD	0.0018 U	0.0019 U		0.0019 U		0.037 U		0.0019 U	
4,4'-DDE	0.0018 U	0.0019 U		0.0036		0.037 U		0.0019 U	
4,4'-DDT	0.0018 U	0.0019 U		0.0019 U		0.037 U		0.0019 U	
ALDRIN	0.0018 U	0.0019 U		0.0025		0.049		0.0019 U	
ALPHA-CHLORDANE	0.00037 R	0.0008 J		0.0018 J		0.42		0.0016 J	
BETA-BHC	0.0018 U	0.0019 U		0.0002 R		0.037 U		0.0019 U	
DIELDRIN	0.00056 R	0.00087 R		0.015 J		0.15		0.0026	
ENDOSULFAN II	0.0018 U	0.0019 U		0.0019 U		0.037 U		0.0019 U	
ENDRIN	0.0018 U	0.0019 U		0.0019 U		0.0068 J		0.0019 U	
ENDRIN KETONE	0.0018 U	0.0019 U		0.0019 U		0.037 U		0.0019 U	
GAMMA-CHLORDANE	0.0007 R	0.0007 R		0.0022 J		0.46		0.0034 J	
HEPTACHLOR EPOXIDE	0.0018 U	0.0019 U		0.00086 J		0.014 R		0.00021 R	
Inorganics (mg/kg)									
ALUMINUM	11800	16100	5720		6670		13500		5510
ANTIMONY	0.23 U	0.23 U	0.23 U		0.23 U		0.23 U		0.23 U
ARSENIC	1.7	3.5	1.3		1.2		1.7		1.2
BARIUM	11.7	12.2	12.3		9.7		13.5		8.9
CADMIUM	0.041 U	0.042 U	0.042 U		0.041 U		0.042 U		0.061
CALCIUM	380	357	2080		461		509		992
CHROMIUM	9.1 J	13.1 J	4.9 J		6.6 J		10.6 J		6 J
COBALT	0.25 U	0.26 U	0.46 U		0.38 U		0.20 U		0.37 U
COPPER	3.4	3.4	2.4		3		4.9		5
IRON	5510	8470	3450		3490		6710		3100
LEAD	2.8	3	5.2		16		7.1		18.4
MAGNESIUM	148	153	552		114		157		158
MANGANESE	22.8	24.4	33.8		36.5		10.4		40.1
MERCURY	0.039 U	0.044 U	0.046 U		0.035 U		0.038 U		0.044 U
NICKEL	2.1	2.1	1.8		1.7		2		1.6
POTASSIUM	126	111	177		126		160		196

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4002	WHF-1485C-4003	WHF-1485C-4101	WHF-1485C-4101A	WHF-1485C-4102	WHF-1485C-4102A	WHF-1485C-4103	WHF-1485C-4103A	WHF-1485C-4201
sample_dat	20031110	20031110	20031111	20031110	20031111	20031110	20031111	20031110	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	0	1	1	2	2	0
bottom depth	2	3	1	1	2	2	3	3	1
SELENIUM	0.25 U	0.25 U	0.25 U		0.25 U		0.25 U		0.25 U
SODIUM	26.3 U	27 U	26.9 U		26.4 U		27 U		26.7 U
VANADIUM	15	23	8.8		9.3		15.8		8.1
ZINC	4.7 J	4.6 J	9.1 J		11 J		7 J		22.7 J
Miscellaneous Parameters (mg/kg)									
CYANIDE	0.54 U	0.55 U	0.55 U		0.54 U		0.55 U		0.54 U
PERCENT SOLIDS (%)	93.1 %	90.8 %	91.1 %		92.7 %		90.8 %		91.8 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS	4.4 U	14		75		7.4 J		9.6 J	
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4201A	WHF-1485C-4202	WHF-1485C-4202A	WHF-1485C-4203	WHF-1485C-4203A	WHF-1485C-4301	WHF-1485C-4302	WHF-1485C-4303	WHF-1485C-4401
sample_dat	20031110	20031111	20031110	20031111	20031110	20031111	20031111	20031111	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	1	1	2	2	0	1	2	0
bottom depth	1	2	2	3	3	1	2	3	1
Volatile Organics (mg/kg)									
2-BUTANONE	0.0057 UJ		0.0055 UJ		0.005 UJ	0.0051 U	0.0057 UJ	0.0053 UJ	0.0056 U
ACETONE	0.023 UJ		0.022 U		0.057 U	0.02 U	0.023 U	0.021 U	0.023 U
Semivolatile Organics (mg/kg)									
4-NITROANILINE	1.7 U		1.8 UJ		1.8 U	3.3 U	0.17 J	3.6 U	3.3 U
ANTHRACENE	0.0073 U		0.0073 U		0.0074 U	0.042 U	0.052 J	0.052 U	0.048 U
BAP EQUIVALENT	0.042909		0.0073 U		0.0074 U	0.26036	2.9786	0.51511	0.41803
BENZO(A)ANTHRACENE	0.019		0.0073 U		0.0074 U	0.17 J	2.5	0.27 J	0.23
BENZO(A)PYRENE	0.028		0.0073 U		0.0074 U	0.18	2	0.36	0.28
BENZO(B)FLUORANTHENE	0.029		0.0073 U		0.0074 U	0.24	3.1	0.53	0.31
BENZO(G,H,I)PERYLENE	0.023 J		0.0073 U		0.0074 U	0.11 J	1.2 J	0.21 J	0.16 J
BENZO(K)FLUORANTHENE	0.018		0.0073 U		0.0074 U	0.12	1.7	0.28	0.18
CARBAZOLE	0.36 U		0.36 UJ		0.36 U	0.68 U	0.33 J	0.73 U	0.68 U
CHRYSENE	0.029		0.0073 U		0.0074 U	0.16	3.6	0.31	0.23
DIBENZO(A,H)ANTHRACENE	0.0073 J		0.0073 U		0.0074 U	0.027 J	0.30 J	0.052 J	0.066 J
FLUORANTHENE	0.063		0.0073 U		0.0074 U	0.24	3.1	0.34	0.31
FLUORENE	0.0073 U		0.0073 U		0.0074 U	0.042 U	0.37 U	0.052 U	0.048 U
INDENO(1,2,3-CD)PYRENE	0.026		0.0073 U		0.0074 U	0.11	0.98	0.2	0.16
PHENANTHRENE	0.014		0.0073 U		0.0074 U	0.052	0.32 J	0.052 U	0.0077 R
PYRENE	0.057 J		0.0073 U		0.0074 U	0.27	3.7	0.44	0.39
Pesticides/PCBs (mg/kg)									
4,4'-DDD	0.0093 U		0.0019 UJ		0.0019 UJ	0.11	1.1 J	0.65 J	0.0088 U
4,4'-DDE	0.0055 R		0.00029 R		0.0019 UJ	0.13	1	1	0.041
4,4'-DDT	0.0019 J		0.0019 UJ		0.0019 UJ	0.33	5.7	5.5	0.087
ALDRIN	0.0058 J		0.00035 J		0.0019 UJ	0.035 U	0.76 U	0.95 U	0.0019 J
ALPHA-CHLORDANE	0.069		0.0048 J		0.002 J	0.15	0.51 J	0.58 J	0.0067 J
BETA-BHC	0.0093 U		0.0019 UJ		0.0019 UJ	0.035 U	0.76 U	0.95 U	0.0088 U
DIELDRIN	0.019		0.0016 J		0.00046 J	0.3	0.67 J	0.94 J	0.06
ENDOSULFAN II	0.0093 U		0.0019 UJ		0.0006 J	0.035 U	0.76 U	0.95 U	0.0088 U
ENDRIN	0.0093 U		0.0019 UJ		0.0019 UJ	0.018 J	0.76 U	0.95 U	0.0088 U
ENDRIN KETONE	0.0093 U		0.0019 UJ		0.0019 UJ	0.004 J	0.76 U	0.95 U	0.00091 R
GAMMA-CHLORDANE	0.08		0.0063 J		0.0025 J	0.15	0.79	0.58 J	0.005 J
HEPTACHLOR EPOXIDE	0.0099 J		0.00053 J		0.00033 J	0.005 R	0.76 U	0.95 U	0.0088 U
Inorganics (mg/kg)									
ALUMINUM		11100		16400		9970	22000	12100	6370
ANTIMONY		0.23 U		0.23 U		0.94	0.55	10.7	0.87
ARSENIC		1.3		1.2		5.4	15.2	6	3.2
BARIUM		12		13.8		37.7	48.1	73.8	16.7
CADMIUM		0.042 U		0.042 U		0.77	2.2	0.86	0.2
CALCIUM		482		240		793	1430	1570	787
CHROMIUM		8.6 J		12.2 J		23.3 J	34.3 J	23.3 J	9.6 J
COBALT		0.26 U		0.16 U		0.93	2.4	1.4	0.49 U
COPPER		3.9		3.6		11.3	26	17.9	8.6
IRON		5470		5080		6510	14800	8950	3690
LEAD		3.8		3.3		137 J	273 J	322 J	54.4 J
MAGNESIUM		156		135		167	313	210	134
MANGANESE		36.4		8.3		135 J	410 J	144 J	85.4 J
MERCURY		0.041 U		0.032 U		0.023 J	0.059 J	0.078 J	0.019 J
NICKEL		2.1		2.3		3	6.1	5	1.8
POTASSIUM		221		267		251	306	135	109

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4201A	WHF-1485C-4202	WHF-1485C-4202A	WHF-1485C-4203	WHF-1485C-4203A	WHF-1485C-4301	WHF-1485C-4302	WHF-1485C-4303	WHF-1485C-4401
sample_dat	20031110	20031111	20031110	20031111	20031110	20031111	20031111	20031111	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	1	1	2	2	0	1	2	0
bottom depth	1	2	2	3	3	1	2	3	1
SELENIUM		0.25 U		0.25 U		0.24 U	0.26 U	0.26 U	0.24 U
SODIUM		26.8 U		27 U		25.3 U	27.4 UJ	27.3 U	25.3 U
VANADIUM		13.5		17		16.6	37.7	20	9
ZINC		8.8 J		12.3 J		139 J	246 J	217 J	49.7 J
Miscellaneous Parameters (mg/kg)									
CYANIDE		0.55 U		0.55 U		0.52 U	0.56 U	0.56 U	0.52 U
PERCENT SOLIDS (%)		91.3 %		90.8 %		96.8 %	89.5 %	89.8 %	96.8 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS	75		5 U		4.8 U	130	630	920	150
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4402	WHF-1485C-4403	WHF-1485C-4501	WHF-1485C-4502	WHF-1485C-4503	WHF-1485C-4601	WHF-1485C-4602	WHF-1485C-4603	WHF-1485C-4701
sample_dat	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	3	1
Volatile Organics (mg/kg)									
2-BUTANONE	0.0062 U	0.0055 U	0.0062 U	0.0041 J	0.0019 J	0.0053 U	0.0023 J	0.0047 U	0.0055 U
ACETONE	0.025 U	0.022 U	0.025 U	0.025	0.029	0.021 U	0.016 J	0.019 U	0.022 U
Semivolatile Organics (mg/kg)									
4-NITROANILINE	1.9 U	1.7 U	1.9 U	2 U	1.8 U	1.7 U	1.7 U	1.7 U	1.7 U
ANTHRACENE	0.008 U	0.0072 U	0.0012 J	0.0083 U	0.0073 U	0.00096 J	0.0072 U	0.0073 U	0.042 U
BAP EQUIVALENT	0.006974	0.011653	0.115132	0.024155	0.0073 U	0.083976	0.007089	0.012504	0.46796
BENZO(A)ANTHRACENE	0.008 U	0.0049 J	0.043	0.0074 J	0.0073 U	0.041	0.0072 U	0.002 J	0.22
BENZO(A)PYRENE	0.0018 J	0.0063 J	0.073	0.015	0.0073 U	0.058	0.0072 U	0.0072 J	0.33
BENZO(B)FLUORANTHENE	0.0035 J	0.0082 J	0.07	0.018	0.0073 U	0.06	0.0033 R	0.0086	0.3
BENZO(G,H,I)PERYLENE	0.0057 J	0.0041 J	0.056 J	0.013 J	0.0073 U	0.041 J	0.0072 U	0.0055 J	0.22 J
BENZO(K)FLUORANTHENE	0.002 J	0.0038 J	0.047	0.01	0.0073 U	0.032	0.0072 U	0.004 J	0.17
CARBAZOLE	0.39 U	0.36 U	0.40 U	0.41 U	0.36 U	0.35 U	0.35 U	0.36 U	0.35 U
CHRYSENE	0.008 U	0.005 J	0.062	0.015	0.0073 U	0.056	0.0072 U	0.0047 J	0.26
DIBENZO(A,H)ANTHRACENE	0.008 U	0.0072 U	0.023 J	0.0049 J	0.0073 U	0.011 J	0.0024 J	0.0073 U	0.059 J
FLUORANTHENE	0.002 J	0.0078	0.13	0.025 J	0.0073 U	0.11	0.0072 U	0.0042 J	0.32
FLUORENE	0.008 U	0.0072 U	0.0081 U	0.0042 J	0.0073 U	0.007 U	0.0072 U	0.0073 U	0.042 U
INDENO(1,2,3-CD)PYRENE	0.008 U	0.004 J	0.073	0.016	0.0073 U	0.045	0.0072 U	0.0055 J	0.25
PHENANTHRENE	0.008 U	0.0016 J	0.027	0.0058 J	0.0073 U	0.029	0.0024 J	0.0073 U	0.058
PYRENE	0.0018 J	0.008	0.1	0.018	0.0073 U	0.094 J	0.0072 U	0.0044 J	0.29
Pesticides/PCBs (mg/kg)									
4,4'-DDD	0.002 U	0.0018 U	0.00072 J	0.0011 J	0.0019 U	0.011	0.00039 J	0.0019 U	0.00082 J
4,4'-DDE	0.00064 J	0.00064 J	0.001 J	0.0012 J	0.0019 U	0.013	0.00057 J	0.00033 J	0.0029 J
4,4'-DDT	0.00079 J	0.00096 J	0.0021 U	0.0021 U	0.0019 U	0.0018 J	0.0018 U	0.0019 U	0.0036 U
ALDRIN	0.002 U	0.0018 U	0.0017 J	0.00084 J	0.0019 U	0.0019 J	0.0018 U	0.0019 U	0.00095 J
ALPHA-CHLORDANE	0.002 U	0.0018 U	0.0012 J	0.00053 J	0.0019 U	0.013	0.0018 U	0.0019 U	0.0025 J
BETA-BHC	0.002 U	0.0018 U	0.0021 U	0.0021 U	0.0019 U	0.0036 U	0.00023 J	0.0019 U	0.0036 U
DIELDRIN	0.00052 J	0.00059 J	0.0048	0.001 J	0.0019 U	0.013 J	0.0018 U	0.0019 U	0.02
ENDOSULFAN II	0.002 U	0.0018 U	0.0021 U	0.0021 U	0.0019 U	0.0036 U	0.0018 U	0.0019 U	0.0036 U
ENDRIN	0.002 U	0.0018 U	0.00042 R	0.0021 U	0.0019 U	0.0036 U	0.0018 U	0.00033 R	0.0036 U
ENDRIN KETONE	0.002 U	0.0018 U	0.0021 U	0.0021 U	0.0019 U	0.0036 U	0.0018 U	0.0019 U	0.0036 U
GAMMA-CHLORDANE	0.002 U	0.0018 U	0.00095 J	0.00081 R	0.0019 U	0.0094 J	0.0018 U	0.0019 U	0.0018 R
HEPTACHLOR EPOXIDE	0.002 U	0.0018 U	0.0021 U	0.0021 U	0.0019 U	0.0019 R	0.0018 U	0.0019 U	0.0036 U
Inorganics (mg/kg)									
ALUMINUM	9870	11200	6090	10500	16400	7510	10900	14900	9560
ANTIMONY	0.82	0.51	0.25 U	0.26 U	0.23 U	0.22 U	0.22 U	0.23 U	0.22 U
ARSENIC	2.2	1.9	1.3	1.5	1.7	1.5	1.3	1.5	1.7
BARIUM	17.1	13.6	10.6	15.6	13.9	9.8	12	14	13.7
CADMIUM	0.045 U	0.041 U	0.046 U	0.047 U	0.042 U	0.04 U	0.041 U	0.041 U	0.04 U
CALCIUM	493	434	519	481	60.3	397	94.8	83.4	1020
CHROMIUM	8.5 J	9.1 J	5.1 J	8.5 J	12.2 J	6 J	8.5 J	11.2 J	8 J
COBALT	0.53 U	0.32 U	0.63	0.38 U	0.13 U	0.51 U	0.23 U	0.22 U	0.46 U
COPPER	4.5	4	3.2	3.5	3.6	3.6	3.6	3.7	9
IRON	4440	5500	3630	4770	5430	4470	4800	5080	5520
LEAD	7.1 J	6.1 J	4.6 J	10.4 J	2.9 J	9.6 J	3.6 J	3 J	11 J
MAGNESIUM	168	172	157	161	112	147	122	127	324
MANGANESE	52.3 J	15.9 J	68.9 J	35 J	4.2 J	31.4 J	8 J	7.2 J	56.3 J
MERCURY	0.015 J	0.024 J	0.021 J	0.022 J	0.015 J	0.0042 U	0.045 J	0.0075 J	0.015 J
NICKEL	2.3	2.4	2	2.7	1.8	2.1	2.2	2.3	2.3
POTASSIUM	75.8	78.8	141	128	138	205	186	154	128

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4402	WHF-1485C-4403	WHF-1485C-4501	WHF-1485C-4502	WHF-1485C-4503	WHF-1485C-4601	WHF-1485C-4602	WHF-1485C-4603	WHF-1485C-4701
sample_dat	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111	20031111
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	1	2	0	1	2	0
bottom depth	2	3	1	2	3	1	2	3	1
SELENIUM	0.27 U	0.25 U	0.28 U	0.29 U	0.25 U	0.24 U	0.25 U	0.25 U	0.24 U
SODIUM	29.2 U	26.4 U	29.7 U	30.4 U	26.8 U	25.8 U	26.2 U	26.7 U	25.8 U
VANADIUM	12.7	14.4	9	13.8	18.6	11	13.6	16.5	13.8
ZINC	8.9 J	6.5 J	9.1 J	7.8 J	6.8 J	9.9 J	4.5 J	6.4 J	27.7 J
Miscellaneous Parameters (mg/kg)									
CYANIDE	0.31	0.54 U	0.61 U	0.62 U	0.55 U	0.53 U	0.53 U	0.55 U	0.53 U
PERCENT SOLIDS (%)	84 %	93 %	82.6 %	80.7 %	91.3 %	95.1 %	93.6 %	91.7 %	95 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS	5 U	4.9 U	32	13	5.5	190	7.5	5.7	27
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID sample_dat matrix top depth bottom depth	WHF-1485C-4702 20031111 SO 1 2	WHF-1485C-4703 20031111 SO 2 3	1485CD00101 20000524 SO 0 1	1485CD00201 20000524 SO 0 1	1485CD00301 20000524 SO 0 1	1485CD00401 20000524 SO 0 1	1485CD00501 20000524 SO 0 1	1485CD00601 20000524 SO 0 1	1485CSS0701 20010517 SO 0 1	1485CSS0801 20010517 SO 0 1
Volatile Organics (mg/kg)										
2-BUTANONE	0.0059 U	0.0055 U	0.01 U	0.01 U	0.012 U	0.0098 U	0.0096 U	0.0099 U		
ACETONE	0.023 U	0.022 U	0.05 U	0.052 U	0.0271 J	0.049 U	0.048 U	0.05 U		
Semivolatile Organics (mg/kg)										
4-NITROANILINE	1.8 U	1.8 U	0.35 U	0.34 U	0.34 U	1.4 U	0.34 U	0.34 U		
ANTHRACENE	0.0075 U	0.0074 U	0.35 U	0.34 U	0.34 U	1.4 U	0.34 U	0.34 U		
BAP EQUIVALENT	0.015496	0.0074 U	0.35 U	0.159	0.185	1.4 U	0.34 U	0.3	0.0693	0.071 U
BENZO(A)ANTHRACENE	0.0081	0.0074 U	0.35 U	0.108 J	0.106 J	1.4 U	0.34 U	0.282 J		
BENZO(A)PYRENE	0.011	0.0074 U	0.35 U	0.159 J	0.185 J	1.4 U	0.34 U	0.30 J	0.0693 J	0.071 U
BENZO(B)FLUORANTHENE	0.011	0.0074 U	0.35 U	0.169 J	0.238 J	1.4 U	0.34 U	0.352		
BENZO(G,H,I)PERYLENE	0.0085 J	0.0074 U	0.35 U	0.17 J	0.255 J	1.4 U	0.34 U	0.349		
BENZO(K)FLUORANTHENE	0.0049 J	0.0074 U	0.35 U	0.123 J	0.126 J	1.4 U	0.34 U	0.266 J		
CARBAZOLE	0.37 U	0.37 U	0.35 U	0.34 U	0.34 U	1.4 U	0.34 U	0.34 U		
CHRYSENE	0.0078	0.0074 U	0.35 U	0.189 J	0.201 J	1.4 U	0.34 U	0.422		
DIBENZO(A,H)ANTHRACENE	0.0018 J	0.0074 U	0.35 U	0.34 U	0.34 U	1.4 U	0.34 U	0.34 U		
FLUORANTHENE	0.015	0.0074 U	0.35 U	0.348	0.357	1.4 U	0.34 U	0.76		
FLUORENE	0.0075 U	0.0074 U	0.35 U	0.34 U	0.34 U	1.4 U	0.34 U	0.34 U		
INDENO(1,2,3-CD)PYRENE	0.0073 J	0.0074 U	0.35 U	0.196 J	0.28 J	1.4 U	0.34 U	0.386		
PHENANTHRENE	0.0079	0.0074 U	0.35 U	0.106 J	0.165 J	1.4 U	0.34 U	0.22 J		
PYRENE	0.015	0.0074 U	0.35 U	0.221 J	0.235 J	1.4 U	0.34 U	0.495		
Pesticides/PCBs (mg/kg)										
4,4'-DDD	0.00049 J	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
4,4'-DDE	0.0015 J	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
4,4'-DDT	0.0009 J	0.0019 U	0.014 UJ	0.014 UJ	0.014 UJ	0.0052 J	0.014 UJ	0.014 UJ		
ALDRIN	0.0019 U	0.0019 U	0.0069 U	0.0068 U	0.0068 U	0.007 U	0.0069 U	0.0068 U		
ALPHA-CHLORDANE	0.00076 J	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
BETA-BHC	0.0019 U	0.0019 U	0.0069 U	0.0068 U	0.0068 U	0.007 U	0.0069 U	0.0068 U		
DIELDRIN	0.00048 R	0.0019 U	0.0034 J	0.0031 J	0.0068 U	0.0126	0.0345	0.0041 J		
ENDOSULFAN II	0.0019 U	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
ENDRIN	0.0019 U	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
ENDRIN KETONE	0.0019 U	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
GAMMA-CHLORDANE	0.00047 R	0.0019 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U		
HEPTACHLOR EPOXIDE	0.0019 U	0.0019 U	0.0069 U	0.0068 U	0.0068 U	0.007 U	0.0069 U	0.0068 U		
Inorganics (mg/kg)										
ALUMINUM	7970	10900	7590	9110	7630	7290	8730	7140		
ANTIMONY	0.24 U	0.23 U	0.24 U	0.24 U	0.26 U	0.24 U	0.23 U	0.24 U		
ARSENIC	1.1	1.4	0.75 U	1.5 U	1.1 U	1 U	1.6 U	0.96 U		
BARIUM	13.7	10.9	18.1	15.2	18.9	19.1	14	32.7		
CADMIUM	0.043 U	0.042 U	0.04 U	0.03 U	0.04 U	0.44 U	0.03 U	0.14 U		
CALCIUM	632	243	1710	1220	1520	1860	778	1290		
CHROMIUM	6.5 J	8.6 J	7.9	10.4	7.4	10.4	9	11.8		
COBALT	0.24 U	0.21 U	1.8	0.91	0.93	0.95	0.99	0.89		
COPPER	3.3	2.6	4.2	5.1	4.8	9.4	15.4	5.7		
IRON	3400	4150	3610	7060	4130	4170	5140	3360		
LEAD	6.1 J	3 J	6.4	7.9	9.7	145	8.6	12.8		
MAGNESIUM	128	120	736	284	496	444	208	315		
MANGANESE	54 J	6.1 J	94.6	109	126	95.4	98.5	158		
MERCURY	0.028 J	0.031 J	0.01 U	0.01	0.02	0.02	0.01 U	0.01 U		
NICKEL	2.1	1.8	8	3.5 U	2.8 U	3.6 U	3.7 U	4.1		
POTASSIUM	132	77	268	174	147	160	183	154		

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-1485C-4702	WHF-1485C-4703	1485CD00101	1485CD00201	1485CD00301	1485CD00401	1485CD00501	1485CD00601	1485CSS0701	1485CSS0801
sample_dat	20031111	20031111	20000524	20000524	20000524	20000524	20000524	20000524	20010517	20010517
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	1	2	0	0	0	0	0	0	0	0
bottom depth	2	3	1	1	1	1	1	1	1	1
SELENIUM	0.26 U	0.25 U	1.2 U	0.58 U	0.98 U	0.81 U	0.99 U	1.2 U		
SODIUM	27.6 U	27.2 U	322	367	347	368	337	299		
VANADIUM	9.9	13.2	10.5	14.5	10.8	13.3	12.7	10.9		
ZINC	10.2 J	46.5 J	11.6	16.7	16.4	68.1	17.2	14.6		
Miscellaneous Parameters (mg/kg)										
CYANIDE	0.56 U	0.55 U	0.52 UJ	0.60 J	0.51 UJ	0.52 UJ	0.52 UJ	0.76 J		
PERCENT SOLIDS (%)	88.8 %	90.2 %								
Petroleum Hydrocarbons (mg/kg)										
TOTAL PETROLEUHYDROCARBONS	5.2	4.3 U	13	17.2	29.2	55.4	21.7	27.4		
SPLP Inorganics (ug/L)										
ALUMINUM			72800	53800	13000	23800	54600	64500		
BARIUM			53	33	14	31	38	78		
CALCIUM			5200	7500	2400	9000	6200	8100		
CHROMIUM			46	37	9.4 U	20	37	42		
COPPER			17	13	2.6 U	16	28	18		
IRON			34800	31400	6600	11100	28900	26400		
LEAD			23	13 U	7.3 U	190	31	37		
MAGNESIUM			1800	1200	810	1300	1600	2000		
MANGANESE			220	210	110	130	250	550		
MERCURY			0.60 U	0.60 U	0.60 U	0.60 U	0.60 U	0.60 U		
NICKEL			20 U	12 U	5.7 U	8.5 U	12 U	21		
POTASSIUM			2900 J	3300 J	1100 U	1200 U	2300 J	4100 J		
SODIUM			5700	5100	8400	9800	11300	8000		
VANADIUM			94	80	19	40	76	84		
ZINC			53 J	47 J	14 U	120 J	64 J	66 J		

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CSS0901	1485CSS1001	1485CSS1101	1485CSS1201	1485CSS1301	1485CSS1301-D	1485CSS1401	1485CSS1501	1485CSS1601	1485CSS1701
sample_dat	20010517	20010517	20010517	20010517	20010517	20010517	20010517	20010815	20010815	20010815
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	0	0	0	0	0	0	0	0	0
bottom depth	1	1	1	1	1	1	1	1	1	1
Volatile Organics (mg/kg)										
2-BUTANONE										
ACETONE										
Semivolatile Organics (mg/kg)										
4-NITROANILINE										
ANTHRACENE										
BAP EQUIVALENT	0.073 U	0.122	0.119	0.079 U	0.197	0.07 U	0.0774	0.196	0.358	0.14
BENZO(A)ANTHRACENE										
BENZO(A)PYRENE	0.073 U	0.122	0.119	0.079 U	0.197	0.07 U	0.0774	0.196	0.358	0.14
BENZO(B)FLUORANTHENE										
BENZO(G,H,I)PERYLENE										
BENZO(K)FLUORANTHENE										
CARBAZOLE										
CHRYSENE										
DIBENZO(A,H)ANTHRACENE										
FLUORANTHENE										
FLUORENE										
INDENO(1,2,3-CD)PYRENE										
PHENANTHRENE										
PYRENE										
Pesticides/PCBs (mg/kg)										
4,4'-DDD										
4,4'-DDE										
4,4'-DDT										
ALDRIN										
ALPHA-CHLORDANE										
BETA-BHC										
DIELDRIN										
ENDOSULFAN II										
ENDRIN										
ENDRIN KETONE										
GAMMA-CHLORDANE										
HEPTACHLOR EPOXIDE										
Inorganics (mg/kg)										
ALUMINUM										
ANTIMONY										
ARSENIC										
BARIUM										
CADMIUM										
CALCIUM										
CHROMIUM										
COBALT										
COPPER										
IRON										
LEAD										
MAGNESIUM										
MANGANESE										
MERCURY										
NICKEL										
POTASSIUM										

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CSS0901	1485CSS1001	1485CSS1101	1485CSS1201	1485CSS1301	1485CSS1301-D	1485CSS1401	1485CSS1501	1485CSS1601	1485CSS1701
sample_dat	20010517	20010517	20010517	20010517	20010517	20010517	20010517	20010815	20010815	20010815
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	0	0	0	0	0	0	0	0	0
bottom depth	1	1	1	1	1	1	1	1	1	1
SELENIUM										
SODIUM										
VANADIUM										
ZINC										
Miscellaneous Parameters (mg/kg)										
CYANIDE										
PERCENT SOLIDS (%)										
Petroleum Hydrocarbons (mg/kg)										
TOTAL PETROLEUHYDROCARBONS										
SPLP Inorganics (ug/L)										
ALUMINUM										
BARIUM										
CALCIUM										
CHROMIUM										
COPPER										
IRON										
LEAD										
MAGNESIUM										
MANGANESE										
MERCURY										
NICKEL										
POTASSIUM										
SODIUM										
VANADIUM										
ZINC										

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CSS1801	1485CSS1901	1485CSS2001	WHF-41-SS-48-1	WHF-41-SS-48-2	WHF-41-SS-48-3	WHF-41-SS-49-1	WHF-41-SS-49-2	WHF-41-SS-49-3
sample_dat	20010815	20010815	20010815	20040831	20040831	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	0	0	0	1	2	0	1	2
bottom depth	1	1	1	1	2	3	1	2	3
Volatile Organics (mg/kg)									
2-BUTANONE									
ACETONE									
Semivolatile Organics (mg/kg)									
4-NITROANILINE									
ANTHRACENE									
BAP EQUIVALENT	0.071 U	0.071 U	0.071 U	0.00625	0.0228	0.008 U	0.042	0.0055	0.08 U
BENZO(A)ANTHRACENE									
BENZO(A)PYRENE	0.071 U	0.071 U	0.071 U	0.0024 J	0.017	0.008 U	0.032	0.0018 J	0.08 U
BENZO(B)FLUORANTHENE									
BENZO(G,H,I)PERYLENE									
BENZO(K)FLUORANTHENE									
CARBAZOLE									
CHRYSENE									
DIBENZO(A,H)ANTHRACENE				0.0077 U	0.0058 J	0.008 U	0.01	0.0074 U	0.08 U
FLUORANTHENE									
FLUORENE									
INDENO(1,2,3-CD)PYRENE									
PHENANTHRENE									
PYRENE									
Pesticides/PCBs (mg/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
ALDRIN				0.00191 U	0.00187 U	0.002 U	0.00175 U	0.00185 U	0.00201 U
ALPHA-CHLORDANE									
BETA-BHC									
DIELDRIN				0.00383 U	0.00375 U	0.00401 U	0.0458	0.0037 U	0.00401 U
ENDOSULFAN II									
ENDRIN									
ENDRIN KETONE									
GAMMA-CHLORDANE									
HEPTACHLOR EPOXIDE									
Inorganics (mg/kg)									
ALUMINUM									
ANTIMONY									
ARSENIC									
BARIUM									
CADMIUM									
CALCIUM									
CHROMIUM									
COBALT									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	1485CSS1801	1485CSS1901	1485CSS2001	WHF-41-SS-48-1	WHF-41-SS-48-2	WHF-41-SS-48-3	WHF-41-SS-49-1	WHF-41-SS-49-2	WHF-41-SS-49-3
sample_dat	20010815	20010815	20010815	20040831	20040831	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	0	0	0	1	2	0	1	2
bottom depth	1	1	1	1	2	3	1	2	3
SELENIUM									
SODIUM									
VANADIUM									
ZINC									
Miscellaneous Parameters (mg/kg)									
CYANIDE									
PERCENT SOLIDS (%)				87 %	89 %	83 %	95 %	90 %	83 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS									
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-50-1	WHF-41-SS-50-2	WHF-41-SS-50-3	WHF-41-SS-51-1	WHF-41-SS-51-2	WHF-41-SS-51-3	WHF-41-SS-52-1	WHF-41-SS-52-2	WHF-41-SS-52-3
sample_dat	20040831	20040831	20040831	20040831	20040831	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	1	2	0	1	2	0	1	2
bottom depth	1	2	3	1	2	3	1	2	3
Volatile Organics (mg/kg)									
2-BUTANONE									
ACETONE									
Semivolatile Organics (mg/kg)									
4-NITROANILINE									
ANTHRACENE									
BAP EQUIVALENT	0.009	0.0068	0.0083 U	0.216	0.0295	0.00575	0.4	0.0052	0.0186
BENZO(A)ANTHRACENE									
BENZO(A)PYRENE	0.0063 J	0.0025 J	0.0083 U	0.16 J	0.022	0.0018 J	0.3	0.0014 J	0.014
BENZO(B)FLUORANTHENE									
BENZO(G,H,I)PERYLENE									
BENZO(K)FLUORANTHENE									
CARBAZOLE									
CHRYSENE									
DIBENZO(A,H)ANTHRACENE	0.0027 J	0.0086 U	0.0083 U	0.056 J	0.0075 J	0.0079 U	0.1	0.0076 U	0.0046 J
FLUORANTHENE									
FLUORENE									
INDENO(1,2,3-CD)PYRENE									
PHENANTHRENE									
PYRENE									
Pesticides/PCBs (mg/kg)									
4,4'-DDD									
4,4'-DDE									
4,4'-DDT									
ALDRIN	0.00185 U	0.00216 U	0.00208 U	0.00208 U	0.00225 U	0.00198 U	0.00183 U	0.00189 U	0.00189 U
ALPHA-CHLORDANE									
BETA-BHC									
DIELDRIN	0.00466 J	0.00433 U	0.00417 U	0.182	0.00772 J	0.00397 U	0.0135 J	0.00379 U	0.00378 U
ENDOSULFAN II									
ENDRIN									
ENDRIN KETONE									
GAMMA-CHLORDANE									
HEPTACHLOR EPOXIDE									
Inorganics (mg/kg)									
ALUMINUM									
ANTIMONY									
ARSENIC									
BARIUM									
CADMIUM									
CALCIUM									
CHROMIUM									
COBALT									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-50-1	WHF-41-SS-50-2	WHF-41-SS-50-3	WHF-41-SS-51-1	WHF-41-SS-51-2	WHF-41-SS-51-3	WHF-41-SS-52-1	WHF-41-SS-52-2	WHF-41-SS-52-3
sample_dat	20040831	20040831	20040831	20040831	20040831	20040831	20040831	20040831	20040831
matrix	SO	SO	SO	SO	SO	SO	SO	SO	SO
top depth	0	1	2	0	1	2	0	1	2
bottom depth	1	2	3	1	2	3	1	2	3
SELENIUM									
SODIUM									
VANADIUM									
ZINC									
Miscellaneous Parameters (mg/kg)									
CYANIDE									
PERCENT SOLIDS (%)	90 %	77 %	80 %	80 %	74 %	84 %	91 %	88 %	88 %
Petroleum Hydrocarbons (mg/kg)									
TOTAL PETROLEUHYDROCARBONS									
SPLP Inorganics (ug/L)									
ALUMINUM									
BARIUM									
CALCIUM									
CHROMIUM									
COPPER									
IRON									
LEAD									
MAGNESIUM									
MANGANESE									
MERCURY									
NICKEL									
POTASSIUM									
SODIUM									
VANADIUM									
ZINC									

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-53-1	WHF-41-SS-53-2	WHF-41-SS-53-3
sample_dat	20040831	20040831	20040831
matrix	SO	SO	SO
top depth	0	1	2
bottom depth	1	2	3
Volatile Organics (mg/kg)			
2-BUTANONE			
ACETONE			
Semivolatile Organics (mg/kg)			
4-NITROANILINE			
ANTHRACENE			
BAP EQUIVALENT	0.0086	0.0075 U	0.0071 U
BENZO(A)ANTHRACENE			
BENZO(A)PYRENE	0.0061 J	0.0075 U	0.0071 U
BENZO(B)FLUORANTHENE			
BENZO(G,H,I)PERYLENE			
BENZO(K)FLUORANTHENE			
CARBAZOLE			
CHRYSENE			
DIBENZO(A,H)ANTHRACENE	0.0025 J	0.0075 U	0.0071 U
FLUORANTHENE			
FLUORENE			
INDENO(1,2,3-CD)PYRENE			
PHENANTHRENE			
PYRENE			
Pesticides/PCBs (mg/kg)			
4,4'-DDD			
4,4'-DDE			
4,4'-DDT			
ALDRIN	0.00191 U	0.00187 U	0.00177 U
ALPHA-CHLORDANE			
BETA-BHC			
DIELDRIN	0.00383 U	0.00374 U	0.00354 U
ENDOSULFAN II			
ENDRIN			
ENDRIN KETONE			
GAMMA-CHLORDANE			
HEPTACHLOR EPOXIDE			
Inorganics (mg/kg)			
ALUMINUM			
ANTIMONY			
ARSENIC			
BARIUM			
CADMIUM			
CALCIUM			
CHROMIUM			
COBALT			
COPPER			
IRON			
LEAD			
MAGNESIUM			
MANGANESE			
MERCURY			
NICKEL			
POTASSIUM			

SITE 41
SOILS
SUMMARY OF POSITIVE DETECTIONS

sample ID	WHF-41-SS-53-1	WHF-41-SS-53-2	WHF-41-SS-53-3
sample_dat	20040831	20040831	20040831
matrix	SO	SO	SO
top depth	0	1	2
bottom depth	1	2	3
SELENIUM			
SODIUM			
VANADIUM			
ZINC			
Miscellaneous Parameters (mg/kg)			
CYANIDE			
PERCENT SOLIDS (%)	87 %	89 %	94 %
Petroleum Hydrocarbons (mg/kg)			
TOTAL PETROLEUHYDROCARBONS			
SPLP Inorganics (ug/L)			
ALUMINUM			
BARIUM			
CALCIUM			
CHROMIUM			
COPPER			
IRON			
LEAD			
MAGNESIUM			
MANGANESE			
MERCURY			
NICKEL			
POTASSIUM			
SODIUM			
VANADIUM			
ZINC			

APPENDIX D

SUPPORTING INFORMATION FOR HUMAN HEALTH RISK ASSESSMENT

APPENDIX D.1

USEPA HUMAN HEALTH RISK CHARACTERIZATION CALCULATIONS AND RESULTS

TABLE D-1

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - RESIDENTIAL EXPOSURES TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[(1)] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[(1)] (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	0.1	1E-05	Cancer	NA	NA
Dieldrin	0.125	0.06	2E-06	Cancer, Liver	2.95	0.04
Chromium	30.6	210	1E-07	Cancer, Respiratory	234	0.1
		Total ILCR	1E-05		Total HI	0.2

1 - Table II Soil Cleanup Target Levels (FDEP, April 2005). Some noncarcinogenic SCTLs not presented in Table II were calculated as per the methodology presented in Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Final Report, February, 2005.

NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-2

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - TYPICAL INDUSTRIAL EXPOSURES TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL(1) (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL(1) (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	0.7	1E-06	Cancer	NA	NA
Dieldrin	0.125	0.3	4E-07	Cancer, Liver	27	0.005
Chromium	30.6	470	7E-08	Cancer, Respiratory	5940	0.005
		Total ILCR	2E-06		Total HI	0.01

1 - Table II Soil Cleanup Target Levels (FDEP, April 2005). Some noncarcinogenic SCTLs not presented in Table II were calculated as per the methodology presented in Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Final Report, February, 2005.

NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-3

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[1] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[1] (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	2.1	5E-07	Cancer	NA	NA
Dieldrin	0.125	1.00	1E-07	Cancer, Liver	11.4	0.01
Chromium	30.6	21.2	1E-06	Cancer, Respiratory	266	0.1
		Total ILCR	2E-06		Total HI	0.1

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - MAINTENANCE WORKERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL(1) (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL(1) (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	2.4	4E-07	Cancer	NA	NA
Dieldrin	0.125	1.19	1E-07	Cancer, Liver	340	0.0004
Chromium	30.6	3606	8E-09	Cancer, Respiratory	49503	0.0006
		Total ILCR	5E-07		Total HI	0.001

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-5

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADOLESCENT RECREATIONAL USERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[(1)] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[(1)] (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	1.5	7E-07	Cancer	NA	NA
Dieldrin	0.125	0.8	2E-07	Cancer, Liver	91.2	0.001
Chromium	30.6	16099	2E-09	Cancer, Respiratory	10908	0.003
		Total ILCR	8E-07		Total HI	0.004

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-6

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RECREATIONAL USERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL(1) (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL(1) (mg/kg)	Estimated HQ
Carcinogenic PAHs	1	1.8	6E-07	Cancer	NA	NA
Dieldrin	0.1	0.871	1E-07	Cancer, Liver	195	0.0006
Chromium	31	9391	3E-09	Cancer, Respiratory	16946	0.002
		Total ILCR	7E-07		Total HI	0.002

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFELONG RECREATIONAL USERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[1] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[1] (mg/kg)	Estimated HQ
Carcinogenic PAHs	1.02	0.8	1E-06			
Dieldrin	0.125	0.417	3E-07			
Chromium	30.6	5931	5E-09			
		Total ILCR	2E-06		Total HI	

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - RESIDENTIAL EXPOSURES TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[1] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[1] (mg/kg)	Estimated HQ
Carcinogenic PAHs	0.288	0.1	3E-06	Cancer	NA	NA
4,4'-DDT	1.73	2.9	6E-07	Cancer, Liver	36.0	0.05
Aldrin	0.161	0.06	3E-06	Cancer, Liver	1.81	0.09
Dieldrin	0.171	0.06	3E-06	Cancer, Liver	2.95	0.06
		Total ILCR	9E-06		Total HI	0.2

1 - Table II Soil Cleanup Target Levels (FDEP, April 2005). Some noncarcinogenic SCTLs not presented in Table II were calculated as per the methodology presented in Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Final Report, February, 2005.

NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - TYPICAL INDUSTRIAL EXPOSURES TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL(1) (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL(1) (mg/kg)	Estimated HQ
Carcinogenic PAHs	0.288	0.7	4E-07	Cancer	NA	NA
4,4'-DDT	1.73	15	1E-07	Cancer, Liver	586	0.003
Aldrin	0.161	0.3	5E-07	Cancer, Liver	17.4	0.009
Dieldrin	0.171	0.3	6E-07	Cancer, Liver	27.1	0.006
		Total ILCR	2E-06		Total HI	0.02

1 - Table II Soil Cleanup Target Levels (FDEP, April 2005). Some noncarcinogenic SCTLs not presented in Table II were calculated as per the methodology presented in Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-777, F.A.C., Final Report, February, 2005.

NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

TABLE D-10

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CONSTRUCTION WORKERS EXPOSED TO SURFACE SOIL
SITE 41
NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)	SCTL[(1)] (mg/kg)	Estimated ILCR	Primary Target Organs	SCTL[(1)] (mg/kg)	Estimated HQ
Carcinogenic PAHs	0.288	2.10	1E-07	Cancer	NA	NA
4,4'-DDT	1.73	57.1	3E-08	Cancer, Liver	139	0.01
Aldrin	0.161	0.956	2E-07	Cancer, Liver	6.97	0.02
Dieldrin	0.171	1.00	2E-07	Cancer, Liver	11.4	0.01
		Total ILCR	5E-07		Total HI	0.05

1 - SCTLs were calculated as per the methodology presented in Section 6.3.
NA - Not applicable. There are no cancer slope factors (CSF) available for this chemical.

APPENDIX D.2

EXAMPLE CALCULATIONS OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS)

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jupin	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for construction workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = 1/RfDo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = 1/RfDd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = 1/RfDi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Arsenic	
SCTL	=		Soil Cleanup Target Level (mg/kg)
THI	=	1	Target Hazard Index (unitless)
BW	=	70	Body weight (kg)
AT	=	365	Averaging time (days)
EF	=	250	Exposure frequency (days/year)
ED	=	1	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	330	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.03	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	1.00E+99	Volatilization factor (m^3/kg) ✓
PEF	=	2.43E+06	Particulate emission factor (m^3/kg) ✓
RfDo	=	3.0E-04	Oral reference dose (mg/kg/day)
RfDd	=	3.0E-04	Dermal reference dose (mg/kg/day)
RfDi	=	3.0E-04	Inhalation reference dose (mg/kg/day)

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, PENSACOLA		**JOB NUMBER:** 4821
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 1/3.0E-04 mg/kg-day x 330 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 1.10E+00 kg-kg/mg ✓

$Intake_{Der}$ = 1/3.0E-04 mg/kg-day x 3300 cm2/day x 0.3 mg/cm2 x 0.03 x 1E-06 kg/mg

$Intake_{Der}$ = 9.90E-02 kg-kg/mg ✓

$Intake_{Inh}$ = 1/3.0E-04 mg/kg-day x 20 m3/day x (1/1.00E+99 m3/kg + 1/2.43E+06 m3/kg)

$Intake_{Inh}$ = 2.74E-02 kg-kg/mg ✓

$$SCTL = \frac{1 \times 70 \text{ kg} \times 365 \text{ days}}{250 \text{ days/yr} \times 1 \text{ yrs} \times 1 \times [1.10E{+}00 \text{ kg-kg/mg} + 9.90E{-}02 \text{ kg-kg/mg} + 2.74E{-}02 \text{ kg-kg/mg}]}$$

SCTL = 8.33E+01 mg/kg ✓

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** J c Jackson	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for construction workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = CSFo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = CSFd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = CSFi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Benzo(a)pyrene (cPAHs)	
SCTL	=		Soil Cleanup Target Level (mg/kg)
TR	=	1.0E-06	Target Cancer Risk (unitless)
BW	=	70	Body weight (kg)
AT	=	25550	Averaging time (days)
EF	=	250	Exposure frequency (days/year)
ED	=	1	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	330	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.13	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	2.72E+07	Volatilization factor (m^3/kg)
PEF	=	2.43E+06	Particulate emission factor (m^3/kg)
CSFo	=	7.30E+00	Oral cancer slope factor $(mg/kg/day)^{-1}$
CSFd	=	7.30E+00	Dermal cancer slope factor $(mg/kg/day)^{-1}$
CSFi	=	3.10E+00	Inhalation cancer slope factor $(mg/kg/day)^{-1}$

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS CONSTRUCTION WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 7.30E+00 (mg/kg-day)-1 x 330 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 2.41E-03 kg-kg/mg ✓

$Intake_{Der}$ = 7.30E+00 (mg/kg-day)-1 x 3300 cm2/day x 0.3 mg/cm2 x 0.13 x 1E-06 kg/mg

$Intake_{Der}$ = 9.40E-04 kg-kg/mg ✓

$Intake_{Inh}$ = 3.10E+00 (mg/kg-day)-1 x 20 m3/day x (1/2.72E+07 m3/kg + 1/2.43E+06 m3/kg)

$Intake_{Inh}$ = 2.78E-05 kg-kg/mg ✓

$$SCTL = \frac{1.E\text{-}06 \text{ x } 70 \text{ kg x } 25550 \text{ days}}{250 \text{ days/yr x } 1 \text{ yrs x } 1 \text{ x } [2.41E\text{-}03 \text{ kg-kg/mg} + 9.40E\text{-}04 \text{ kg-kg/mg} + 2.78E\text{-}05 \text{ kg-kg/mg}]}$$

SCTL = 2.12E+00 mg/kg ✓

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS MAINTENANCE WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for maintenance workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = CSFo \times IRo \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Der} = CSFd \times SA \times AF \times DA \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Inh} = CSFi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Benzo(a)pyrene (cPAHs)	
SCTL	=		Soil Cleanup Target Level (mg/kg)
TR	=	1.0E-06	Target Cancer Risk (unitless)
BW	=	70	Body weight (kg)
AT	=	25550	Averaging time (days)
EF	=	30	Exposure frequency (days/year)
ED	=	25	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	50	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.2	Adherence factor (mg/cm^2)
DA	=	0.13	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	2.72E+07	Volatilization factor (m^3/kg)
PEF	=	1.24E+09	Particulate emission factor (m^3/kg)
CSFo	=	7.30E+00	Oral cancer slope factor $(mg/kg/day)^{-1}$
CSFd	=	7.30E+00	Dermal cancer slope factor $(mg/kg/day)^{-1}$
CSFi	=	3.10E+00	Inhalation cancer slope factor $(mg/kg/day)^{-1}$

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS MAINTENANCE WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 7.30E+00 (mg/kg-day)-1 x 50 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 3.65E-04 kg-kg/mg ✓

$Intake_{Der}$ = 7.30E+00 (mg/kg-day)-1 x 3300 cm2/day x 0.2 mg/cm2 x 0.13 x 1E-06 kg/mg

$Intake_{Der}$ = 6.26E-04 kg-kg/mg ✓

$Intake_{Inh}$ = 3.10E+00 (mg/kg-day)-1 x 20 m3/day x (1/2.72E+07 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 2.33E-06 kg-kg/mg ✓

$$SCTL = \frac{1.E\text{-}06 \times 70\ kg \times 25550\ days}{30\ days/yr \times 25\ yrs \times 1 \times [3.65E\text{-}04\ kg\text{-}kg/mg + 6.26E\text{-}04\ kg\text{-}kg/mg + 2.33E\text{-}06\ kg\text{-}kg/mg]}$$

SCTL = 2.40E+00 mg/kg ✓

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - MAINTENANCE WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for maintenance workers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = 1/RfDo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = 1/RfDd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = 1/RfDi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Arsenic	
SCTL	=		Soil Cleanup Target Level (mg/kg)
THI	=	1	Target Hazard Index (unitless)
BW	=	70	Body weight (kg)
AT	=	9125	Averaging time (days)
EF	=	30	Exposure frequency (days/year)
ED	=	25	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	50	Ingestion rate, oral (mg/day)
SA	=	3300	Surface area of skin exposed (cm^2/day)
AF	=	0.2	Adherence factor (mg/cm^2)
DA	=	0.03	Dermal absorption (unitless)
IRi	=	20	Inhalation rate (m^3/day)
VF	=	1.00E+99	Volatilization factor (m^3/kg) ✓
PEF	=	1.24E+09	Particulate emission factor (m^3/kg) ✓
RfDo	=	3.0E-04	Oral reference dose (mg/kg/day)
RfDd	=	3.0E-04	Dermal reference dose (mg/kg/day)
RfDi	=	3.0E-04	Inhalation reference dose (mg/kg/day)

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - MAINTENANCE WORKERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:**	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 1/3.0E-04 mg/kg-day x 50 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 1.67E-01 kg-kg/mg

$Intake_{Der}$ = 1/3.0E-04 mg/kg-day x 3300 cm2/day x 0.2 mg/cm2 x 0.03 x 1E-06 kg/mg

$Intake_{Der}$ = 6.60E-02 kg-kg/mg

$Intake_{Inh}$ = 1/3.0E-04 mg/kg-day x 20 m3/day x (1/1.00E+99 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 5.38E-05 kg-kg/mg

$$SCTL = \frac{1 \text{ x } 70 \text{ kg x } 9125 \text{ days}}{30 \text{ days/yr x } 25 \text{ yrs x } 1 \text{ x } [1.67E\text{-}01 \text{ kg-kg/mg} + 6.60E\text{-}02 \text{ kg-kg/mg} + 5.38E\text{-}05 \text{ kg-kg/mg}]}$$

SCTL = 3.66E+03 mg/kg

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD	**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS ADOLESCENT TRESPASSERS	
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005	
BY: R. JUPIN	**CHECKED BY:** T. Jupin **DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for adolescent trespassers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = CSFo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = CSFd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = CSFi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Benzo(a)pyrene (cPAHs)	
SCTL	=		Soil Cleanup Target Level (mg/kg)
TR	=	1.0E-06	Target Cancer Risk (unitless)
BW	=	45	Body weight (kg)
AT	=	25550	Averaging time (days)
EF	=	45	Exposure frequency (days/year)
ED	=	10	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	100	Ingestion rate, oral (mg/day)
SA	=	3280	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.13	Dermal absorption (unitless)
IRi	=	4.8	Inhalation rate (m^3/day)
VF	=	2.98E+07	Volatilization factor (m^3/kg)
PEF	=	1.24E+09	Particulate emission factor (m^3/kg)
CSFo	=	7.30E+00	Oral cancer slope factor $(mg/kg/day)^{-1}$
CSFd	=	7.30E+00	Dermal cancer slope factor $(mg/kg/day)^{-1}$
CSFi	=	3.10E+00	Inhalation cancer slope factor $(mg/kg/day)^{-1}$

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS ADOLESCENT TRESPASSERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 7.30E+00 (mg/kg-day)-1 x 100 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 7.30E-04 kg-kg/mg ✓

$Intake_{Der}$ = 7.30E+00 (mg/kg-day)-1 x 3280 cm2/day x 0.3 mg/cm2 x 0.13 x 1E-06 kg/mg

$Intake_{Der}$ = 9.34E-04 kg-kg/mg ✓

$Intake_{Inh}$ = 3.10E+00 (mg/kg-day)-1 x 4.8 m3/day x (1/2.98E+07 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 5.11E-07 kg-kg/mg ✓

$$SCTL = \frac{1.E\text{-}06 \times 45\ kg \times 25550\ days}{45\ days/yr \times 10\ yrs \times 1 \times [7.30E\text{-}04\ kg\text{-}kg/mg + 9.34E\text{-}04\ kg\text{-}kg/mg + 5.11E\text{-}07\ kg\text{-}kg/mg]}$$

SCTL = 1.54E+00 mg/kg ✓

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - ADOLESCENT TRESPASERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for adolescent trespassers exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = 1/RfDo \times IRo \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Der} = 1/RfDd \times SA \times AF \times DA \times 10^{-6} \text{ kg/mg}$$

$$Intake_{Inh} = 1/RfDi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Arsenic	
SCTL	=		Soil Cleanup Target Level (mg/kg)
THI	=	1	Target Hazard Index (unitless)
BW	=	45	Body weight (kg)
AT	=	3650	Averaging time (days)
EF	=	45	Exposure frequency (days/year)
ED	=	10	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	100	Ingestion rate, oral (mg/day)
SA	=	3280	Surface area of skin exposed (cm^2/day)
AF	=	0.3	Adherence factor (mg/cm^2)
DA	=	0.03	Dermal absorption (unitless)
IRi	=	4.8	Inhalation rate (m^3/day)
VF	=	1.00E+99	Volatilization factor (m^3/kg)
PEF	=	1.24E+09	Particulate emission factor (m^3/kg)
RfDo	=	3.0E-04	Oral reference dose (mg/kg/day)
RfDd	=	3.0E-04	Dermal reference dose (mg/kg/day)
RfDi	=	3.0E-04	Inhalation reference dose (mg/kg/day)

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - ADOLESCENT TRESPASERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:**	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 1/3.0E-04 mg/kg-day x 100 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 3.33E-01 kg-kg/mg

$Intake_{Der}$ = 1/3.0E-04 mg/kg-day x 3280 cm2/day x 0.3 mg/cm2 x 0.03 x 1E-06 kg/mg

$Intake_{Der}$ = 9.84E-02 kg-kg/mg

$Intake_{Inh}$ = 1/3.0E-04 mg/kg-day x 4.8 m3/day x (1/1.00E+99 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 1.29E-05 kg-kg/mg

$$SCTL = \frac{1 \times 45 \text{ kg} \times 3650 \text{ days}}{45 \text{ days/yr} \times 10 \text{ yrs} \times 1 \times [3.33E\text{-}01 \text{ kg-kg/mg} + 9.84E\text{-}02 \text{ kg-kg/mg} + 1.29E\text{-}05 \text{ kg-kg/mg}]}$$

SCTL = 8.45E+02 mg/kg

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS ADULT RECREATIONAL USERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for adult recreational users exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{TR \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = CSFo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = CSFd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = CSFi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Benzo(a)pyrene (cPAHs)	
SCTL	=		Soil Cleanup Target Level (mg/kg)
TR	=	1.0E-06	Target Cancer Risk (unitless)
BW	=	70	Body weight (kg)
AT	=	25550	Averaging time (days)
EF	=	45	Exposure frequency (days/year)
ED	=	20	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	100	Ingestion rate, oral (mg/day)
SA	=	5700	Surface area of skin exposed (cm^2/day)
AF	=	0.07	Adherence factor (mg/cm^2)
DA	=	0.13	Dermal absorption (unitless)
IRi	=	6.4	Inhalation rate (m^3/day)
VF	=	2.98E+07	Volatilization factor (m^3/kg) ✓
PEF	=	1.24E+09	Particulate emission factor (m^3/kg) ✓
CSFo	=	7.30E+00	Oral cancer slope factor $(mg/kg/day)^{-1}$
CSFd	=	7.30E+00	Dermal cancer slope factor $(mg/kg/day)^{-1}$
CSFi	=	3.10E+00	Inhalation cancer slope factor $(mg/kg/day)^{-1}$

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR CARCINOGENS ADULT RECREATIONAL USERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** J. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 7.30E+00 (mg/kg-day)-1 x 100 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 7.30E-04 kg-kg/mg ✓

$Intake_{Der}$ = 7.30E+00 (mg/kg-day)-1 x 5700 cm2/day x 0.07 mg/cm2 x 0.13 x 1E-06 kg/mg

$Intake_{Der}$ = 3.79E-04 kg-kg/mg ✓

$Intake_{Inh}$ = 3.10E+00 (mg/kg-day)-1 x 6.4 m3/day x (1/2.98E+07 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 6.81E-07 kg-kg/mg ✓

$$SCTL = \frac{1.E\text{-}06 \times 70\ kg \times 25550\ days}{45\ days/yr \times 20\ yrs \times 1 \times [7.30E\text{-}04\ kg\text{-}kg/mg + 3.79E\text{-}04\ kg\text{-}kg/mg + 6.81E\text{-}07\ kg\text{-}kg/mg]}$$

SCTL = 1.79E+00 mg/kg ✓

CLIENT: NAVAL AIR STATION, WHITING FIELD	**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - ADULT RECREATIONAL USERS	
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005	

BY:	**CHECKED BY:**	**DATE:**
R. JUPIN	T. Jackson	8/28/2007

PURPOSE: To calculate an alternative soil cleanup level for adult recreational users exposed to soil.

RELEVANT EQUATIONS:

$$SCTL = \frac{THI \times BW \times AT}{EF \times ED \times FC \times [Intake_{Ing} + Intake_{Der} + Intake_{Inh}]}$$

$$Intake_{Ing} = 1/RfDo \times IRo \times 10^{-6}\ kg/mg$$

$$Intake_{Der} = 1/RfDd \times SA \times AF \times DA \times 10^{-6}\ kg/mg$$

$$Intake_{Inh} = 1/RfDi \times IRi \times (1/VF + 1/PEF)$$

Where:

Chemical	=	Arsenic	
SCTL	=		Soil Cleanup Target Level (mg/kg)
THI	=	1	Target Hazard Index (unitless)
BW	=	70	Body weight (kg)
AT	=	7300	Averaging time (days)
EF	=	45	Exposure frequency (days/year)
ED	=	20	Exposure duration (years)
FC	=	1	Fraction from contaminated source (unitless)
IRo	=	100	Ingestion rate, oral (mg/day)
SA	=	5700	Surface area of skin exposed (cm^2/day)
AF	=	0.07	Adherence factor (mg/cm^2)
DA	=	0.03	Dermal absorption (unitless)
IRi	=	6.4	Inhalation rate (m^3/day)
VF	=	1.00E+99	Volatilization factor (m^3/kg)
PEF	=	1.24E+09	Particulate emission factor (m^3/kg)
RfDo	=	3.0E-04	Oral reference dose (mg/kg/day)
RfDd	=	3.0E-04	Dermal reference dose (mg/kg/day)
RfDi	=	3.0E-04	Inhalation reference dose (mg/kg/day)

CALCULATION WORKSHEET

CLIENT: NAVAL AIR STATION, WHITING FIELD		**JOB NUMBER:** 0052
SUBJECT: CALCULATION OF ALTERNATE SOIL CLEANUP TARGET LEVELS (SCTLS) FOR NONCARCINOGENS - ADULT RECREATIONAL USERS		
BASED ON: TECHNICAL REPORT: DEVELOPMENT OF SOIL CLEANUP TARGET LEVELS FOR CHAPTER 62-777, F.A.C., FDEP, FEBRUARY 2005		
BY: R. JUPIN	**CHECKED BY:** T. Jackson	**DATE:** 8/28/2007

EXAMPLE CALCULATION

$Intake_{Ing}$ = 1/3.0E-04 mg/kg-day x 100 mg/day x 1E-06 kg/mg

$Intake_{Ing}$ = 3.33E-01 kg-kg/mg ✓

$Intake_{Der}$ = 1/3.0E-04 mg/kg-day x 5700 cm2/day x 0.07 mg/cm2 x 0.03 x 1E-06 kg/mg

$Intake_{Der}$ = 3.99E-02 kg-kg/mg ✓

$Intake_{Inh}$ = 1/3.0E-04 mg/kg-day x 6.4 m3/day x (1/1.00E+99 m3/kg + 1/1.24E+09 m3/kg)

$Intake_{Inh}$ = 1.72E-05 kg-kg/mg ✓

$$SCTL = \frac{1 \text{ x } 70 \text{ kg x } 7300 \text{ days}}{45 \text{ days/yr x } 20 \text{ yrs x } 1 \text{ x } [3.33E-01 \text{ kg-kg/mg} + 3.99E-02 \text{ kg-kg/mg} + 1.72E-05 \text{ kg-kg/mg}]}$$

SCTL = 1.52E+03 mg/kg ✓

APPENDIX E

SURROGATE SPECIES RECEPTOR PROFILES

APPENDIX E

SURROGATE RECEPTOR PROFILES
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

The following sections present the receptor profiles for the short-tailed shrew, American robin, meadow vole, northern bobwhite quail, mink, belted kingfisher, American woodcock, great blue heron, red fox, and red-tailed hawk. The majority of the information for the profiles was obtained from the Wildlife Exposure Factors Handbook (USEPA, 1993). The data for the incidental soil ingestion rates were obtained from the Estimates of Soil Ingestion by Wildlife (Beyer, 1993) or the draft USEPA Ecological Soil Screening Guidance (USEPA, July 2000).

The food and water ingestion rates are listed in g/g (of body weight)-day on a wet weight basis but were converted to dry weight for the ERA. The home ranges are presented in hectares in USEPA (1993) but were converted to acres by multiplying the number of hectares by 2.471. Also note that the estimated percent of soil in the diets are listed in dry weight. The attached table presents the calculation of the exposure parameters and how the calculations were done.

Short-Tailed Shrew (*Blarina brevicauda*)

Shrews inhabit a wide variety of habitats and are common in areas with abundant vegetative cover. They need cool, moist habitats because of their high metabolic and water-loss rates. The short-tailed shrew is primarily carnivorous, eating insects such as earthworms, slugs, and snails.

The adult body weight for the short-tailed shrew in various habitats ranged from 0.015 to 0.01921 kg with an average of 0.0161 kg. The listed food ingestion rates for shrews are 0.49 and 0.62 g/g-day (wet-weight). The water ingestion rate was listed as 0.223 g/g-day. The food and water ingestion rates in kg/day and L/day, respectively, were calculated as shown in the attached table. The food ingestion rates were then multiplied by 0.16, which is the percent solids of worms (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (assumed 3% for conservative food chain model and 1.5% for the average food chain model) from USEPA (July 2000). 3% is the 90^{th} percentile value and 1.5% is the 50^{th} percentile value from USEPA (July 2000). The home range for the shrew (0. 9699 acres) was calculated using data from a tamarek bog in Manitoba (only value available).

American Woodcock (*Scolopax minor*)

Woodcocks inhabit both woodlands and abandoned fields, particularly those with rich and moderately to poorly drained loamy soils, which tend to support abundant earthworm populations. They feed primarily on invertebrates found in moist upland soils by probing the soil with their long prehensile-tipped bill. Earthworms are their preferred diet, but seeds and other plant matter may also be consumed.

The adult body weight for the woodcock ranges from 0.134 to 0.218 kg with an average of 0.173 kg. The listed food ingestion rate for the woodcock is 0.77 g/g-day (wet-weight). The water ingestion rate is listed as 0.1 g/g-day. The food ingestion rates were then multiplied by 0.16, which is the percent solids of worms (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate was calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (assumed 11.74% for conservative food chain model and 6.68% for the average food chain model) from USEPA (July 2000). 11.74% is the 90th percentile value and 6.68% is the 50th percentile value from USEPA (July 2000).

The range of home range sizes for the woodcock is 7.66 to 182 acres with an average home range of 61 acres.

Meadow Vole (*Microtus pennsylvanicus*)

Meadow voles inhabit grassy fields, marshes, and bogs; however, they prefer fields with more grass, more cover, and fewer woody plants. They typically consume green succulent vegetation, sedges, seeds, roots, bark, fungi, insects, and animal matter. However, green succulent vegetation makes up the majority of their diet.

The adult body weight for the vole ranges from 0.017 to 0.0524 kg with an average of 0.0358 kg. The only listed food ingestion rates for voles range from 0.30 to 0.35 g/g-day (wet-weight), with an average of 0.325 g/g-day. The water ingestion rates are 0.14 (estimated) and 0.21 g/g-day, with an average of 0.175 g/g-day. The food and water ingestion rates in kg/day and L/day, respectively, were calculated as shown in the attached table. The food ingestion rates were then multiplied by 0.30, which is the percent solids of young grass (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. Finally, the incidental soil ingestion rate is calculated by multiplying the ingestion rate by the percentage of soil that is incidentally ingested (2.4 percent) from Beyer (1993). The home range for the meadow vole ranges from 0.000494 to 0.2051 acres with an average home range of 0.0659 acres.

Northern Bobwhite Quail (*Colinus virginianus*)

Quails inhabit grasslands, idle fields, pastures, and large clumps of grasses. Bobwhite quails forage in areas with open vegetation, some bare ground, and light litter. Seeds from weeds, woody plants, and grasses comprise the majority of an adult's diet, although green vegetation has been found to dominate the diet of this species in winter in the southern areas of the United States.

The adult body weight for the bobwhite quail ranges from 0.154 to 0.1939 kg with an average of 0.1751 kg.

The listed food ingestion rates for quails range from 0.067 to 0.093 g/g-day (wet-weight), with an average of 0.078 g/g-day. The water ingestion rate is estimated as 0.10 and 0.11 g/g-day, and measured as 0.10 to 0.13 g/g-day, for an average water ingestion rate of 0.11 g/g-day. The food and water ingestion rates in kg/day and L/day, respectively, were calculated as shown in the attached table. The food ingestion rates were then multiplied by 0.30, which is the percent solids of young grass (Sample et al., 1997) to convert the ingestion rate from a wet-weight value to a dry-weight value. The incidental soil ingestion rate is calculated by multiplying the food ingestion rate by the percentage of soil that is incidentally ingested (8.2 percent). The 8.2 percent is based on the incidental sediment ingestion rate of a Canada goose (Beyer, 1994), which also consumes terrestrial vegetation, because an incidental soil ingestion rate was not available for the quail.

The home range for the quail ranges from 8.9 to 41.3 acres with an average home range of 18.8 acres.

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APPENDIX E

DERIVATION OF BIOACCUMULATION FACTORS
SITE 41 NAS WHITING FIELD
MILTON, FLORIDA

This attachment presents the bioaccumulation factors (BAFs) and biota sediment accumulation factors (BSAFs) that were used in the food chain models. Note that dry weight BAFs/BSAFs were used for this ERA. The following sources of BAFs/BSAFs were used in the ecological risk assessment for most of the chemicals:

- Plant and Soil Invertebrate BAFs: EPA Guidance for Developing Ecological Soil Screening Levels, Attachment 4-1 (USEPA, 2007).
- Plant BAFs (organic chemicals): Toxicity and Chemical-Specific Factors Database (ORNL, 2008).
- Plant BAFs (metals): Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants (ORNL, September 1998).
- Soil Invertebrate BAFs: Development and Validation of Bioaccumulation Models for Earthworms (Sample et al., 1998).

The Appendix G Table titled “Dry Weight BAFs for Plants and Earthworms” presents the BAFs that were used in the food-chain models for the individual chemicals that were retained for food chain modeling at Site 1. A default value of 1.0 was used for the BAF if chemical-specific data was not available.

The EPA Guidance for Developing Ecological Soil Screening Levels (Eco SSLs) (USEPA, 2007) was the source of the BAFs for PAHs, dieldrin, and most metals. The majority of these BAFs are actually regression or BAF equations that are used to calculate the tissue concentration from the soil concentration.

The earthworm BAFs for some pesticides were from field studies summarized in various publications as presented in Beyer (1990). The sources of the BAF are listed in the footnotes in the Appendix Table G-3 titled “Derivation of Soil to Earthworm Bioaccumulation Factors for Some Pesticides” and references are provided below. BAFs were calculated by dividing the worm concentration by the soil concentration (if the BAFs were not calculated within the study). The BAFs were either presented on a wet-weight or dry weight basis. Wet weight BAFs were derived by multiplying the dry weight BAF by 0.16, which is the percent solids of soil invertebrates (Sample et. al., 1997), while dry-weight BAFs were derived by dividing the wet weight BAF by 0.16. The BAFs from the studies were used for both the conservative and average food chain models.

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APPENDIX E

TRV SOURCE AND ENDPOINT REFERENCES
SITE 41 NAS WHITING FIELD
MILTON, FLORIDA

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APPENDIX TABLE E-1

DRY WEIGHT DERIVATION OF BODY WEIGHT, FOOD INTAKE, AND WATER INTAKE FACTORS FOR TERRESTRIAL FOOD CHAIN MODELS
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Data from EPA (1993)				Derivation of Factors for Modeling			
Species/Factor	**Age/Sex/ Cond./Seas.**	**Value**	**Study Average**	**Calculation of Values**			**Notes**
Short-Tailed Shrew							
Body Weight (g)	A B	15	15	Minimum Value	0.0150	kg	
				Maximum Value	0.01921	kg	
	M summer	19.21	17.27	Overall Study Average	0.01613	kg	
	F summer	17.4					
	M fall	16.87					
	M fall	15.58					
Food Ingestion Rate (g/g-day)	A B	0.49		Conservative value:	0.0016	kg/day	Maximum ingestion rate * Average Body weight * 0.16[1]
	A B	0.62		Average value	0.00143	kg/day	Average ingestion rate * Average Body weight * 0.16[1]
	Overall Study Average		0.555				[1] - 0.16 = percent solids in earthworms to convert to a dry weight ingestion rate
Water Ingestion Rate (g/g-day)	A B	0.223		Conservative value:	0.00428	L/day	Ingestion rate * Maximum Body weight
				Average value	0.00360	L/day	Ingestion rate * Average Body weight
Home Range (ha)	B B all	0.39		0.39ha*2.471(ac/ha) =			0.96369
				Average value (acres):			0.96369
Meadow Vole							
Body Weight (g)	A M summer	40	36.7	Minimum Value	0.017	kg	
	A F summer	33.4		Maximum Value	0.052	kg	
				Overall Study Average	0.0358	kg	
	A M spring	52.4	48.0				
	A F spring	43.5					
	A B spring	26	21.2				
	A B summer	24.3					
	A B fall	17					
	A B winter	17.5					
	A M	35.5	37.3				
	A F	39					
Food Ingestion Rate (g/g-day)		0.3	0.33	Conservative value:	0.001878	kg/day	Maximum ingestion rate * Average Body weight * 0.15 [1]
		0.35					
				Average value	0.001744	kg/day	Average ingestion rate * Average Body weight * 0.15[1]
							[1] - 0.15 = percent solids in foilage to convert to a dry weight ingestion rate
Water Ingestion Rate	A B	0.21	0.18	Conservative value:	0.007513	L/day	Maximum ingestion rate * Average Body weight
	A B	0.14		Average value	0.006261	L/day	Average ingestion rate * Average Body weight
Home Range (ha)	A M summer	0.019		0.019ha*2.471(ac/ha)		=	0.046949
	A F summer	0.0069		0.0069ha*2.471(ac/ha)		=	0.0170499
	A B summer	0.014		0.014ha*2.471(ac/ha)		=	0.034594
	A B winter	0.0002		0.0002ha*2.471(ac/ha)		=	0.0004942
	A M summer	0.083		0.083ha*2.471(ac/ha)		=	0.205093
	A F summer	0.037		0.037ha*2.471(ac/ha)		=	0.091427
				Average value (acres):			0.065934517

APPENDIX TABLE E-1

DRY WEIGHT DERIVATION OF BODY WEIGHT, FOOD INTAKE, AND WATER INTAKE FACTORS FOR TERRESTRIAL FOOD CHAIN MODELS
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Data from EPA (1993)				Derivation of Factors for Modeling			
Species/Factor	Age/Sex/ Cond./Seas.	Value	Study Average	Calculation of Values			Notes
Northern Bobwhite Quail							
Body Weight (g)	A B fall	189.9	191	Minimum Value	0.154	kg	
	A B winter	193.9		Maximum Value	0.194	kg	
	A B spring	190		Overall Study Average	0.1751	kg	
	A M winter	181	177				
	A M summer	163					
	A F winter	183					
	A F summer	180					
	A M winter	161	157				
	A M summer	154					
	A F winter	157					
	A F summer	157					
Food Ingestion Rate (g/g-day)	A B winter	0.093	0.078	Conservative value:	0.00244	kg/day	Maximum ingestion rate * Average Body weight * 0.15[1]
	A B spring	0.067					
	A B summer	0.079		Average value	0.00204	kg/day	Average ingestion rate * Average Body weight * 0.15[1]
	A B fall	0.072					[1] - 0.15 = percent solids in foilage to convert to a dry weight ingestion rate
Water Ingestion Rate (g/g-day)	A M summer	0.1	0.11	Conservative value:	0.0227616	L/day	Maximum ingestion rate * Average Body weight
	A F summer	0.13					
	A M summer	0.11		Average value	0.0192598	L/day	Average ingestion rate * Average Body weight
	A F summer	0.1					
Home Range (ha)	A B summer	3.6		3.6ha*2.471(ac/ha)		=	8.8956
	A M summer	7.6		7.6ha*2.471(ac/ha)		=	18.7796
	A M summer	16.7		16.7ha*2.471(ac/ha)		=	41.2657
	A F summer	6.4		6.4ha*2.471(ac/ha)		=	15.8144
	A F summer	15.6		15.6ha*2.471(ac/ha)		=	38.5476
				Average value (acres):			24.66058
American Woodcock							
Body Weight (g)	A M	176	197	Minimum Value	0.134	kg	
	A F	218		Maximum Value	0.218	kg	
				Overall Study Average	0.1731	kg	
	A M April	134.6	139.9				
	A M May	133.8					
	A M June	151.2					
	A M summer	145.9	164.4				
	A F summer	182.9					
	A M fall	169	191				
	A F fall	213					
Food Ingestion Rate (g/g-day)	A B winter	0.77		Conservative value:	0.02686	kg/day	Ingestion rate * Maximum Body weight * 0.16[1]
				Average value	0.02132	kg/day	Ingestion rate * Average Body weight * 0.16[1]
							[1] - 0.16 = percent solids in earthworms to convert to a dry weight ingestion rate
Water Ingestion Rate (g/g-day)	A M	0.1	0.1	Conservative value:	0.02180	L/day	Ingestion rate * Maximum Body weight
	A F	0.1					
				Average value	0.01731	L/day	Ingestion rate * Average Body weight
Home Range (ha)	A M	3.1		3.1ha*2.471(ac/ha)		=	7.6601
	A M	73.6		73.6ha*2.471(ac/ha)		=	181.8656
	A M	10.5		10.5ha*2.471(ac/ha)		=	25.9455
	B B	32.4		32.4ha*2.471(ac/ha)		=	80.0604
	A F	4.5		4.5ha*2.471(ac/ha)		=	11.1195
				Average value (acres):			61.33022

Notes:
A = Adult
F = Female, M = Male, B = Both
BW = Body Weight

TABLE E-2

DRY WEIGHT BAFS AND/OR BSAFS FOR PLANTS, EARTHWORMS, AND FISH
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

	Plant BAFs[1,2,3]		Earthworm BAFs[3,4]	
Chemicals	**Conservative[5]**	**Average[5]**	**Conservative[5]**	**Average[5]**
PAHs				
Anthracene	2.09E+00	2.09E+00	3.04E+00	3.04E+00
Benzo(a)anthracene	Regression from Eco SSL		2.60E+00	2.60E+00
Benzo(a)pyrene	Regression from Eco SSL		2.60E+00	2.60E+00
Benzo(b)fluoranthene	Regression from Eco SSL		2.60E+00	2.60E+00
Benzo(g,h,i)perylene	Regression from Eco SSL		2.60E+00	2.60E+00
Benzo(k)fluoranthene	Regression from Eco SSL		2.60E+00	2.60E+00
Chrysene	Regression from Eco SSL		2.60E+00	2.60E+00
Dibenzo(a,h)anthracene	Regression from Eco SSL		2.60E+00	2.60E+00
Fluoranthene	2.09E+00	2.09E+00	3.04E+00	3.04E+00
Indeno(1,2,3-cd)pyrene	Regression from Eco SSL		2.60E+00	2.60E+00
Phenanthrene	2.09E+00	2.09E+00	3.04E+00	3.04E+00
Pyrene	Regression from Eco SSL		2.60E+00	2.60E+00
Total PAHs	Regression from Eco SSL		2.60E+00	2.60E+00
Pesticides				
4,4'-DDD	Regression from Eco SSL		Regression from Eco SSL	
4,4'-DDE	Regression from Eco SSL		Regression from Eco SSL	
4,4'-DDT	Regression from Eco SSL		Regression from Eco SSL	
Aldrin	6.90E-01	6.90E-01	3.30E+00	3.30E+00
Alpha-Chlordane	2.50E-02	2.50E-02	5.00E+00	5.00E+00
Dieldrin	8.20E-02	8.20E-02	1.47E+01	1.47E+01
Gamma-Chlordane	8.20E-02	8.20E-02	3.60E+00	3.60E+00
Endrin	2.50E-02	2.50E-02	5.00E+00	5.00E+00
Heptachlor Epoxide	2.80E-02	2.80E-02	3.00E+00	3.00E+00
Inorganics				
Arsenic	3.75E-02	3.75E-02	Regression from Eco SSL	
Cadmium	Regression from Eco SSL		Regression from Eco SSL	
Chromium	4.10E-02	4.10E-02	3.06E-01	3.06E-01
Copper	Regression from Eco SSL		5.15E-01	5.15E-01
Lead	Regression from Eco SSL		Regression from Eco SSL	
Mercury	5.00E+00	6.52E-01	Regression - Sample et al., (1998)	
Nickel	Regression from Eco SSL		1.06E+00	1.06E+00
Zinc	Regression from Eco SSL		Regression from Eco SSL	

BAF - Bioaccumulation Factor

1 - ORNL (2007) for organics; only one value is available for conservative and average exposures
2 - ORNL (1998) for mercury; conservative value is 90th percentile; average value is median value
3 - Where "Eco-SSL" is given, values were calculated using equations from USEPA (2007), Attachment 4-1, Tables 4a (for inorganics) and 4b (for organics).
4 - Sources for the pesticide BAFs are given in this Appendix Table G-3 "Derivation of Earthworm BAFs for Some Pesticides; Sample et al., (February, 1998) for mercury.
5 - Conservative and average refers to the exposure scenarios for which the uptake factors are used

USEPA (U.S. Environmental Protection Agency), 2007. Guidance for Developing Ecological Soil Screening Level. Office of Solid Waste and Emergency and Response. OSWER Directive 92857-55. April.

ORNL (Oak Ridge National Laboratory). 2007. Toxicity and Chemical-Specific Factors Database. Oak Ridge National Laboratory Web Page, http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=csf.

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

APPENDIX TABLE E-3

DERIVATION OF SOIL TO EARTHWORM BAFs FOR SOME PESTICIDES
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

	Study Values					Calculated Values			
	Worm Concentration		Soil	Dry	Wet	Final	Final		
Parameter	**Dry Weight**	**Wet Weight**	**Conc. (dry weight)**	**Weight BAF**	**Weight BAF**	**Dry Weight[1] BAF**	**Wet Weight[2] BAF**	**Reference**	**Comments**
Heptachlor	NA	NA	NA	10	NA	10	1.60	1	soil type unknown (11-year field study)
Average dry/wet weight BAF from field studies[3]				***NA***	***NA***	***10***	***1.6***		
Aldrin	NA	NA	NA	3.3	NA	3.3	0.528	2	from data collected in 7 agricultural fields
Chlordane	NA	NA	NA	5	NA	5.0	0.8	2	from data collected in 7 agricultural fields
Endrin	NA	NA	NA	3.6	NA	3.6	0.576	2	from data collected in 26 agricultural fields
Heptachlor epoxide	NA	NA	NA	3	NA	3.0	0.48	2	from data collected in 9 agricultural fields

Notes:
BAF - bioaccumulation factor = worm concentration/soil concentration
NA - Not applicable
The percent solids of earthworms is assummed to be 0.16 [Sample et al., 1997])
1 - The calculated dry weight BAF was either obtained directly from the study or was calculated by dividing the wet weight BAF by 0.16
2 - The calculated wet weight BAF was either obtained directly from the study or was calculated by multiplying the dry weight BAF by 0.16

References
1 - Wheatly and Hardman, 1968
2 - Gish, 1970

TABLE E-4

WILDLIFE TOXICITY REFERENCE VALUES
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

PARAMETER	Mammal		Bird	
	NOAEL	LOAEL	NOAEL	LOAEL
SEMIVOLATILES				
Anthracene	65.6	356	2	20
Benzo(a)anthracene	0.615	38.4	2	20
Benzo(a)pyrene	0.615	38.4	2	20
Benzo(b)fluoranthene	0.615	38.4	2	20
Benzo(g,h,i)perylene	0.615	38.4	2	20
Benzo(k)fluoranthene	0.615	38.4	2	20
Chrysene	0.615	38.4	2	20
Dibenzo(a,h)anthracene	0.615	38.4	2	20
Fluoranthene	65.6	356	2	20
Indeno(1,2,3-cd)pyrene	0.615	38.4	2	20
Phenanthrene	65.6	356	2	20
Pyrene	0.615	38.4	2	20
Total PAHs	0.615	38.4	2	20
PESTICIDES/PCBs				
4,4'-DDD	0.147	0.274	0.227	0.281
4,4'-DDE	0.147	0.274	0.227	0.281
4,4'-DDT	0.147	0.274	0.227	0.281
Aldrin	0.2	1	NV	NV
Alpha-Chlordane	4.58	9.16	2.14	10.7
Dieldrin	0.015	1.27	0.0709	0.8
Endrin	0.092	0.92	0.01035	0.1035
Endrin Ketone	0.092	0.92	0.01	0.1
Gamma-Chlordane	4.58	9.16	2.14	10.7
Heptachlor Epoxide	0.1	1	NV	NV
INORGANICS				
Arsenic	1.04	4.55	2.24	4.51
Cadmium	0.8	6.9	1.5	6.3
Chromium	2.40	58.17	2.66	15.63
Copper	5.6	82.7	4.05	34.87
Lead	4.7	186.4	1.63	44.63
Mercury	0.032	0.16	0.0064	0.064
Nickel	1.70	14.77	6.71	18.57
Zinc	75.4	298	66.1	171.44

Notes:

The sources of these NOAELS and LOAELS are presented in the table titled "Sources and Endpoints for NOAELS and LOAELS for Terrestrial Wildlife" in this appendix.
The NOAELS and LOAELS in the source table were divided by 10 if a subchronic study was the basis for the value. Also, if only a NOAEL was available, the value was multiplied by 10 to estimate the LOAEL. If only a LOAEL was available, the value was divided by 10 to estimate the NOAEL.
The NOAELs and LOAELs for the following PAHs are based on the Low Molecular Weight PAH values:anthracene, fluoranthene, and phenanthrene,
The NOAELs and LOAELs for the following PAHs are based on the High Molecular Weight PAH values: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, pyrene, and total PAHs.
The NOAELs and LOAELs for the PAHs for birds were based on 7,12-dimethylbenz(a)anthracene.
The LOAELs used for several metals were calculated as the geometric mean of growth and reproduction data from the Ecological Soil Screening Levels (U.S. EPA, 2005, 2006, 2007, 2008).

APPENDIX TABLE E-5

SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE

Parameters	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Semivolatiles Organics							
Low Molecular Weight PAHs	65.6	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Low Molecular Weight PAHs	356	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
High Molecular Weight PAHs	0.615	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
High Molecular Weight PAHs	38.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
7,12-Dimethylbenz(a)anthracene	2	NOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
7,12-Dimethylbenz(a)anthracene	20	LOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
Pesticides/PCBs							
Aldrin	0.2	NOAEL	reproductive	chronic	rat	Treon and Cleveland, 1955	Sample et.al., 1996
Aldrin	1	LOAEL	reproductive	chronic	rat	Treon and Cleveland, 1955	Sample et.al., 1996
Chlordane	2.14	NOAEL	mortality	chronic	red-winged blackbird	Stickel et al., 1983	Sample et.al., 1996
Chlordane	10.7	LOAEL	mortality	chronic	red-winged blackbird	Stickel et al., 1983	Sample et.al., 1996
Chlordane	4.58	NOAEL	reproduction	chronic	mouse	WHO, 1984	Sample et.al., 1996
Chlordane	9.16	LOAEL	reproduction	chronic	mouse	WHO, 1984	Sample et.al., 1996
4,4'-DDT	0.147	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
4,4'-DDT	0.274	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
4,4'-DDT	0.227	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
4,4'-DDT	0.281	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Dieldrin	0.0709	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Dieldrin	0.8	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Dieldrin	0.015	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Dieldrin	1.27	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Endrin	0.92	LOAEL	reproduction	chronic	mouse	Good and Ware, 1969	Sample et.al., 1996
Endrin	0.1035	LOAEL	reproduction	chronic	screech owl	Fleming et al., 1982	Sample et.al., 1996
Heptachlor	1	LOAEL	reproduction	chronic	mink	Crum et al., 1993	Sample et.al., 1996
Inorganics							
Arsenic	2.24	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Arsenic	4.51	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Arsenic	1.04	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Arsenic	4.55	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Cadmium	1.47	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	6.35	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	0.77	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Cadmium	6.9	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Chromium(III)	2.66	NOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	15.63	LOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	2.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(III)	58.17	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(VI)	5.66	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(VI)	38.37	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	

APPENDIX TABLE E-5

SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE

Parameters	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Copper	4.05	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Copper	34.87	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Copper	5.6	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Copper	82.7	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Lead	1.63	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Lead	44.6	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Lead	4.7	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Lead	186.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Mercury	0.064	LOAEL	reproductive	chronic	mallard duck	Heinz, 1979	Sample et.al., 1996
Mercury	0.032	NOAEL	reproductive	chronic	rat	Verschuuren et al., 1976	Sample et.al., 1996
Mercury	0.16	LOAEL	reproductive	chronic	rat	Verschuuren et al., 1976	Sample et.al., 1996
Nickel	6.71	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Nickel	18.57	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Nickel	1.7	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Nickel	14.77	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	75.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	297.58	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	66.1	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Zinc	171.44	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	

Notes:

NOAEL = No Observed Adverse Effects Level

LOAEL = Lowest Observed Adverse Effects Level

The NOAELS and LOAELS for the following PAHs are based on the Low Molecular Weight PAH values: acenapthylene, acenaphthene, anthracene, fluoranthene, fluorene, phenanthrene, 2-methylnaphthalene, and naphthalene.

The NOAELS and LOAELS for the following PAHs are based on the High Molecular Weight PAH values: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, indeno(1,2,3-c,d)pyrene, and pyrene.

The NOAELS and LOAELS for the PAHs for birds were based on 7,12-dimethylbenz(a)anthracene.

The LOAELs used for several metals were calculated as the geometric mean of growth and reproduction data from the Ecological Soil Screening Levels (U.S. EPA, 2005, 2006, 2007).

The LOAELs for Aroclor-1254 were used as surrogates for Aroclor-1260.

References for the NOAELS and LOAELs are presented in this Attachment and Titled "TRV Source and Endpoint References".

BOBWHITE QUAIL - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Avg Soil Conc. (mg/kg)	Avg SW Conc. (mg/L)	Vegetation Conc. (mg/kg)	Dose (mg/kg/d) from: Soil	Dose (mg/kg/d) from: Surface Water	Dose (mg/kg/d) from: Veget.	Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients NOAEL	Hazard Quotients LOAEL
PAHs											
Anthracene	5.39E-03	0.00E+00	1.13E-02	7.66E-06	0.00E+00	2.62E-04	2.70E-04	2.00E+00	2.00E+01	1.3E-04	1.3E-05
Benzo(a)anthracene	1.54E-01	0.00E+00	3.09E-02	2.18E-04	0.00E+00	7.21E-04	9.39E-04	2.00E+00	2.00E+01	4.7E-04	4.7E-05
Benzo(a)pyrene	3.02E-01	0.00E+00	5.86E-02	4.29E-04	0.00E+00	1.36E-03	1.79E-03	2.00E+00	2.00E+01	9.0E-04	9.0E-05
Benzo(b)fluoranthene	1.98E-01	0.00E+00	3.93E-02	2.81E-04	0.00E+00	9.16E-04	1.20E-03	2.00E+00	2.00E+01	6.0E-04	6.0E-05
Benzo(g,h,i)perylene	1.68E-01	0.00E+00	3.37E-02	2.39E-04	0.00E+00	7.85E-04	1.02E-03	2.00E+00	2.00E+01	5.1E-04	5.1E-05
Benzo(k)fluoranthene	1.43E-01	0.00E+00	2.88E-02	2.03E-04	0.00E+00	6.71E-04	8.74E-04	2.00E+00	2.00E+01	4.4E-04	4.4E-05
Chrysene	1.83E-01	0.00E+00	3.65E-02	2.60E-04	0.00E+00	8.51E-04	1.11E-03	2.00E+00	2.00E+01	5.6E-04	5.6E-05
Dibenzo(a,h)anthracene	8.95E-02	0.00E+00	1.85E-02	1.27E-04	0.00E+00	4.32E-04	5.59E-04	2.00E+00	2.00E+01	2.8E-04	2.8E-05
Fluoranthene	2.79E-01	0.00E+00	5.83E-01	3.96E-04	0.00E+00	1.36E-02	1.40E-02	2.00E+00	2.00E+01	7.0E-03	7.0E-04
Indeno(1,2,3-cd)pyrene	1.81E-01	0.00E+00	3.60E-02	2.57E-04	0.00E+00	8.40E-04	1.10E-03	2.00E+00	2.00E+01	5.5E-04	5.5E-05
Phenanthrene	1.24E-01	0.00E+00	2.59E-01	1.76E-04	0.00E+00	6.03E-03	6.20E-03	2.00E+00	2.00E+01	3.1E-03	3.1E-04
Pyrene	2.37E-01	0.00E+00	4.67E-02	3.37E-04	0.00E+00	1.09E-03	1.43E-03	2.00E+00	2.00E+01	7.1E-04	7.1E-05
Total PAHs	1.36E+00	0.00E+00	2.44E-01	1.93E-03	0.00E+00	5.68E-03	7.61E-03	2.00E+00	2.00E+01	3.8E-03	3.8E-04
Pesticides/PCBs											
4,4'-DDD	2.14E-02	0.00E+00	4.49E-03	3.04E-05	0.00E+00	1.05E-04	1.35E-04	2.27E-01	2.81E-01	5.9E-04	4.8E-04
4,4'-DDE	1.74E-02	0.00E+00	3.86E-03	2.48E-05	0.00E+00	8.98E-05	1.15E-04	2.27E-01	2.81E-01	5.0E-04	4.1E-04
4,4'-DDT	3.88E-02	0.00E+00	7.03E-03	5.51E-05	0.00E+00	1.64E-04	2.19E-04	2.27E-01	2.81E-01	9.6E-04	7.8E-04
ALDRIN	2.17E-03	0.00E+00	1.50E-03	3.08E-06	0.00E+00	3.49E-05	3.79E-05	NV	NV	#VALUE!	#VALUE!
ALPHA-CHLORDANE	5.38E-02	0.00E+00	1.34E-03	7.64E-05	0.00E+00	3.13E-05	1.08E-04	2.14E+00	1.07E+01	5.0E-05	1.0E-05
DIELDRIN	4.95E-02	0.00E+00	4.06E-03	7.04E-05	0.00E+00	9.46E-05	1.65E-04	7.09E-02	8.00E-01	2.3E-03	2.1E-04
ENDRIN	1.63E-02	0.00E+00	1.34E-03	2.32E-05	0.00E+00	3.12E-05	5.43E-05	1.04E-02	1.04E-01	5.2E-03	5.2E-04
GAMMA-CHLORDANE	5.68E-02	0.00E+00	1.42E-03	8.08E-05	0.00E+00	3.31E-05	1.14E-04	2.14E+00	1.07E+01	5.3E-05	1.1E-05
HEPTACHLOR EPOXIDE	3.09E-03	0.00E+00	8.65E-05	4.39E-06	0.00E+00	2.02E-06	6.41E-06	NV	NV	#VALUE!	#VALUE!
Inorganics											
ARSENIC	1.54E+00	0.00E+00	5.77E-02	2.19E-03	0.00E+00	1.35E-03	3.53E-03	2.24E+00	4.51E+00	1.6E-03	7.8E-04
CADMIUM	1.08E-01	0.00E+00	1.85E-01	1.54E-04	0.00E+00	4.30E-03	4.45E-03	1.47E+00	6.35E+00	3.0E-03	7.0E-04
CHROMIUM	1.32E+01	0.00E+00	5.43E-01	1.88E-02	0.00E+00	1.27E-02	3.15E-02	2.66E+00	1.56E+01	1.2E-02	2.0E-03
COPPER	6.36E+00	0.00E+00	4.04E+00	9.05E-03	0.00E+00	9.42E-02	1.03E-01	4.05E+00	3.49E+01	2.5E-02	3.0E-03
LEAD	4.94E+01	0.00E+00	2.36E+00	7.01E-02	0.00E+00	5.50E-02	1.25E-01	1.63E+00	4.46E+01	7.7E-02	2.8E-03
MERCURY	1.57E-02	0.00E+00	1.02E-02	2.23E-05	0.00E+00	2.38E-04	2.61E-04	6.40E-03	6.40E-02	4.1E-02	4.1E-03
NICKEL	2.44E+00	0.00E+00	2.11E-01	3.46E-03	0.00E+00	4.91E-03	8.37E-03	6.71E+00	1.86E+01	1.2E-03	4.5E-04
ZINC	3.24E+01	0.00E+00	3.32E+01	4.60E-02	0.00E+00	7.73E-01	8.19E-01	6.61E+01	1.71E+02	1.2E-02	4.8E-03

Body Weight = (BW)	1.75E-01	kg
Food Ingestion Rate = (If)	4.08E-03	kg/day
Water Ingestion Rate = (Iw)	1.93E-02	L/day
Soil Ingestion Rate = (Is)	2.49E-04	kg/day
Home Range = (HR)	1.88E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Cv = Contaminant concentration in vegetation
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (vegetation) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

BOBWHITE QUAIL - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Max Soil Conc. (mg/kg)	Max SW Conc. (mg/L)	Vegetation Conc. (mg/kg)	Dose (mg/kg/d) from:			Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients	
				Soil	Surface Water	Veget.				NOAEL	LOAEL
PAHs											
Anthracene	1.40E-02	0.00E+00	2.93E-02	6.17E-05	0.00E+00	9.27E-04	9.89E-04	2.00E+00	2.00E+01	4.9E-04	4.9E-05
Benzo(a)anthracene	2.82E-01	0.00E+00	5.50E-02	1.24E-03	0.00E+00	1.74E-03	2.98E-03	2.00E+00	2.00E+01	1.5E-03	1.5E-04
Benzo(a)pyrene	9.00E+00	0.00E+00	1.46E+00	3.96E-02	0.00E+00	4.62E-02	8.59E-02	2.00E+00	2.00E+01	4.3E-02	4.3E-03
Benzo(b)fluoranthene	3.90E-01	0.00E+00	7.47E-02	1.72E-03	0.00E+00	2.37E-03	4.09E-03	2.00E+00	2.00E+01	2.0E-03	2.0E-04
Benzo(g,h,i)perylene	3.49E-01	0.00E+00	6.72E-02	1.54E-03	0.00E+00	2.13E-03	3.67E-03	2.00E+00	2.00E+01	1.8E-03	1.8E-04
Benzo(k)fluoranthene	2.66E-01	0.00E+00	5.20E-02	1.17E-03	0.00E+00	1.65E-03	2.82E-03	2.00E+00	2.00E+01	1.4E-03	1.4E-04
Chrysene	4.22E-01	0.00E+00	8.05E-02	1.86E-03	0.00E+00	2.55E-03	4.41E-03	2.00E+00	2.00E+01	2.2E-03	2.2E-04
Dibenzo(a,h)anthracene	1.00E-01	0.00E+00	2.06E-02	4.40E-04	0.00E+00	6.52E-04	1.09E-03	2.00E+00	2.00E+01	5.5E-04	5.5E-05
Fluoranthene	8.00E-01	0.00E+00	1.67E+00	3.52E-03	0.00E+00	5.30E-02	5.65E-02	2.00E+00	2.00E+01	2.8E-02	2.8E-03
Indeno(1,2,3-cd)pyrene	3.86E-01	0.00E+00	7.40E-02	1.70E-03	0.00E+00	2.34E-03	4.04E-03	2.00E+00	2.00E+01	2.0E-03	2.0E-04
Phenanthrene	2.20E-01	0.00E+00	4.60E-01	9.69E-04	0.00E+00	1.46E-02	1.55E-02	2.00E+00	2.00E+01	7.8E-03	7.8E-04
Pyrene	6.10E-01	0.00E+00	1.14E-01	2.69E-03	0.00E+00	3.62E-03	6.30E-03	2.00E+00	2.00E+01	3.2E-03	3.2E-04
Total PAHs	3.94E+00	0.00E+00	6.67E-01	1.73E-02	0.00E+00	2.11E-02	3.85E-02	2.00E+00	2.00E+01	1.9E-02	1.9E-03
Pesticides/PCBs											
4,4'-DDD	1.10E-01	0.00E+00	1.54E-02	4.85E-04	0.00E+00	4.88E-04	9.73E-04	2.27E-01	2.81E-01	4.3E-03	3.5E-03
4,4'-DDE	1.30E-01	0.00E+00	1.75E-02	5.73E-04	0.00E+00	5.54E-04	1.13E-03	2.27E-01	2.81E-01	5.0E-03	4.0E-03
4,4'-DDT	3.30E-01	0.00E+00	3.52E-02	1.45E-03	0.00E+00	1.12E-03	2.57E-03	2.27E-01	2.81E-01	1.1E-02	9.1E-03
ALDRIN	5.80E-03	0.00E+00	4.00E-03	2.55E-05	0.00E+00	1.27E-04	1.52E-04	NV	NV	#VALUE!	#VALUE!
ALPHA-CHLORDANE	6.10E-01	0.00E+00	1.53E-02	2.69E-03	0.00E+00	4.83E-04	3.17E-03	2.14E+00	1.07E+01	1.5E-03	3.0E-04
DIELDRIN	3.40E-01	0.00E+00	2.79E-02	1.50E-03	0.00E+00	8.83E-04	2.38E-03	7.09E-02	8.00E-01	3.4E-02	3.0E-03
ENDRIN	1.80E-02	0.00E+00	1.48E-03	7.93E-05	0.00E+00	4.68E-05	1.26E-04	1.04E-02	1.04E-01	1.2E-02	1.2E-03
GAMMA-CHLORDANE	5.60E-01	0.00E+00	1.40E-02	2.47E-03	0.00E+00	4.44E-04	2.91E-03	2.14E+00	1.07E+01	1.4E-03	2.7E-04
HEPTACHLOR EPOXIDE	9.90E-03	0.00E+00	2.77E-04	4.36E-05	0.00E+00	8.78E-06	5.24E-05	NV	NV	#VALUE!	#VALUE!
Inorganics											
ARSENIC	5.40E+00	0.00E+00	2.03E-01	2.38E-02	0.00E+00	6.42E-03	3.02E-02	2.24E+00	4.51E+00	1.3E-02	6.7E-03
CADMIUM	7.70E-01	0.00E+00	5.39E-01	3.39E-03	0.00E+00	1.71E-02	2.05E-02	1.47E+00	6.35E+00	1.4E-02	3.2E-03
CHROMIUM	7.50E+01	0.00E+00	3.08E+00	3.30E-01	0.00E+00	9.74E-02	4.28E-01	2.66E+00	1.56E+01	1.6E-01	2.7E-02
COPPER	1.54E+01	0.00E+00	5.73E+00	6.78E-02	0.00E+00	1.82E-01	2.49E-01	4.05E+00	3.49E+01	6.2E-02	7.2E-03
LEAD	3.45E+02	0.00E+00	7.03E+00	1.52E+00	0.00E+00	2.23E-01	1.74E+00	1.63E+00	4.46E+01	1.1E+00	3.9E-02
MERCURY	2.30E-02	0.00E+00	1.15E-01	1.01E-04	0.00E+00	3.64E-03	3.75E-03	6.40E-03	6.40E-02	5.9E-01	5.9E-02
NICKEL	8.00E+00	0.00E+00	5.13E-01	3.52E-02	0.00E+00	1.63E-02	5.15E-02	6.71E+00	1.86E+01	7.7E-03	2.8E-03
ZINC	1.39E+02	0.00E+00	7.43E+01	6.12E-01	0.00E+00	2.36E+00	2.97E+00	6.61E+01	1.71E+02	4.5E-02	1.7E-02

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.54E-01	kg
Food Ingestion Rate = (If)	4.88E-03	kg/day
Water Ingestion Rate = (Iw)	2.28E-02	L/day
Soil Ingestion Rate = (Is)	6.78E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Cv = Contaminant concentration in vegetation
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (vegetation) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

SHORT-TAILED SHREW - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Avg Soil Conc. (mg/kg)	Avg SW Conc. (mg/L)	Invertebrate Conc. (mg/kg)	Dose (mg/kg/d) from: Soil	Surface Water	Invert.	Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients NOAEL	LOAEL
PAHs											
Anthracene	5.39E-03	0.00E+00	1.13E-02	4.31E-06	0.00E+00	1.00E-03	1.01E-03	6.56E+01	3.56E+02	1.5E-05	2.8E-06
Benzo(a)anthracene	1.54E-01	0.00E+00	3.09E-02	1.23E-04	0.00E+00	2.75E-03	2.87E-03	6.15E-01	3.84E+01	4.7E-03	7.5E-05
Benzo(a)pyrene	3.02E-01	0.00E+00	5.86E-02	2.41E-04	0.00E+00	5.21E-03	5.45E-03	6.15E-01	3.84E+01	8.9E-03	1.4E-04
Benzo(b)fluoranthene	1.98E-01	0.00E+00	3.93E-02	1.59E-04	0.00E+00	3.50E-03	3.66E-03	6.15E-01	3.84E+01	5.9E-03	9.5E-05
Benzo(g,h,i)perylene	1.68E-01	0.00E+00	3.37E-02	1.35E-04	0.00E+00	3.00E-03	3.13E-03	6.15E-01	3.84E+01	5.1E-03	8.2E-05
Benzo(k)fluoranthene	1.43E-01	0.00E+00	2.88E-02	1.14E-04	0.00E+00	2.56E-03	2.68E-03	6.15E-01	3.84E+01	4.4E-03	7.0E-05
Chrysene	1.83E-01	0.00E+00	3.65E-02	1.47E-04	0.00E+00	3.25E-03	3.40E-03	6.15E-01	3.84E+01	5.5E-03	8.8E-05
Dibenzo(a,h)anthracene	8.95E-02	0.00E+00	1.85E-02	7.17E-05	0.00E+00	1.65E-03	1.72E-03	6.15E-01	3.84E+01	2.8E-03	4.5E-05
Fluoranthene	2.79E-01	0.00E+00	5.83E-01	2.23E-04	0.00E+00	5.19E-02	5.21E-02	6.56E+01	3.56E+02	7.9E-04	1.5E-04
Indeno(1,2,3-cd)pyrene	1.81E-01	0.00E+00	3.60E-02	1.45E-04	0.00E+00	3.21E-03	3.35E-03	6.15E-01	3.84E+01	5.5E-03	8.7E-05
Phenanthrene	1.24E-01	0.00E+00	2.59E-01	9.91E-05	0.00E+00	2.30E-02	2.31E-02	6.56E+01	3.56E+02	3.5E-04	6.5E-05
Pyrene	2.37E-01	0.00E+00	4.67E-02	1.90E-04	0.00E+00	4.15E-03	4.34E-03	6.15E-01	3.84E+01	7.1E-03	1.1E-04
Total PAHs	1.36E+00	0.00E+00	2.44E-01	1.09E-03	0.00E+00	2.17E-02	2.28E-02	6.15E-01	3.84E+01	3.7E-02	5.9E-04
Pesticides/PCBs											
4,4'-DDD	2.14E-02	0.00E+00	4.49E-03	1.71E-05	0.00E+00	4.00E-04	4.17E-04	1.47E-01	2.74E-01	2.8E-03	1.5E-03
4,4'-DDE	1.74E-02	0.00E+00	3.86E-03	1.40E-05	0.00E+00	3.43E-04	3.57E-04	1.47E-01	2.74E-01	2.4E-03	1.3E-03
4,4'-DDT	3.88E-02	0.00E+00	7.03E-03	3.10E-05	0.00E+00	6.26E-04	6.57E-04	1.47E-01	2.74E-01	4.5E-03	2.4E-03
ALDRIN	2.17E-03	0.00E+00	1.50E-03	1.74E-06	0.00E+00	1.33E-04	1.35E-04	2.00E-01	1.00E+00	6.7E-04	1.3E-04
ALPHA-CHLORDANE	5.38E-02	0.00E+00	1.34E-03	4.31E-05	0.00E+00	1.20E-04	1.63E-04	4.58E+00	9.16E+00	3.6E-05	1.8E-05
DIELDRIN	4.95E-02	0.00E+00	4.06E-03	3.97E-05	0.00E+00	3.61E-04	4.01E-04	1.50E-02	1.27E+00	2.7E-02	3.2E-04
ENDRIN	1.63E-02	0.00E+00	1.34E-03	1.31E-05	0.00E+00	1.19E-04	1.32E-04	9.20E-02	9.20E-01	1.4E-03	1.4E-04
GAMMA-CHLORDANE	5.68E-02	0.00E+00	1.42E-03	4.55E-05	0.00E+00	1.26E-04	1.72E-04	4.58E+00	9.16E+00	3.8E-05	1.9E-05
HEPTACHLOR EPOXIDE	3.09E-03	0.00E+00	8.65E-05	2.47E-06	0.00E+00	7.70E-06	1.02E-05	1.00E-01	1.00E+00	1.0E-04	1.0E-05
Inorganics											
ARSENIC	1.54E+00	0.00E+00	5.77E-02	1.23E-03	0.00E+00	5.14E-03	6.37E-03	1.04E+00	4.55E+00	6.1E-03	1.4E-03
CADMIUM	1.08E-01	0.00E+00	1.85E-01	8.66E-05	0.00E+00	1.64E-02	1.65E-02	7.70E-01	6.90E+00	2.1E-02	2.4E-03
CHROMIUM	1.32E+01	0.00E+00	5.43E-01	1.06E-02	0.00E+00	4.83E-02	5.89E-02	2.40E+00	5.82E+01	2.5E-02	1.0E-03
COPPER	6.36E+00	0.00E+00	4.04E+00	5.10E-03	0.00E+00	3.60E-01	3.65E-01	5.60E+00	8.27E+01	6.5E-02	4.4E-03
LEAD	4.94E+01	0.00E+00	2.36E+00	3.95E-02	0.00E+00	2.10E-01	2.50E-01	4.70E+00	1.86E+02	5.3E-02	1.3E-03
MERCURY	1.57E-02	0.00E+00	1.02E-02	1.26E-05	0.00E+00	9.10E-04	9.22E-04	3.20E-02	1.60E-01	2.9E-02	5.8E-03
NICKEL	2.44E+00	0.00E+00	2.11E-01	1.95E-03	0.00E+00	1.87E-02	2.07E-02	1.70E+00	1.48E+01	1.2E-02	1.4E-03
ZINC	3.24E+01	0.00E+00	3.32E+01	2.59E-02	0.00E+00	2.95E+00	2.98E+00	7.54E+01	2.98E+02	3.9E-02	9.99E-03

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.61E-02	kg
Food Ingestion Rate = (If)	1.43E-03	kg/day
Water Ingestion Rate = (Iw)	3.60E-03	L/day
Soil Ingestion Rate = (Is)	1.29E-05	kg/day
Home Range = (HR)	9.70E-01	acres
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (invertebrate) = (Ci * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Ci = Contaminant concentration in invertebrate
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (invertebrate) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

SHORT-TAILED SHREW - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Max Soil Conc. (mg/kg)	Max SW Conc. (mg/L)	Invertebrate Conc. (mg/kg)	Dose (mg/kg/d) from:			Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients	
				Soil	Surface Water	Invert.				NOAEL	LOAEL
PAHs											
Anthracene	1.40E-02	0.00E+00	4.26E-02	4.48E-05	0.00E+00	4.54E-03	4.59E-03	6.56E+01	3.56E+02	7.0E-05	1.3E-05
Benzo(a)anthracene	2.82E-01	0.00E+00	7.33E-01	9.03E-04	0.00E+00	7.82E-02	7.91E-02	6.15E-01	3.84E+01	1.3E-01	2.1E-03
Benzo(a)pyrene	9.00E+00	0.00E+00	2.34E+01	2.88E-02	0.00E+00	2.50E+00	2.53E+00	6.15E-01	3.84E+01	4.1E+00	6.6E-02
Benzo(b)fluoranthene	3.90E-01	0.00E+00	1.01E+00	1.25E-03	0.00E+00	1.08E-01	1.09E-01	6.15E-01	3.84E+01	1.8E-01	2.8E-03
Benzo(g,h,i)perylene	3.49E-01	0.00E+00	9.07E-01	1.12E-03	0.00E+00	9.68E-02	9.79E-02	6.15E-01	3.84E+01	1.6E-01	2.6E-03
Benzo(k)fluoranthene	2.66E-01	0.00E+00	6.92E-01	8.51E-04	0.00E+00	7.38E-02	7.46E-02	6.15E-01	3.84E+01	1.2E-01	1.9E-03
Chrysene	4.22E-01	0.00E+00	1.10E+00	1.35E-03	0.00E+00	1.17E-01	1.18E-01	6.15E-01	3.84E+01	1.9E-01	3.1E-03
Dibenzo(a,h)anthracene	1.00E-01	0.00E+00	2.60E-01	3.20E-04	0.00E+00	2.77E-02	2.81E-02	6.15E-01	3.84E+01	4.6E-02	7.3E-04
Fluoranthene	8.00E-01	0.00E+00	2.43E+00	2.56E-03	0.00E+00	2.59E-01	2.62E-01	6.56E+01	3.56E+02	4.0E-03	7.4E-04
Indeno(1,2,3-cd)pyrene	3.86E-01	0.00E+00	1.00E+00	1.24E-03	0.00E+00	1.07E-01	1.08E-01	6.15E-01	3.84E+01	1.8E-01	2.8E-03
Phenanthrene	2.20E-01	0.00E+00	6.69E-01	7.04E-04	0.00E+00	7.14E-02	7.21E-02	6.56E+01	3.56E+02	1.1E-03	2.0E-04
Pyrene	6.10E-01	0.00E+00	1.59E+00	1.95E-03	0.00E+00	1.69E-01	1.71E-01	6.15E-01	3.84E+01	2.8E-01	4.5E-03
Total PAHs	3.94E+00	0.00E+00	1.02E+01	1.26E-02	0.00E+00	1.09E+00	1.10E+00	6.15E-01	3.84E+01	1.8E+00	2.9E-02
Pesticides/PCBs											
4,4'-DDD	1.10E-01	0.00E+00	6.85E-01	3.52E-04	0.00E+00	7.31E-02	7.34E-02	1.47E-01	2.74E-01	5.0E-01	2.7E-01
4,4'-DDE	1.30E-01	0.00E+00	1.98E+00	4.16E-04	0.00E+00	2.11E-01	2.11E-01	1.47E-01	2.74E-01	1.4E+00	7.7E-01
4,4'-DDT	3.30E-01	0.00E+00	3.19E+00	1.06E-03	0.00E+00	3.41E-01	3.42E-01	1.47E-01	2.74E-01	2.3E+00	1.2E+00
ALDRIN	5.80E-03	0.00E+00	1.91E-02	1.86E-05	0.00E+00	2.04E-03	2.06E-03	2.00E-01	1.00E+00	1.0E-02	2.1E-03
ALPHA-CHLORDANE	6.10E-01	0.00E+00	3.05E+00	1.95E-03	0.00E+00	3.25E-01	3.27E-01	4.58E+00	9.16E+00	7.1E-02	3.6E-02
DIELDRIN	3.40E-01	0.00E+00	5.00E+00	1.09E-03	0.00E+00	5.33E-01	5.34E-01	1.50E-02	1.27E+00	3.6E+01	4.2E-01
ENDRIN	1.80E-02	0.00E+00	6.48E-02	5.76E-05	0.00E+00	6.91E-03	6.97E-03	9.20E-02	9.20E-01	7.6E-02	7.6E-03
GAMMA-CHLORDANE	5.60E-01	0.00E+00	2.80E+00	1.79E-03	0.00E+00	2.99E-01	3.01E-01	4.58E+00	9.16E+00	6.6E-02	3.3E-02
HEPTACHLOR EPOXIDE	9.90E-03	0.00E+00	2.97E-02	3.17E-05	0.00E+00	3.17E-03	3.20E-03	1.00E-01	1.00E+00	3.2E-02	3.2E-03
Inorganics											
ARSENIC	5.40E+00	0.00E+00	7.94E-01	1.73E-02	0.00E+00	8.47E-02	1.02E-01	1.04E+00	4.55E+00	9.8E-02	2.2E-02
CADMIUM	7.70E-01	0.00E+00	6.73E+00	2.46E-03	0.00E+00	7.18E-01	7.20E-01	7.70E-01	6.90E+00	9.4E-01	1.0E-01
CHROMIUM	7.50E+01	0.00E+00	2.30E+01	2.40E-01	0.00E+00	2.45E+00	2.69E+00	2.40E+00	5.82E+01	1.1E+00	4.6E-02
COPPER	1.54E+01	0.00E+00	7.93E+00	4.93E-02	0.00E+00	8.46E-01	8.95E-01	5.60E+00	8.27E+01	1.6E-01	1.1E-02
LEAD	3.45E+02	0.00E+00	8.98E+01	1.10E+00	0.00E+00	9.58E+00	1.07E+01	4.70E+00	1.86E+02	2.3E+00	5.7E-02
MERCURY	2.30E-02	0.00E+00	3.03E-01	7.36E-05	0.00E+00	3.24E-02	3.24E-02	3.20E-02	1.60E-01	1.0E+00	2.0E-01
NICKEL	8.00E+00	0.00E+00	8.47E+00	2.56E-02	0.00E+00	9.04E-01	9.29E-01	1.70E+00	1.48E+01	5.5E-01	6.3E-02
ZINC	1.39E+02	0.00E+00	4.32E+02	4.45E-01	0.00E+00	4.60E+01	4.65E+01	7.54E+01	2.98E+02	6.2E-01	1.6E-01

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.50E-02	kg
Food Ingestion Rate = (If)	1.60E-03	kg/day
Water Ingestion Rate = (Iw)	4.28E-03	L/day
Soil Ingestion Rate = (Is)	4.80E-05	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (invertebrate) = (Ci * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Ci = Contaminant concentration in invertebrate
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (invertebrate) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

MEADOW VOLE - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Avg Soil Conc. (mg/kg)	Avg SW Conc. (mg/L)	Vegetation Conc. (mg/kg)	Dose (mg/kg/d) from: Soil	Surface Water	Veget.	Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients NOAEL	LOAEL
PAHs											
Anthracene	5.39E-03	0.00E+00	1.13E-02	6.30E-06	0.00E+00	1.10E-03	1.10E-03	6.56E+01	3.56E+02	1.7E-05	3.1E-06
Benzo(a)anthracene	1.54E-01	0.00E+00	3.09E-02	1.80E-04	0.00E+00	3.01E-03	3.19E-03	6.15E-01	3.84E+01	5.2E-03	8.3E-05
Benzo(a)pyrene	3.02E-01	0.00E+00	5.86E-02	3.53E-04	0.00E+00	5.70E-03	6.06E-03	6.15E-01	3.84E+01	9.8E-03	1.6E-04
Benzo(b)fluoranthene	1.98E-01	0.00E+00	3.93E-02	2.31E-04	0.00E+00	3.83E-03	4.06E-03	6.15E-01	3.84E+01	6.6E-03	1.1E-04
Benzo(g,h,i)perylene	1.68E-01	0.00E+00	3.37E-02	1.97E-04	0.00E+00	3.28E-03	3.48E-03	6.15E-01	3.84E+01	5.7E-03	9.1E-05
Benzo(k)fluoranthene	1.43E-01	0.00E+00	2.88E-02	1.67E-04	0.00E+00	2.81E-03	2.97E-03	6.15E-01	3.84E+01	4.8E-03	7.7E-05
Chrysene	1.83E-01	0.00E+00	3.65E-02	2.14E-04	0.00E+00	3.56E-03	3.77E-03	6.15E-01	3.84E+01	6.1E-03	9.8E-05
Dibenzo(a,h)anthracene	8.95E-02	0.00E+00	1.85E-02	1.05E-04	0.00E+00	1.81E-03	1.91E-03	6.15E-01	3.84E+01	3.1E-03	5.0E-05
Fluoranthene	2.79E-01	0.00E+00	5.83E-01	3.26E-04	0.00E+00	5.68E-02	5.71E-02	6.56E+01	3.56E+02	8.7E-04	1.6E-04
Indeno(1,2,3-cd)pyrene	1.81E-01	0.00E+00	3.60E-02	2.11E-04	0.00E+00	3.51E-03	3.72E-03	6.15E-01	3.84E+01	6.1E-03	9.7E-05
Phenanthrene	1.24E-01	0.00E+00	2.59E-01	1.45E-04	0.00E+00	2.52E-02	2.54E-02	6.56E+01	3.56E+02	3.9E-04	7.1E-05
Pyrene	2.37E-01	0.00E+00	4.67E-02	2.78E-04	0.00E+00	4.55E-03	4.83E-03	6.15E-01	3.84E+01	7.8E-03	1.3E-04
Total PAHs	1.36E+00	0.00E+00	2.44E-01	1.59E-03	0.00E+00	2.38E-02	2.53E-02	6.15E-01	3.84E+01	4.1E-02	6.6E-04
Pesticides/PCBs											
4,4'-DDD	2.14E-02	0.00E+00	4.49E-03	2.50E-05	0.00E+00	4.37E-04	4.62E-04	1.47E-01	2.74E-01	3.1E-03	1.7E-03
4,4'-DDE	1.74E-02	0.00E+00	3.86E-03	2.04E-05	0.00E+00	3.76E-04	3.96E-04	1.47E-01	2.74E-01	2.7E-03	1.4E-03
4,4'-DDT	3.88E-02	0.00E+00	7.03E-03	4.53E-05	0.00E+00	6.85E-04	7.30E-04	1.47E-01	2.74E-01	5.0E-03	2.7E-03
ALDRIN	2.17E-03	0.00E+00	1.50E-03	2.54E-06	0.00E+00	1.46E-04	1.48E-04	2.00E-01	1.00E+00	7.4E-04	1.5E-04
ALPHA-CHLORDANE	5.38E-02	0.00E+00	1.34E-03	6.29E-05	0.00E+00	1.31E-04	1.94E-04	4.58E+00	9.16E+00	4.2E-05	2.1E-05
DIELDRIN	4.95E-02	0.00E+00	4.06E-03	5.79E-05	0.00E+00	3.96E-04	4.54E-04	1.50E-02	1.27E+00	3.0E-02	3.6E-04
ENDRIN	1.63E-02	0.00E+00	1.34E-03	1.91E-05	0.00E+00	1.30E-04	1.49E-04	9.20E-02	9.20E-01	1.6E-03	1.6E-04
GAMMA-CHLORDANE	5.68E-02	0.00E+00	1.42E-03	6.64E-05	0.00E+00	1.38E-04	2.05E-04	4.58E+00	9.16E+00	4.5E-05	2.2E-05
HEPTACHLOR EPOXIDE	3.09E-03	0.00E+00	8.65E-05	3.61E-06	0.00E+00	8.43E-06	1.20E-05	1.00E-01	1.00E+00	1.2E-04	1.2E-05
Inorganics											
ARSENIC	1.54E+00	0.00E+00	5.77E-02	1.80E-03	0.00E+00	5.62E-03	7.42E-03	1.04E+00	4.55E+00	7.1E-03	1.6E-03
CADMIUM	1.08E-01	0.00E+00	1.85E-01	1.26E-04	0.00E+00	1.80E-02	1.81E-02	7.70E-01	6.90E+00	2.4E-02	2.6E-03
CHROMIUM	1.32E+01	0.00E+00	5.43E-01	1.55E-02	0.00E+00	5.29E-02	6.84E-02	2.40E+00	5.82E+01	2.8E-02	1.2E-03
COPPER	6.36E+00	0.00E+00	4.04E+00	7.44E-03	0.00E+00	3.94E-01	4.01E-01	5.60E+00	8.27E+01	7.2E-02	4.9E-03
LEAD	4.94E+01	0.00E+00	2.36E+00	5.77E-02	0.00E+00	2.30E-01	2.88E-01	4.70E+00	1.86E+02	6.1E-02	1.5E-03
MERCURY	1.57E-02	0.00E+00	1.02E-02	1.83E-05	0.00E+00	9.96E-04	1.01E-03	3.20E-02	1.60E-01	3.2E-02	6.3E-03
NICKEL	2.44E+00	0.00E+00	2.11E-01	2.85E-03	0.00E+00	2.05E-02	2.34E-02	1.70E+00	1.48E+01	1.4E-02	1.6E-03
ZINC	3.24E+01	0.00E+00	3.32E+01	3.78E-02	0.00E+00	3.23E+00	3.27E+00	7.54E+01	2.98E+02	4.3E-02	1.1E-02

Body Weight = (BW)	3.58E-02	kg
Food Ingestion Rate = (If)	3.49E-03	kg/day
Water Ingestion Rate = (Iw)	6.26E-03	L/day
Soil Ingestion Rate = (Is)	4.19E-05	kg/day
Home Range = (HR)	6.59E-02	acres
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Cv = Contaminant concentration in vegetation
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (vegetation) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

MEADOW VOLE - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Max Soil Conc. (mg/kg)	Max SW Conc. (mg/L)	Vegetation Conc. (mg/kg)	Dose (mg/kg/d) from: Soil	Surface Water	Veget.	Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients NOAEL	LOAEL
PAHs											
Anthracene	1.40E-02	0.00E+00	2.93E-02	9.90E-05	0.00E+00	6.47E-03	6.56E-03	6.56E+01	3.56E+02	1.0E-04	1.8E-05
Benzo(a)anthracene	2.82E-01	0.00E+00	5.50E-02	1.99E-03	0.00E+00	1.21E-02	1.41E-02	6.15E-01	3.84E+01	2.3E-02	3.7E-04
Benzo(a)pyrene	9.00E+00	0.00E+00	1.46E+00	6.36E-02	0.00E+00	3.22E-01	3.86E-01	6.15E-01	3.84E+01	6.3E-01	1.0E-02
Benzo(b)fluoranthene	3.90E-01	0.00E+00	7.47E-02	2.76E-03	0.00E+00	1.65E-02	1.93E-02	6.15E-01	3.84E+01	3.1E-02	5.0E-04
Benzo(g,h,i)perylene	3.49E-01	0.00E+00	6.72E-02	2.47E-03	0.00E+00	1.49E-02	1.73E-02	6.15E-01	3.84E+01	2.8E-02	4.5E-04
Benzo(k)fluoranthene	2.66E-01	0.00E+00	5.20E-02	1.88E-03	0.00E+00	1.15E-02	1.34E-02	6.15E-01	3.84E+01	2.2E-02	3.5E-04
Chrysene	4.22E-01	0.00E+00	8.05E-02	2.98E-03	0.00E+00	1.78E-02	2.08E-02	6.15E-01	3.84E+01	3.4E-02	5.4E-04
Dibenzo(a,h)anthracene	1.00E-01	0.00E+00	2.06E-02	7.07E-04	0.00E+00	4.55E-03	5.26E-03	6.15E-01	3.84E+01	8.5E-03	1.4E-04
Fluoranthene	8.00E-01	0.00E+00	1.67E+00	5.66E-03	0.00E+00	3.69E-01	3.75E-01	6.56E+01	3.56E+02	5.7E-03	1.1E-03
Indeno(1,2,3-cd)pyrene	3.86E-01	0.00E+00	7.40E-02	2.73E-03	0.00E+00	1.63E-02	1.91E-02	6.15E-01	3.84E+01	3.1E-02	5.0E-04
Phenanthrene	2.20E-01	0.00E+00	4.60E-01	1.56E-03	0.00E+00	1.02E-01	1.03E-01	6.56E+01	3.56E+02	1.6E-03	2.9E-04
Pyrene	6.10E-01	0.00E+00	1.14E-01	4.31E-03	0.00E+00	2.52E-02	2.95E-02	6.15E-01	3.84E+01	4.8E-02	7.7E-04
Total PAHs	3.94E+00	0.00E+00	6.67E-01	2.78E-02	0.00E+00	1.47E-01	1.75E-01	6.15E-01	3.84E+01	2.8E-01	4.6E-03
Pesticides/PCBs											
4,4'-DDD	1.10E-01	0.00E+00	1.54E-02	7.78E-04	0.00E+00	3.41E-03	4.18E-03	1.47E-01	2.74E-01	2.8E-02	1.5E-02
4,4'-DDE	1.30E-01	0.00E+00	1.75E-02	9.19E-04	0.00E+00	3.86E-03	4.78E-03	1.47E-01	2.74E-01	3.3E-02	1.7E-02
4,4'-DDT	3.30E-01	0.00E+00	3.52E-02	2.33E-03	0.00E+00	7.78E-03	1.01E-02	1.47E-01	2.74E-01	6.9E-02	3.7E-02
ALDRIN	5.80E-03	0.00E+00	4.00E-03	4.10E-05	0.00E+00	8.84E-04	9.25E-04	2.00E-01	1.00E+00	4.6E-03	9.3E-04
ALPHA-CHLORDANE	6.10E-01	0.00E+00	1.53E-02	4.31E-03	0.00E+00	3.37E-03	7.68E-03	4.58E+00	9.16E+00	1.7E-03	8.4E-04
DIELDRIN	3.40E-01	0.00E+00	2.79E-02	2.40E-03	0.00E+00	6.16E-03	8.56E-03	1.50E-02	1.27E+00	5.7E-01	6.7E-03
ENDRIN	1.80E-02	0.00E+00	1.48E-03	1.27E-04	0.00E+00	3.26E-04	4.53E-04	9.20E-02	9.20E-01	4.9E-03	4.9E-04
GAMMA-CHLORDANE	5.60E-01	0.00E+00	1.40E-02	3.96E-03	0.00E+00	3.09E-03	7.05E-03	4.58E+00	9.16E+00	1.5E-03	7.7E-04
HEPTACHLOR EPOXIDE	9.90E-03	0.00E+00	2.77E-04	7.00E-05	0.00E+00	6.13E-05	1.31E-04	1.00E-01	1.00E+00	1.3E-03	1.3E-04
Inorganics											
ARSENIC	5.40E+00	0.00E+00	2.03E-01	3.82E-02	0.00E+00	4.48E-02	8.30E-02	1.04E+00	4.55E+00	8.0E-02	1.8E-02
CADMIUM	7.70E-01	0.00E+00	5.39E-01	5.44E-03	0.00E+00	1.19E-01	1.25E-01	7.70E-01	6.90E+00	1.6E-01	1.8E-02
CHROMIUM	7.50E+01	0.00E+00	3.08E+00	1.27E+00	4.86E-03	1.62E+00	2.89E+00	2.40E+00	5.82E+01	1.2E+00	5.0E-02
COPPER	1.54E+01	0.00E+00	5.73E+00	1.09E-01	0.00E+00	1.27E+00	1.37E+00	5.60E+00	8.27E+01	2.5E-01	1.7E-02
LEAD	3.45E+02	0.00E+00	7.03E+00	2.44E+00	0.00E+00	1.55E+00	3.99E+00	4.70E+00	1.86E+02	8.5E-01	2.1E-02
MERCURY	2.30E-02	0.00E+00	1.15E-01	1.63E-04	0.00E+00	2.54E-02	2.56E-02	3.20E-02	1.60E-01	8.0E-01	1.6E-01
NICKEL	8.00E+00	0.00E+00	5.13E-01	5.66E-02	0.00E+00	1.13E-01	1.70E-01	1.70E+00	1.48E+01	1.0E-01	1.2E-02
ZINC	1.39E+02	0.00E+00	7.43E+01	9.83E-01	0.00E+00	1.64E+01	1.74E+01	7.54E+01	2.98E+02	2.3E-01	5.8E-02

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.70E-02	kg
Food Ingestion Rate = (If)	3.76E-03	kg/day
Water Ingestion Rate = (Iw)	7.51E-03	L/day
Soil Ingestion Rate = (Is)	1.20E-04	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (vegetation) = (Cv * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Cv = Contaminant concentration in vegetation
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (vegetation) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

AMERICAN WOODCOCK - AVERAGE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

Chemical	Avg Soil Conc. (mg/kg)	Avg SW Conc. (mg/L)	Invertebrate Conc. (mg/kg)	Dose (mg/kg/d) from: Soil	Dose (mg/kg/d) from: Surface Water	Dose (mg/kg/d) from: Invert.	Total Dose (mg/kg/d)	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Hazard Quotients NOAEL	Hazard Quotients LOAEL
PAHs											
Anthracene	5.39E-03	0.00E+00	1.13E-02	4.25E-05	0.00E+00	1.39E-03	1.43E-03	2.00E+00	2.00E+01	7.1E-04	7.1E-05
Benzo(a)anthracene	1.54E-01	0.00E+00	3.09E-02	1.21E-03	0.00E+00	3.81E-03	5.02E-03	2.00E+00	2.00E+01	2.5E-03	2.5E-04
Benzo(a)pyrene	3.02E-01	0.00E+00	5.86E-02	2.38E-03	0.00E+00	7.21E-03	9.59E-03	2.00E+00	2.00E+01	4.8E-03	4.8E-04
Benzo(b)fluoranthene	1.98E-01	0.00E+00	3.93E-02	1.56E-03	0.00E+00	4.84E-03	6.40E-03	2.00E+00	2.00E+01	3.2E-03	3.2E-04
Benzo(g,h,i)perylene	1.68E-01	0.00E+00	3.37E-02	1.33E-03	0.00E+00	4.15E-03	5.48E-03	2.00E+00	2.00E+01	2.7E-03	2.7E-04
Benzo(k)fluoranthene	1.43E-01	0.00E+00	2.88E-02	1.12E-03	0.00E+00	3.55E-03	4.67E-03	2.00E+00	2.00E+01	2.3E-03	2.3E-04
Chrysene	1.83E-01	0.00E+00	3.65E-02	1.44E-03	0.00E+00	4.50E-03	5.94E-03	2.00E+00	2.00E+01	3.0E-03	3.0E-04
Dibenzo(a,h)anthracene	8.95E-02	0.00E+00	1.85E-02	7.06E-04	0.00E+00	2.28E-03	2.99E-03	2.00E+00	2.00E+01	1.5E-03	1.5E-04
Fluoranthene	2.79E-01	0.00E+00	5.83E-01	2.20E-03	0.00E+00	7.18E-02	7.40E-02	2.00E+00	2.00E+01	3.7E-02	3.7E-03
Indeno(1,2,3-cd)pyrene	1.81E-01	0.00E+00	3.60E-02	1.42E-03	0.00E+00	4.44E-03	5.87E-03	2.00E+00	2.00E+01	2.9E-03	2.9E-04
Phenanthrene	1.24E-01	0.00E+00	2.59E-01	9.76E-04	0.00E+00	3.19E-02	3.29E-02	2.00E+00	2.00E+01	1.6E-02	1.6E-03
Pyrene	2.37E-01	0.00E+00	4.67E-02	1.87E-03	0.00E+00	5.75E-03	7.62E-03	2.00E+00	2.00E+01	3.8E-03	3.8E-04
Total PAHs	1.36E+00	0.00E+00	2.44E-01	1.07E-02	0.00E+00	3.00E-02	4.08E-02	2.00E+00	2.00E+01	2.0E-02	2.0E-03
Pesticides/PCBs											
4,4'-DDD	2.14E-02	0.00E+00	4.49E-03	1.68E-04	0.00E+00	5.53E-04	7.22E-04	2.27E-01	2.81E-01	3.2E-03	2.6E-03
4,4'-DDE	1.74E-02	0.00E+00	3.86E-03	1.38E-04	0.00E+00	4.75E-04	6.12E-04	2.27E-01	2.81E-01	2.7E-03	2.2E-03
4,4'-DDT	3.88E-02	0.00E+00	7.03E-03	3.06E-04	0.00E+00	8.66E-04	1.17E-03	2.27E-01	2.81E-01	5.2E-03	4.2E-03
ALDRIN	2.17E-03	0.00E+00	1.50E-03	1.71E-05	0.00E+00	1.84E-04	2.01E-04	NV	NV	#VALUE!	#VALUE!
ALPHA-CHLORDANE	5.38E-02	0.00E+00	1.34E-03	4.24E-04	0.00E+00	1.66E-04	5.89E-04	2.14E+00	1.07E+01	2.8E-04	5.5E-05
DIELDRIN	4.95E-02	0.00E+00	4.06E-03	3.90E-04	0.00E+00	5.00E-04	8.91E-04	7.09E-02	8.00E-01	1.3E-02	1.1E-03
ENDRIN	1.63E-02	0.00E+00	1.34E-03	1.29E-04	0.00E+00	1.65E-04	2.93E-04	1.04E-02	1.04E-01	2.8E-02	2.8E-03
GAMMA-CHLORDANE	5.68E-02	0.00E+00	1.42E-03	4.48E-04	0.00E+00	1.75E-04	6.23E-04	2.14E+00	1.07E+01	2.9E-04	5.8E-05
HEPTACHLOR EPOXIDE	3.09E-03	0.00E+00	8.65E-05	2.44E-05	0.00E+00	1.07E-05	3.50E-05	NV	NV	#VALUE!	#VALUE!
Inorganics											
ARSENIC	1.54E+00	0.00E+00	5.77E-02	1.21E-02	0.00E+00	7.11E-03	1.92E-02	2.24E+00	4.51E+00	8.6E-03	4.3E-03
CADMIUM	1.08E-01	0.00E+00	1.85E-01	8.52E-04	0.00E+00	2.27E-02	2.36E-02	1.47E+00	6.35E+00	1.6E-02	3.7E-03
CHROMIUM	1.32E+01	0.00E+00	5.43E-01	1.04E-01	0.00E+00	6.69E-02	1.71E-01	2.66E+00	1.56E+01	6.4E-02	1.1E-02
COPPER	6.36E+00	0.00E+00	4.04E+00	5.02E-02	0.00E+00	4.98E-01	5.48E-01	4.05E+00	3.49E+01	1.4E-01	1.6E-02
LEAD	4.94E+01	0.00E+00	2.36E+00	3.89E-01	0.00E+00	2.91E-01	6.80E-01	1.63E+00	4.46E+01	4.2E-01	1.5E-02
MERCURY	1.57E-02	0.00E+00	1.02E-02	1.24E-04	0.00E+00	1.26E-03	1.38E-03	6.40E-03	6.40E-02	2.2E-01	2.2E-02
NICKEL	2.44E+00	0.00E+00	2.11E-01	1.92E-02	0.00E+00	2.60E-02	4.52E-02	6.71E+00	1.86E+01	6.7E-03	2.4E-03
ZINC	3.24E+01	0.00E+00	3.32E+01	2.55E-01	0.00E+00	4.09E+00	4.34E+00	6.61E+01	1.71E+02	6.6E-02	2.5E-02

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.73E-01	kg
Food Ingestion Rate = (If)	2.13E-02	kg/day
Water Ingestion Rate = (Iw)	1.73E-02	L/day
Soil Ingestion Rate = (Is)	1.36E-03	kg/day
Home Range = (HR)	6.13E+01	acres
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (invertebrate) = (Ci * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Ci = Contaminant concentration in invertebrate
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (invertebrate) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

AMERICAN WOODCOCK - CONSERVATIVE INPUTS
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

	Max Soil	Max SW	Invertebrate	Dose (mg/kg/d) from:			Total				
	Conc.	Conc.	Conc.		Surface		Dose	NOAEL	LOAEL	Hazard Quotients	
Chemical	**(mg/kg)**	**(mg/L)**	**(mg/kg)**	**Soil**	**Water**	**Invert.**	**(mg/kg/d)**	**(mg/kg/d)**	**(mg/kg/d)**	**NOAEL**	**LOAEL**
PAHs											
Anthracene	1.40E-02	0.00E+00	4.26E-02	4.61E-04	0.00E+00	8.54E-03	9.00E-03	2.00E+00	2.00E+01	4.5E-03	4.5E-04
Benzo(a)anthracene	2.82E-01	0.00E+00	7.33E-01	9.28E-03	0.00E+00	1.47E-01	1.56E-01	2.00E+00	2.00E+01	7.8E-02	7.8E-03
Benzo(a)pyrene	9.00E+00	0.00E+00	2.34E+01	2.96E-01	0.00E+00	4.70E+00	4.99E+00	2.00E+00	2.00E+01	2.5E+00	2.5E-01
Benzo(b)fluoranthene	3.90E-01	0.00E+00	1.01E+00	1.28E-02	0.00E+00	2.04E-01	2.16E-01	2.00E+00	2.00E+01	1.1E-01	1.1E-02
Benzo(g,h,i)perylene	3.49E-01	0.00E+00	9.07E-01	1.15E-02	0.00E+00	1.82E-01	1.94E-01	2.00E+00	2.00E+01	9.7E-02	9.7E-03
Benzo(k)fluoranthene	2.66E-01	0.00E+00	6.92E-01	8.76E-03	0.00E+00	1.39E-01	1.48E-01	2.00E+00	2.00E+01	7.4E-02	7.4E-03
Chrysene	4.22E-01	0.00E+00	1.10E+00	1.39E-02	0.00E+00	2.20E-01	2.34E-01	2.00E+00	2.00E+01	1.2E-01	1.2E-02
Dibenzo(a,h)anthracene	1.00E-01	0.00E+00	2.60E-01	3.29E-03	0.00E+00	5.22E-02	5.55E-02	2.00E+00	2.00E+01	2.8E-02	2.8E-03
Fluoranthene	8.00E-01	0.00E+00	2.43E+00	2.63E-02	0.00E+00	4.88E-01	5.15E-01	2.00E+00	2.00E+01	2.6E-01	2.6E-02
Indeno(1,2,3-cd)pyrene	3.86E-01	0.00E+00	1.00E+00	1.27E-02	0.00E+00	2.01E-01	2.14E-01	2.00E+00	2.00E+01	1.1E-01	1.1E-02
Phenanthrene	2.20E-01	0.00E+00	6.69E-01	7.24E-03	0.00E+00	1.34E-01	1.41E-01	2.00E+00	2.00E+01	7.1E-02	7.1E-03
Pyrene	6.10E-01	0.00E+00	1.59E+00	2.01E-02	0.00E+00	3.18E-01	3.38E-01	2.00E+00	2.00E+01	1.7E-01	1.7E-02
Total PAHs	3.94E+00	0.00E+00	1.02E+01	1.30E-01	0.00E+00	2.05E+00	2.18E+00	2.00E+00	2.00E+01	1.1E+00	1.1E-01
Pesticides/PCBs											
4,4'-DDD	1.10E-01	0.00E+00	6.85E-01	3.62E-03	0.00E+00	1.38E-01	1.41E-01	2.27E-01	2.81E-01	6.2E-01	5.0E-01
4,4'-DDE	1.30E-01	0.00E+00	1.98E+00	4.28E-03	0.00E+00	3.97E-01	4.01E-01	2.27E-01	2.81E-01	1.8E+00	1.4E+00
4,4'-DDT	3.30E-01	0.00E+00	3.19E+00	1.09E-02	0.00E+00	6.41E-01	6.52E-01	2.27E-01	2.81E-01	2.9E+00	2.3E+00
ALDRIN	5.80E-03	0.00E+00	1.91E-02	1.91E-04	0.00E+00	3.84E-03	4.03E-03	NV	NV	#VALUE!	#VALUE!
ALPHA-CHLORDANE	6.10E-01	0.00E+00	3.05E+00	2.01E-02	0.00E+00	6.12E-01	6.32E-01	2.14E+00	1.07E+01	3.0E-01	5.9E-02
DIELDRIN	3.40E-01	0.00E+00	5.00E+00	1.12E-02	0.00E+00	1.00E+00	1.01E+00	7.09E-02	8.00E-01	1.4E+01	1.3E+00
ENDRIN	1.80E-02	0.00E+00	6.48E-02	5.93E-04	0.00E+00	1.30E-02	1.36E-02	1.04E-02	1.04E-01	1.3E+00	1.3E-01
GAMMA-CHLORDANE	5.60E-01	0.00E+00	2.80E+00	1.84E-02	0.00E+00	5.62E-01	5.80E-01	2.14E+00	1.07E+01	2.7E-01	5.4E-02
HEPTACHLOR EPOXIDE	9.90E-03	0.00E+00	2.97E-02	3.26E-04	0.00E+00	5.96E-03	6.29E-03	NV	NV	#VALUE!	#VALUE!
Inorganics											
ARSENIC	5.40E+00	0.00E+00	7.94E-01	1.78E-01	0.00E+00	1.59E-01	3.37E-01	2.24E+00	4.51E+00	1.5E-01	7.5E-02
CADMIUM	7.70E-01	0.00E+00	6.73E+00	2.53E-02	0.00E+00	1.35E+00	1.38E+00	1.47E+00	6.35E+00	9.4E-01	2.2E-01
CHROMIUM	7.50E+01	0.00E+00	2.30E+01	2.47E+00	0.00E+00	4.61E+00	7.08E+00	2.66E+00	1.56E+01	2.7E+00	4.5E-01
COPPER	1.54E+01	0.00E+00	7.93E+00	5.07E-01	0.00E+00	1.59E+00	2.10E+00	4.05E+00	3.49E+01	5.2E-01	6.0E-02
LEAD	3.45E+02	0.00E+00	8.98E+01	1.14E+01	0.00E+00	1.80E+01	2.94E+01	1.63E+00	4.46E+01	1.8E+01	6.6E-01
MERCURY	2.30E-02	0.00E+00	3.03E-01	7.57E-04	0.00E+00	6.09E-02	6.17E-02	6.40E-03	6.40E-02	9.6E+00	9.6E-01
NICKEL	8.00E+00	0.00E+00	8.47E+00	2.63E-01	0.00E+00	1.70E+00	1.96E+00	6.71E+00	1.86E+01	2.9E-01	1.1E-01
ZINC	1.39E+02	0.00E+00	4.32E+02	4.58E+00	0.00E+00	8.66E+01	9.12E+01	6.61E+01	1.71E+02	1.4E+00	5.3E-01

Cells are shaded if the value is greater than 1.0

Body Weight = (BW)	1.34E-01	kg
Food Ingestion Rate = (If)	2.69E-02	kg/day
Water Ingestion Rate = (Iw)	2.18E-02	L/day
Soil Ingestion Rate = (Is)	4.40E-03	kg/day
Home Range = (HR)	Assume 100% on site	
Contaminated Area = (CA)	Assume equal to home range	

Dose (soil) = (Cs * Is)(H)/BW
Dose (invertebrate) = (Ci * If)(H)/BW
Dose (water) = (Cw * Iw)(H)/BW
Ci = Contaminant concentration in invertebrate
Cs = Contaminant concentration in soil
Cw = Contaminant concentration in water
Total Dose = Dose (soil) + Dose (invertebrate) + Dose (water)
H=HR/CA (Assume = to 1)

Conc = Concentration
LOAEL = Lowest Observed Adverse Effects Concentration
NOAEL = No Observed Adverse Effects Concentration
SW = Surface Water

SURFACE SOIL TISSUE CONCENTRATION CALCULATION
SITE 41 - FORMER PESTICIDE STORAGE BUILDING 1485C
NAS WHITING FIELD, MILTON, FLORIDA

	Surface Soil Concentrations (mg/kg)				Surface Water Concentrations (mg/L)		Earthworm Bioaccumulation Factors		Earthworm Concentrations (mg/kg)		Plant Bioaccumulation Factors		Plant Concentrations (mg/kg)	
Chemical	Maximum Detection	Average All	Average of Positive Detections	Average (1)	Maximum Detection	Average Concentration(1)	Conservative	Average	Maximum Detection	Average	Conservative	Average	Maximum Detection	Average
PAHs														
Anthracene	1.40E-02	9.74E-02	5.39E-03	5.39E-03	0.00E+00	0.00E+00	3.04E+00	3.04E+00	4.26E-02	1.64E-02	2.09E+00	2.09E+00	2.93E-02	1.13E-02
Benzo(a)anthracene	2.82E-01	1.54E-01	1.12E-01	1.54E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	7.33E-01	3.99E-01	Regression from Eco SSL		5.50E-02	3.09E-02
Benzo(a)pyrene	9.00E+00	3.02E-01	3.34E-01	3.02E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	2.34E+01	7.84E-01	Regression from Eco SSL		1.46E+00	5.86E-02
Benzo(b)fluoranthene	3.90E-01	1.98E-01	1.66E-01	1.98E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	1.01E+00	5.15E-01	Regression from Eco SSL		7.47E-02	3.93E-02
Benzo(g,h,i)perylene	3.49E-01	1.68E-01	1.30E-01	1.68E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	9.07E-01	4.37E-01	Regression from Eco SSL		6.72E-02	3.37E-02
Benzo(k)fluoranthene	2.66E-01	1.43E-01	9.85E-02	1.43E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	6.92E-01	3.71E-01	Regression from Eco SSL		5.20E-02	2.88E-02
Chrysene	4.22E-01	1.83E-01	1.48E-01	1.83E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	1.10E+00	4.76E-01	Regression from Eco SSL		8.05E-02	3.65E-02
Dibenzo(a,h)anthracene	1.00E-01	8.95E-02	3.13E-02	8.95E-02	0.00E+00	0.00E+00	2.60E+00	2.60E+00	2.60E-01	2.33E-01	Regression from Eco SSL		2.06E-02	1.85E-02
Fluoranthene	8.00E-01	2.79E-01	2.64E-01	2.79E-01	0.00E+00	0.00E+00	3.04E+00	3.04E+00	2.43E+00	8.48E-01	2.09E+00	2.09E+00	1.67E+00	5.83E-01
Indeno(1,2,3-cd)pyrene	3.86E-01	1.81E-01	1.45E-01	1.81E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	1.00E+00	4.70E-01	Regression from Eco SSL		7.40E-02	3.60E-02
Phenanthrene	2.20E-01	1.24E-01	7.20E-02	1.24E-01	0.00E+00	0.00E+00	3.04E+00	3.04E+00	6.69E-01	3.76E-01	2.09E+00	2.09E+00	4.60E-01	2.59E-01
Pyrene	6.10E-01	2.37E-01	2.14E-01	2.37E-01	0.00E+00	0.00E+00	2.60E+00	2.60E+00	1.59E+00	6.17E-01	Regression from Eco SSL		1.14E-01	4.67E-02
Total PAHs	3.94E+00	1.36E+00	1.52E+00	1.36E+00	0.00E+00	0.00E+00	2.60E+00	2.60E+00	1.02E+01	3.54E+00	Regression from Eco SSL		6.67E-01	2.44E-01
Pesticides/PCBs														
4,4'-DDD	1.10E-01	2.14E-02	2.48E-02	2.14E-02	0.00E+00	0.00E+00	Regression from Eco SSL		6.85E-01	2.18E-01	Regression from Eco SSL		1.54E-02	4.49E-03
4,4'-DDE	1.30E-01	1.74E-02	2.44E-02	1.74E-02	0.00E+00	0.00E+00	Regression from Eco SSL		1.98E+00	3.37E-01	Regression from Eco SSL		1.75E-02	3.86E-03
4,4'-DDT	3.30E-01	3.88E-02	5.44E-02	3.88E-02	0.00E+00	0.00E+00	Regression from Eco SSL		3.19E+00	4.97E-01	Regression from Eco SSL		3.52E-02	7.03E-03
ALDRIN	5.80E-03	1.07E-02	2.17E-03	2.17E-03	0.00E+00	0.00E+00	3.30E+00	3.30E+00	1.91E-02	7.16E-03	6.90E-01	6.90E-01	4.00E-03	1.50E-03
ALPHA-CHLORDANE	6.10E-01	5.38E-02	8.71E-02	5.38E-02	0.00E+00	0.00E+00	5.00E+00	5.00E+00	3.05E+00	2.69E-01	2.50E-02	2.50E-02	1.53E-02	1.34E-03
DIELDRIN	3.40E-01	4.95E-02	5.66E-02	4.95E-02	0.00E+00	0.00E+00	1.47E+01	1.47E+01	5.00E+00	7.28E-01	8.20E-02	8.20E-02	2.79E-02	4.06E-03
ENDRIN	1.80E-02	1.63E-02	9.20E-03	1.63E-02	0.00E+00	0.00E+00	3.60E+00	3.60E+00	6.48E-02	5.87E-02	8.20E-02	8.20E-02	1.48E-03	1.34E-03
GAMMA-CHLORDANE	5.60E-01	5.68E-02	1.01E-01	5.68E-02	0.00E+00	0.00E+00	5.00E+00	5.00E+00	2.80E+00	2.84E-01	2.50E-02	2.50E-02	1.40E-02	1.42E-03
HEPTACHLOR EPOXIDE	9.90E-03	3.09E-03	4.52E-03	3.09E-03	0.00E+00	0.00E+00	3.00E+00	3.00E+00	2.97E-02	9.27E-03	2.80E-02	2.80E-02	2.77E-04	8.65E-05
Inorganics														
ARSENIC	5.40E+00	1.54E+00	2.06E+00	1.54E+00	0.00E+00	0.00E+00	Regression from Eco SSL		7.94E-01	3.27E-01	3.75E-02	3.75E-02	2.03E-01	5.77E-02
CADMIUM	7.70E-01	1.08E-01	2.29E-01	1.08E-01	0.00E+00	0.00E+00	Regression from Eco SSL		6.73E+00	1.41E+00	Regression from Eco SSL		5.39E-01	1.85E-01
CHROMIUM	7.50E+01	1.32E+01	1.32E+01	1.32E+01	0.00E+00	0.00E+00	3.06E-01	3.06E-01	2.30E+01	4.05E+00	4.10E-02	4.10E-02	3.08E+00	5.43E-01
COPPER	1.54E+01	6.36E+00	6.36E+00	6.36E+00	0.00E+00	0.00E+00	5.15E-01	5.15E-01	7.93E+00	3.28E+00	Regression from Eco SSL		5.73E+00	4.04E+00
LEAD	3.45E+02	4.94E+01	4.94E+01	4.94E+01	0.00E+00	0.00E+00	Regression from Eco SSL		8.98E+01	1.87E+01	Regression from Eco SSL		7.03E+00	2.36E+00
MERCURY	2.30E-02	1.57E-02	1.83E-02	1.57E-02	0.00E+00	0.00E+00	Regression - Sample et al., (1998)		3.03E-01	2.67E-01	5.00E+00	6.52E-01	1.15E-01	1.02E-02
NICKEL	8.00E+00	2.44E+00	2.66E+00	2.44E+00	0.00E+00	0.00E+00	1.06E+00	1.06E+00	8.47E+00	2.58E+00	Regression from Eco SSL		5.13E-01	2.11E-01
ZINC	1.39E+02	3.24E+01	3.24E+01	3.24E+01	0.00E+00	0.00E+00	Regression from Eco SSL		4.32E+02	2.68E+02	Regression from Eco SSL		7.43E+01	3.32E+01

(1) Average concentration is the mean concentration of all samples, using 1/2 the detection limit for non-detects, unless the value is greater than the maximum concentration. In that case, the average concentration is the mean of the positive detection
(2) Appendix G provides the sources of the bioaccumulation factors.
(3) The earthworm and plant concentrations are calculated by multiplying the soil concentration by the bioaccumulation factors or by entering the soil concentration into the regression equation.

APPENDIX F

RESPONSE TO COMMENTS

APPENDIX F

RESPONSE TO COMMENTS: REVISION 1 - FEBRUARY 2009

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

September 17, 2008

Mr. Benjamin T. "Tread" Kissam, P.G.
Department of the Navy
Naval Facilities Engineering Command Southeast
Building 903
NAS Jacksonville
Jacksonville, Florida 32212-0030

RE: Remedial Investigation for Site 41, Naval Air Station Whiting Field, Milton, Florida
(Tetra Tech NUS, Inc., March 10, 2008)

Dear Mr. Kissam:

I have reviewed the above document dated March 10, 2008 (received on March 12, 2008). The purpose of this Remedial Investigation (RI) is to document field investigation activities associated with the RI of the soil for Site 41 and to report the results from the soil investigation. The RI Report was developed based on the results of a field investigation conducted according to the RI/FS Work Plan for Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C (Tetra Tech NUS, 2000). This report also presents recommendations for the site based on the findings. The impact of Site 41 soil leaching into groundwater will be addressed in the Site 40 Basewide Groundwater RI Report. Site 41 was initially designated PSC 1485C (potential source of contamination), and is the site of the former Pesticide Storage Building 1485C. I concur with Tetra Tech's conclusions detailed in section 8.0 of this report, and I also consider their recommendation to conduct a Feasibility Study to address soil screening level exceedances and potential human health risks related to surface and subsurface soil exposure at Site 41 to be appropriate. Please begin this work as soon as feasible.

Thank you for the opportunity to review this document. If you require additional clarification or other assistance please feel free to contact me at 850/245-8999.

Sincerely,

John Winters

John Winters, P.G.
Remedial Project Manager

JJC

for
ESN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 17, 2008

4SF-FFB

Mr. Benjamin T. Kissam
NAVFAC SE
P.O. Box 30, Bldg. 103
NAS Jacksonville, Fl 32212-0030

SUBJECT: NAS Whiting Field, Florida
EPA ID# FL2170023244

Dear Mr. Kissam:

The United States Environmental Protection Agency (EPA) has received and reviewed the following document:

- **Remedial Investigation for Site 41, Former Pesticide Storage Building 1485C, Naval Air Station Whiting Field, Milton, Florida** (Prepared by Tetra Tech NUS, Inc.)

Enclosed are EPA's review comments. If you should have any questions, please contact me at (404) 562-8555 or by email at Benedikt.Craig@epa.gov .

Sincerely,

Craig A. Benedikt

Craig A. Benedikt
Senior Remedial Project Manager
Federal Facilities Branch

Enclosure

cc: John Winters, FDEP

EPA Review Comments
OU 27 – Site 41 Remedial Investigation
NAS Whiting Field
Dated, March 2008

1. **Cover Page and Title Page:** Please include the OU number as OU-27 on the cover page as well as the title page.
2. **Acronyms, Page ix:** The acronym for "B(b)F" should be defined as "benzo(b)fluoranthene. The acronym for "COPC" should be defined as "Chemicals of Potential Concern".
3. **Executive Summary, Page ES-1:** In the first sentence of the first paragraph, please change "NAVFAC SE" to "the Navy". Also in the first sentence, please spell out "RI" as "Remedial Investigation" as this is the first occurrence of the acronym in the text. In the second sentence of the second paragraph, please delete "and recommendations". Per EPA Remedial Investigation (RI)/Feasibility Study (FS) guidance, the RI report should not contain recommendations, just the details of the investigation. In the fourth sentence of the second paragraph, please add the word "potential" between "The" and "impact". In the first sentence of the fourth paragraph, please delete the word "formal". In the third sentence of the fourth paragraph, please change the word "site" to "installation". In the fifth paragraph, please delete the word "conducted".
4. **Executive Summary, Page ES-2:** In the "Conclusions" section at the bottom of the page, please delete the first bulleted item as it relates to recommendations. In the second bulleted item, please revise the second sentence as follows: "The lateral and vertical extent of the contaminated soils has not been fully defined."
5. **Executive Summary, Page ES-3:** Please delete the recommendations section as recommendations are not to be included in the RI report.
6. **Section 1.0, Page 1-1:** Please change "Department of NAVFAC SE" to "Navy" in the first sentence. Please add "OU-27" before "Site 41" in the first sentence. Please add the EPA ID number after "Whiting Field" in the first sentence.
7. **Section 1.1, Page 1-1:** Please delete the second sentence of this section as recommendations are not to be included in the RI report. Please add the word "potential" between "The" and "impact" in the third sentence.
8. **Section 1.2, Page 1-1:** Please spell out the following acronyms as this is the first occurrence of their usage in the document: IR, CERCLA, SARA, NAVFAC SE, PA, SI, RI/FS and USEPA.
9. **Section 1.3, Page 1-2:** In the fourth sentence of the first paragraph, please add ",separated by an industrial area," in between "(North and South Fields)" and "and".
10. **Section 1.4, Page 1-2:** In the ninth sentence of the first paragraph, please delete "and recommendations".
11. **Figure 1-2, Page 1-4:** Please provide an enlarged figure to show the site location in greater detail.
12. **Section 3.0, Page 3-1:** Please delete "if present" in the first sentence.
13. **Section 3.1, Page 3-1:** Please delete "general categories of" in the first sentence of this section.

14. **Figure 3-1, Page 3-2:** Site 41 as depicted by the solid red line does not include the southern portion of the 2003 building boundary. Please revise the figure or provide an explanation in the text for why this portion of the property is not considered part of the site.
15. **Section 3.1, Page 3-3:** Please describe what is meant by appropriate regulatory Standard Operating Procedures as stated in the first paragraph on this page. In addition, please provide a reference to any and all standard operating procedures utilized in this investigation.
16. **Section 3.3, Page 3-3:** The third paragraph of this section states that soil vapor headspace analyses were performed according to the method prescribed in FDEP Rule 62-770.200 (2); however, 62-770 is a petroleum protocol and is not applicable to a CERCLA investigation.
17. **Section 3.4, Page 3-4:** Please insert the word "Groundwater" in between the words "Basewide" and "RI" in the third sentence of the third paragraph.
18. **Section 3.4, Page 3-5:** The first paragraph at the top of the page discusses samples which exceeded FDEP criteria; however, the criteria that was exceeded is not defined. Please clarify. In addition, the text should state whether or not EPA screening standards were exceeded for the media being sampled. Please revise the second sentence of the second paragraph as follows: "These analytes were used as indicator compounds for soil contamination at the site." The first sentence in the third paragraph refers to the evaluation of an additional area at the site; however, it is unclear which additional area is being referenced. The first sentence of the sixth paragraph on this page mentions primary screening criteria; however, it is unclear which primary screening criteria is being referenced. Please provide a reference for all screening criteria.
19. **Section 4.3, Page 4-2:** A more complete description of the data validation process should be provided.
20. **Section 5.0, Page 5-1:** Please delete the information beginning with "The RI objectives proposed in the RI/FS Work Plan….." and ending with the second set of bulleted items on this page and replace the information with just the final standards that were used for screening purposes during the investigation.
21. **Section 5.0, Page 5-2:** Please provide a reference for the primary or secondary FDEP criteria referred to in the second sentence of the "Naturally Occurring Inorganics" section.
22. **Section 5.1.1, Page 5-12:** Please revise the second sentence in the description of VOCs as follows: "Since acetone is considered a common laboratory contaminant, the low concentrations of acetone detected are most likely due to laboratory contamination." In the description of SVOCs, please change the word "exceedinf" to "exceeding" in the second sentence. Samples SS41, SS44 and SS52 are mentioned in the text; however, these samples could not be found on Figure 5-1. Please verify and correct.
23. **Figures 5-1, 5-2, 5-3, 5-4, 5-5, and 5-6:** It would be useful to include a breakout box for each sample location where a constituent was detected which shows the constituent and the detected concentration.
24. **Section 5.1.1, Page 5-14:** The sample locations for samples SS40, SS43, SS44 and SS51 which are discussed in the Pesticides/PCBs section could not be found on Figure 5-2. Please verify and correct. The text states that elevated detection limits were higher than

the SCTLs for certain constituents. It is unclear why detection limits that were lower than the corresponding SCTLs were not used. Please provide an explanation.

25. **Figure 5-2:** The slanted lines shown on the figure should be defined in the legend. In addition, it is unclear why the boundary of Site 41 was not extended to include the entire area of contaminated soil.
26. **Section 5.2, Page 5-19:** The first sentence of this section states that samples were collected from depths up to 10 feet below land surface (bls). An explanation should be provided as to why samples were not collected below 10 feet (bls).
27. **Section 5.2.1, Page 5-23:** The last sentence of the first paragraph should be revised for clarity. The first sentence in the second paragraph should be revised for clarity. In the second sentence of the second paragraph, please add ",SB45 and SB46" at the end of the sentence.
28. **Section 5.3, Pages 5-43 and 5-44:** Throughout this section, the text indicates that there are numerous areas of the site that have not been adequately defined or delineated. Since the purpose of the remedial investigation is to define the nature and extent of site related contamination, an explanation should be provided as to why the numerous areas of Site 41 have not been defined.
29. **Section 8.0, Page 8-1:** The first paragraph of this section states that the sections of this RI report described the nature and extent of hazardous constituents in groundwater and that the risk assessment examined the risk from exposure to groundwater. However, this RI report focused on the investigation of onsite soils and not groundwater. Please correct the text accordingly.
30. **Section 8.2, Page 8-2:** Please delete this section. Recommendations for further action should not be included in remedial investigation reports.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

4SD-SSB

MEMORANDUM

SUBJECT: Human Health Risk Assessment Comments for the Remedial Investigation for Site 41, Former Pesticide Storage Building 1485C, Naval Air Station Whiting Field, Milton, Florida

TO: Craig Benedikt, Remedial Project Manager
Federal Facilities Branch
Superfund Division

FROM: Tim Frederick, Life Scientist
Technical Services Section
Superfund Division

THRU: Glenn Adams, Chief
Technical Services Section
Superfund Division

Per your request, the **Remedial Investigation for Site 41, Former Pesticide Storage Building, Naval Air Station Whiting Field, Milton, Florida** (RI) has been reviewed by TSS. Based upon the review, I offer the following comments:

Comments

1. **Section 6.1.1.2.2**. Insufficient information is provided in this section describing the methodology for screening detected contaminant concentrations against background. The source of the data set has not been identified in this section. The statistic used to represent the background is also not identified in the section (i.e., is the background max detect, UTL 95, UCL 95, 2x the average, other?). The background concentration used to screen the soil data is also not presented in the screening tables. Instead a simple Yes/No selection is presented in the column "Site Above Background?". In addition, the footnote in that column states, "To determine whether metal concentrations were within background levels, soil concentrations ere compared to facility background levels as described in Section 6.1.1.1." However, Section 6.1.1.1 discusses Data Usability and laboratory validation, not background. As presented in the text, it is not possible to

evaluate the background screening of the soil data. The text should be revised to include greater detail on background screening.

2. **Section 6.3.2**. This section discusses calculation of the exposure point concentration to be used in the risk calculations. The text indicates that FDEP's Florida UCL Calculator Tool (Version 1.0) was used to calculate the UCL 95. EPA recommends use of the ProUCL software (Version 4.00.02) for calculating the UCL 95. It is unclear how the methods might differ in the calculations might differ in the results generated. The text should be expanded to discuss the differences in the two methods and why one was selected over the other. The text should also discuss how the results in the calculations may have differed and the direction in bias that may result from the use of one calculator over the other.

3. **Section 6.4.1**. The text identifies sources for the toxicity criteria to be used in risk assessment calculations from "the following primary recommended USEPA sources…" The bullet list identifies Tables 5A and 5B from FDEP 62-777 as one of the primary recommended USEPA sources. OSWER Directive 9285.7-53 (USEPA, 2003) identifies a three tiered approach for the selection of toxicity criteria. The Florida tables would fall under Tier 3 and are not specifically cited as this bullet list suggests. For clarity, the list should be revised.

4. **Section 8.0**. The text states, "The preceding sections of the RI Report have described the nature and extent of hazardous constituents in groundwater…" However, no groundwater samples appear to have been collected as part of this investigation. The text should be corrected accordingly.

References:

USEPA (2003). *Human Health Toxicity Values in Superfund Risk Assessments*. OSWER Directive 9285.7-53. December 5, 2003. Online: http://www.epa.gov/oswer/riskassessment/pdf/hhmemo.pdf

USEPA – ProUCL Software Version 4.00.02. Online: http://www.epa.gov/esd/tsc/software.htm

If you have any questions regarding these comments, please feel free to contact me at 404-562-8598 or frederick.tim@epa.gov.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 4

61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

4SFD-SSB

MEMORANDUM - DRAFT

SUBJECT: Review of the Remedial Investigation for Site 41, Former Pesticide Storage Building 1485C, at the Naval Air Station Whiting Field, Milton, Florida

FROM: Brett Thomas, Ph.D., Life Scientist
Technical Services Section
Superfund Division, Superfund Support Branch

THROUGH: Glenn Adams, Chief, Technical Services Section

TO: Craig Benedikt, Remedial Project Manager, Federal Facilities

Per your request, I have reviewed the Remedial Investigation for Site 41, Former Pesticide Storage Building 1485C, at the Naval Air Station Whiting Field in Milton, Florida. The focus of my review was the adequacy of the ecological risk assessment for Site 41. I did identify a few exposure factors and assumptions that I do not agree with, however the overall assessment appears to be sound enough to support the conclusion of no unacceptable ecological risk at Site 41. These conclusions are based upon my best review efforts in a reasonable time frame, having never visited the site. If more or clarifying information becomes available, these conclusions could change.

The part of the NAS Whiting Field site under investigation is Site 41, a former ground maintenance equipment and pesticide storage building that burned down 20 or so years ago. The remains of the building and its foundation have reportedly been removed, and this investigation is to determine the risks posed by the contaminants remaining in the soil in the area where the building used to be and its immediate surroundings. It did not sound like surface water (even small ponding) was present, and the area was described as poor quality habitat consisting of dirt, sand and gravel with some weed and grass cover.

It makes most sense to list my comments by the section or page in the report to which they pertain, and I have done so below, with calculations and general conclusions added where applicable.

Comments

Section 5.0 states that dieldrin was the only pesticide detected above screening criteria, and that it was above screening criteria in 20 of 22 samples. PAHs were also fairly widespread at elevated concentrations. PCBs were not detected at concentrations of concern.

Section 5.1.2: The report states that metals were not detected above the screening criteria except for Cr in one sample. I did see in Table 5-2 a few exceedances for other metals, however, such as lead at 3x the screening value of 50 ppm in SS-04 and 7x the screening value in SB-37, and zinc at ~3x the screening value of 46 ppm. So there appears to be a discrepancy between the table and the text for the report.

Section 5.2: It sounds as though the subsurface soils may contain more contaminants such as pesticides than the surface soils do, however I did not look at the samples in detail as it does not appear that ecological exposure to these subsurface soils is likely.

Section 5.3 Conclusions: For the surface soil, exceedances of PAHs, metals and pesticides are noted on the site. Most of the areas of the exceedances are not fully bounded spatially, so the lateral extent of the exceedances is unknown. The situation for the subsurface soils appears similar.

P. 7-14, Section 7.5.3.1.3: The DDTs are screened out for plants and inverts, and this appears supported and acceptable.

P. 7-15: The report states that because some of the pesticides are not widespread (although dieldrin is), and the area has such limited eco habitat value, that it is reasonable to screen out the pesticides for plant and invertebrate receptors. If the area does look like what they say (gravel and compact dirt with sparse vegetation), it is likely acceptable that the area provides such little habitat that limited risk exists for inverts and especially plants, except for gross contamination (which does not appear to be present), therefore dismissing the pesticides for inverts and plants is acceptable.

P. 7-15, Section 7.5.3.1.4: For antimony, cadmium, and vanadium, the report states that their maximum concentrations at Site 41 are below the basewide background and therefore are being dropped. This is acceptable, as their screening (conservative) HQs (hazard quotients) are also not that high (up to 3.5). One issue concerning this however is that the report references Table F-5 for the background, which I do not see in the report. Inclusion of this table and information on how the background values were generated would be helpful.

P. 7-16: Chromium, lead and zinc are also dropped for plants and invertebrates, and the explanations for doing so in the report are acceptable.

P. 7-17: The report states that PAHs are not bioaccumulative except under percent level concentrations, and therefore they won't consider them in the FCM exercise. [FCM = food chain model, a way to look at potential risk to wildlife from exposure to chemicals that don't fall out during the initial screening process.] But, PAHs weren't addressed for wildlife in the earlier section. PAHs could be taken up by wildlife receptors via incidental soil ingestion, therefore even if they don't bioaccumulate there is exposure. Also, they usually don't bioaccumulate appreciably, but they can accumulate in inverts enough for ingestion of inverts to provide a food borne source of PAHs. Therefore, PAH risks to wildlife should be evaluated. EPA Region 6 SLERAP guidance (1999) has the highest individual PAH wet weight BAF for soil invertebrates as 0.08 (for Indeno(1,2,3-cd)pyrene; listed PAH BAF range is 0.03 to 0.08). The Eco-SSL Exposure Factors and Bioaccumulation Models document (2007) has the dry weight PAH BAFs listed as 3.04 for low molecular weight (LMW) PAHs and 2.6 for the high molecular weight (HMW) PAHs. Converted to wet weight (by multiplying by the 0.16 dry weight to wet weight factor given in the report) the BAFs are 0.49 for the LMW PAHs and 0.42 for the HMW PAHs. This information could be used to estimate the invertebrate PAH body burden and thus the dose to the wildlife. In fact, I'll do that here, using the 0.49 BAF:

Dose = amount of PAH in water + amount of PAH in food + amount of PAH in ingested soil. In this case the BAFs for PAHs partitioning into inverts are bigger than those for plants, so I assume the insectivore's exposure will be worse case, so I'll focus on those receptors (shrew and woodcock). Also, from the description of the site, there isn't standing water on the site, so the wildlife must get their water from elsewhere, so it may be reasonable to assume that the offsite water source has negligible PAHs. So,

Dose = $[PAH]_{water}$ + $[PAH]_{invert}$ + $[PAH]_{soil\ ingested}$ = 0 + $[PAH]_{invert}$ + $[PAH]_{soil\ ingested}$

For the $[PAH]_{soil}$, I'll use the maximum total PAH given of 3.94 mg/kg to be conservative. The TRVs are from the Eco SSLs and are NOAEL based.

For the Short Tailed Shrew, the food ingestion rate (FIR) = 0.62 kg/kg-day (wet wt), the average body weight = 0.0161 kg, and the sediment ingestion rate = 3.0% (from the report and acceptable given what is found in EPA's 1993 Wildlife Exposure Factors Handbook).

$[PAH]_{invert}$ = ($[PAH]_{soil}$ x $BAF_{PAH\text{-}invert}$) x FIR = 3.94 mg PAH/kg dry soil x 0.49 mg PAH/kg wet tissue //mg PAH/kg dry soil x 0.62 kg food/kg bw-day = 1.20 mg PAH/kg BW-day

$[PAH]_{soil\ ingested}$ = $[PAH]_{soil}$ x FIR x % as soil = 3.94 mg PAH/kg dry soil x 0.62 kg food/kg bw-day x 0.03 = 0.0733 mg PAH/kg-day

Total PAH ingested for the shrew = $[PAH]_{invert}$ + $[PAH]_{soil\ ingested}$ = 1.20 mg/kg-d + 0.0733 mg PAH/kg-day = 1.27 mg PAH/kg-day

HQ: The TRV for the Shrew for PAHs is estimated at 0.615 (mammalian insectivore from Eco-SSLs), so HQ = dose/TRV = 1.27/0.615 = 2.1

For the American Woodcock, the average food ingestion rate (FIR) = 0.77 kg/kg-day (wet wt), the average body weight = 0.173 kg, and the sediment ingestion rate = 11.74% (from the report and acceptable given what is found in EPA's 1993 Wildlife Exposure Factors Handbook).

$[PAH]_{invert}$ = ($[PAH]_{soil}$ x $BCF_{PAH\text{-}invert}$) x FIR = 3.94 mg PAH/kg dry soil x 0.49 mg PAH/kg wet tissue //mg PAH/kg dry soil x 0.77 kg food/kg bw-day = 1.49 mg PAH/kg BW-day

$[PAH]_{soil\ ingested}$ = $[PAH]_{soil}$ x FIR x % as soil = 3.94 mg PAH/kg dry soil x 0.77 kg food/kg bw-day x 0.117 = 0.355 mg PAH/kg-day

Total PAH ingested for the woodcock = $[PAH]_{invert}$ + $[PAH]_{soil\ ingested}$ = 1.49 mg/kg-d + 0.355 mg PAH/kg-day = 1.85 mg PAH/kg-day

HQ: The TRV for the woodcock for PAHs is estimated at 0.615 (no avian data, so mammalian insectivore TRV from Eco-SSLs used), so HQ = dose/TRV = 1.85/0.615 = 3.0

The magnitude ($\leq$3) of the above hazard quotient estimates for the shrew and the woodcock, despite them being above 1.0, indicate that PAHs should not pose a significant risk to these insectivores, nor likely to herbivores that may use the site. These risk estimates were based on very conservative assumptions (feeding only on Site 41, NOAEL based TRVs, maximum reported soil PAH concentrations used), so it is likely that a more realistic risk scenario would show much less risk. This of course is assuming that the site has been adequately characterized for PAHs and that significantly higher contamination was not missed during the characterization. Assuming that the site has been well characterized, ameliorating factors for the risk estimate include the use of the provided average PAH concentration instead of the maximum and the consideration of LMW PAH TRVs vs. HMW PAH TRVs. The average PAH concentration is reported as 1.52 mg/kg in soil. Use of the 95% UCL of the mean would be better, but not having this, using the average PAH concentration in the risk calculations would reduce the risk estimate by a factor of 2.6x compared to using the maximum PAH concentration, which would reduce the risk estimates to near 1 or below. Also, I used the PAH TRV for high molecular weight (HMW) PAHs of 0.615 mg/kg BW-day for both the LMW and HMW PAHs. The TRV for the LMW PAHS listed in the Eco-SSLs is 65.6. Therefore, if the time were taken to separate out the total PAH value into LMW and HMW totals, and then the risks were calculated separately for these 2 fractions, the risk estimate for PAHs would be reduced, probably significantly, from what I estimated in the above calculations. Therefore it is believed that PAH risks to ecological receptors on the site is not significant, given the data available.

P. 7-18 to 21: The report presents food chain model derived EEQs (ecological effects quotients, like hazard quotients) for the four wildlife receptors based upon "conservative" and "average" assumptions. I looked at many but not all of the inputs that went into the calculations. Generally speaking, the inputs such as toxicity values and exposure factors were acceptable. The food ingestion rate for the shrew was low, but not outrageously so. The risk estimates are presented in

Table 7-3 in the report. Under the conservative scenario, the herbivorous receptors (the vole and quail) showed basically no significant risk. The insectivorous receptors (shrew and woodcock) did show risk estimates above 1.0 for the conservative scenario, but most of the estimates were below 3 even for the conservative scenario which included the use of NOAEL based toxicity reference values. The exceptions to the negligible risk results are for the woodcock for whom risk estimates of 6.5 for dieldrin and 9.6 for mercury were calculated. The corresponding LOAEL-based risk estimates are less than 1.0 for these two contaminants given the LOAEL in the report (hopefully not calculated as NOAELx10), and for situations not involving threatened or endangered species it is usually acceptable to consider LOAEL-based toxicity values in risk estimates. Under the "average scenario", no significant risks were calculated. Some of the assumptions made for the average scenario may be a little too liberal; however, as mentioned even under the conservative scenario the risks are not deemed all that significant, so a reasonable risk scenario (somewhere between the "conservative" and "average" scenarios in the report) would likely give an acceptable risk outcome. This is believed to be true because even for the two higher risk estimates for the woodcock, reasonable assumptions to make under a still fairly conservative risk scenario, such as utilization of area use factors (the animals will likely feed in areas other than this half acre of poor quality habitat) and a 95% UCL of the mean exposure point contaminant concentration rather than using the maximum concentration would likely have resulted in little to no risk being estimated, even for NOAEL based toxicity reference values. As mentioned, for non-threatened species, assessments will often times use LOAEL based toxicity values, and so with a few reasonable assumptions and the LOAEL based toxicity values the risk estimates certainly fall below 1.

Therefore, even though some of the exposure factors or toxicity values were somewhat off from what I would prefer, I do not believe it is worth having the assessment reworked to address these, as what is presented is robust enough that it can be seen that no significant risk likely exists for wildlife receptors at this site. There are some uncertainties, such as for reptiles and amphibians who were not addressed in the risk assessment. This is not unusual, however, as the toxicity information for these receptors is incomplete. There is also some question as to the spatial extent of contamination, as the report states that the entire area of contamination has not been delineated for some parts of the site. Unless the area of contamination is extensive, however, it probably would not make much difference. The rationale for this statement largely comes from the fact that the site is not likely valuable ecological habitat, and by the worded description in the text it sounds like better habitat exists for most receptors in the surrounding forest areas. Therefore given the risk assessment presented and the characteristics of the site in question, it is not believed likely that significant ecological risk exists at this site, and it is not believed that further revision of the ecological parts of this assessment will change that conclusion.

Appendix E: The page discussing the derivation of soil to earthworm BAFs says that the "dry weight BAFs were derived by dividing the dry weight BAF by 0.16. For this ERA, the dry weight BAFs were used in the food chain model." It is often not necessary to convert dry weight to wet weight or wet to dry weight if the proper (associated) factors are used in the rest of the calculations. However, if it is felt necessary it is not unreasonable to make the conversion. However in this case I believe they should have divided the wet weight BAF by 0.16 to obtain the dry weight BAF. I am going to trust that this is simply a typo and that the calculations are correct. However, if they are incorrect this would probably serve to make their risk estimates more conservative, as the BAF would have been inflated by a factor of about six, which would cause them to over predict the prey tissue contaminant concentrations. Most of the BAFs used were not listed (in Appendix Table E-2), so it is not possible to check most of the numbers. I was able to check a few values, for heptachlor and dieldrin as examples in earthworms using the EPA Region 6 Combustion Guidance and the Eco-SSLs, and the values in the references are about 2.5x bigger than what is listed in the report. In these cases (and perhaps others) the report may underestimate the concentration of contaminants in the earthworms and thus underestimate the risk posed by these contaminants to insectivores. As stated previously for other issues, however, the magnitude of disagreement is in this case not likely to be large enough to substantively change the estimate of ecological risk and so is probably not worth a revisionary effort. If a revision is performed some discussion around the BAFs used is warranted. Also, as a note, in Table E-4 it is stated that if a LOAEL was not available that a NOAEL was multiplied by 10 to estimate a LOAEL. The EPA ecological risk assessors generally do not agree with this approach. If a LOAEL is not available then the NOAEL is used and the conservatism in the risk estimate is noted. Also, the NOAEL TRV for zinc for the mammal is about 2x too high compared to that in the Eco SSL document for zinc, again causing some underestimate of risk but not enough to change the outcome of this risk assessment. Also for zinc in Table E-12, the "average" zinc concentration is significantly higher than the "maximum" zinc concentration. This error does not appear to have affected the calculation, as the "average" insect zinc concentration is lower than the "conservative" insect zinc concentration, so the error must have only been textural in the table.

Conclusions

Despite a few issues being identified, I believe the ecological risk assessment presented in this RI is adequate to indicate that no unacceptable ecological risk likely exists at Site 41. Qualifications to this conclusion are: 1) Some areas of contamination were not completely delineated spatially, therefore the exposure area could be bigger than assumed in this effort (although receptor home range considerations should help to address this); 2) Site 41 is described as fairly poor ecological habitat at this time, but it is unknown whether Site 41 is to be redeveloped industrially (further reducing habitat value) or rehabilitated to ecological habitat, which would encourage increased ecological exposure; 3) I have never been to the Site nor seen pictures, so my conclusions are based on the mental picture I have of the Site from the descriptions in the report.

Thank you for the opportunity to review these materials. If you have questions or would like to discuss this review, please contact me at (404) 562-8751, or at Thomas.Brett@epa.gov.

Brett Thomas

Note: Acceptance of a risk approach and/or toxicity values, exposure assumptions, etc. for this report do not necessarily constitute broad endorsement of these values or approaches by EPA Region 4 for other parts of this site or for other sites. In the interest of time, not all values and assumptions were checked, so unacceptable values other than those noted may have been missed.

In the future, different values, assumptions or approaches may be deemed more appropriate for ecological risk assessments performed in similar and especially different situations, therefore values or approaches different from those used here may be recommended.

RESPONSE TO USEPA COMMENTS ON DRAFT REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 27, SITE 41 FORMER PESTICIDE STORAGE BUILDING 1485C NAS WHITING FIELD

EPA Comments issued 17 November 2008, from Mr. Craig Benedict to Mr. Tread Kissam NAVFAC SE.

1. **Cover and Title Page:** Please include the OU number as 0U-27 on the cover page as well as the title page.

Response: *Will make this change.*

2. **Acronyms, Page IX:** The Acronym for "B(b)F" should be defined as "benzo(b)fluorenthene. The acronym for "COPC" should be defined as "Chemicals of Potential Concern".

Response: *Will make this change.*

3. **Executive Summary, Page ES-1**: The first sentence of the paragraph, please change "NAVFAC SE" to "Navy". Also in the first sentence, please spell out "RI" as "Remedial Investigation" as this is the first occurrence of acronym in the text. In the second sentence of the second paragraph, please delete "and recommendations". Per EPA Remedial Investigation (RI)/Feasibility Study (FS) guidance, the RI report should not contain recommendations, just the details of the investigation. In the fourth sentence of the second paragraph, please have the word "potential" between "The" and "impact". In the first sentence of the fourth paragraph, please delete the word "formal". In the third sentence of the fourth paragraph, please change the word "site" to "installation". In the fifth paragraph, please delete the word "conducted".

Response: *Will make these changes.*

4. Executive Summary, Page ES-2: In the conclusions section at the bottom of the page, please delete the first bulleted item as it relates to second bulleted item, please revise the second sentence as follows: the lateral and vertical extent of contamination soils has not been fully defined.

Response: *Will make these changes.*

5. **Executive Summary, Page ES-3:** Please delete the recommendations section as recommendations are not to be included in the RI report.

Response: *Will make this change.*

6. **<u>Section 1.0, Page 1-1:</u>** Please change "Department of NAVFAC SE" to "Navy" in the first sentence. Please add "OU-27" before "Site 41" in the first sentence. Please add the EPA ID number after "Whiting Field" in the first sentence.

Response: *Will make these changes.*

7. **<u>Section 1. One, Page 1-1:</u>** Please delete the second sentence of this section as recommendations are not to be included in RI report. Please add were "potential" between "The" and "impact" in the third sentence.

Response: *Will make these changes.*

8. **<u>Section 1.2, Page 1-1:</u>** Please spell out the following acronyms as this is the first occurrence of the usage of this document: IR, CERCLA, SARA, NAVFAC SE, PA, SI, RI/FS and USEPA.
Response: *Will make these changes.*

9. **<u>Section 1.3, Page 1-2:</u>** In the fourth sentence of the first paragraph, please add ",separated by an industrial area," in between "(North and South fields)" and "and".

Response: *Will make these changes.*

10. **<u>Section 1.4, Page 1-2:</u>** In the ninth sentence of the first paragraph, please delete "and recommendations".

Response: *Will make this change.*

11. **<u>Figure 1-2, Page 1-4:</u>** Please provide an enlarged figure to show the site location in greater detail.

Response: *An enlarged site figure has been provided.*

12 .**<u>Section 3.0, Page 3-1:</u>** Please delete "if present" in the first sentence.

Response: *Will make this change.*

13. **<u>Section 3.1, Page 3-1:</u>** Please delete "general categories of" in the first sentence of this section.

Response: *Will make this change.*

14. **<u>Figure 3-1, Page 3-2:</u>** Site 41 as depicted by the solid red line does not include the southern portion of the 2003 building boundary. Please revised the figures or provide an explanation in the text for why this portion of the property is not considered part of the site.

Response: *The original boundaries of AOC 1485C were shown on the map. The figure was revised by expanding the southern boundary to include all sample locations.*

15. **<u>Section 3.1, Page 3-3:</u>** Please describe what is meant by approximate regulatory Standard Operating Procedures as stated in the first paragraph on this page. In addition, please provide a reference to any and all standard operating procedures utilized in this investigation.

Response: *The text was revised to state that USEPA and FDEP SOPs were followed. Additional SOP references were provided where required to describe the procedures used in the investigation.*

16. **<u>Section 3.3, Page 3-3:</u>** The third paragraph of the section states that soil vapor headspace analyses were performed according to the method prescribed in FDEP 62-770. (2); however, 62-770 is a petroleum protocol and is not applicable to a CERCLA investigation.

Response: *In the initial stages of the investigation of AOC 1485C the character of the contamination at the Site was not known. The Work Plan directed the investigators to use FDEP UST screening protocols. The USEPA reviewed the Work Plan and approved this screening methodology.*

17. **<u>Section 3.4, Page 3-4:</u>** Please insert the word "Groundwater" in between the words "Basewide and "RI" in the third sentence of the third paragraph.

Response*: Will make this change.*

18. **<u>Section 3.4, Page 3-5:</u>** **A.** The first paragraph at the top of the page discusses samples which exceed FDEP criteria; however, the criteria that was exceeded is not defined. Please clarify. **B.**

In addition, the text should state whether or not EPA screening standards were exceeded for the media being sampled. **C**. Please revise the second sentence of the second paragraph as follows: "These analytes were used as indicator compounds for soil contamination at the site". **D.** The first sentence in the third paragraph refers to the evaluation of an additional area of the site; however, it is unclear which additional area is being referenced. **E**. The first sentence of the sixth paragraph on this page mentions primary screening criteria; however, it is unclear which primary screening criteria is being referenced. Please provide a reference for all screening criteria.

Response: *A. The sentence will be revised to read"....results either exceed FDEP 62-770 FAC criteria or USEPA Region 9 Superfund Preliminary Remediation Goals (PRGs) or Risk Assessment Guidance Ecological screening Values (RAGs).*

B. This sentence will be added.

C. This sentence was revised as suggested.

D. The sentence was revised to read, "....were collected on 16 October 2003 from the area around the initial site."

E. See response 18-A.

19. **<u>Section 4.3, Page 4-2:</u>** A more complete description of the data validation process should be provided.

Response: *A more complete description of the data validation process is now present in the report.*

20. **<u>Section 5.0, Page 5-1:</u>** Please delete information beginning with "The RI objectives proposed in the RI/FS Work Plan......" and ending with the second set of bullets bulleted items on this page and replace the information with just the final standards that were used for screening purposes during the investigation.

Response: *Will make this change.*

21. **<u>Section 5.0, Page 5-2:</u>** Please provide a reference for the primary or secondary FDEP criteria referred to in the second sentence of the "Naturally Occurring Inorganics" section.

Response: *The reference has been added.*

22. **Section 5.1.1, Page 5-12:** Please revise the second sentence in the description of VOCs as follows: "Since acetone is considered a common laboratory contaminant, the low concentrations of acetone detected are most likely due to laboratory contamination.: In the description of SVOCs, please change the word "exceedinf" to "exceeding" in the second sentence. Samples SS41, SS44 and SS52 are mentioned in the text; however, these samples could not be found on Figure 5-1. Please verify and correct.

Response: *These corrections have been made.*

23. **Figures 5-1, 5-2, 5-3, 5-4, 5-4, and 5-6:** It would be useful to include a breakout box for each example location where a constituent was detected which shows a constituent in the detected concentration.

Response: *Breakout boxes have been added for each sample location where USEPA residential, industrial, or environmental exceedances occurred with detected concentrations.*

24. **Section 5.1.1, Page 5-14:** The sample locations for samples SS40, SS43, SS44 and SS51 which are discussed in the Pesticides/PCBs section could not be found on Figure 5-2. Please verify correct. The text states that elevated detection limits were higher than the SCTLs for certain constituents. It's unclear why detection limits that were lower than the corresponding SCTLs were not used. Please provide an explanation.

Response: *The sample locations SS40, SS43, SS44 and SS51 were added to Figure 5-2. Detection limits for aldrin and dieldrin are a function of the limits of technology. At the time the samples were taken and at this time, January 2009, the technology had not been developed to achieve detection levels lower than FDEP SCTLs for aldrin and dieldrin .*

25. **Figure 5-2**: The slanted lines shown in the figure should be defined in the legend. In addition, it is unclear why the boundary of Site 41 was not extended to include the entire area contaminated school.

Response: *The slanted lines were replaced with breakout boxes as requested in Response # 23.*

26. **<u>Section 5.2, Page 5-19:</u>** The first sentence of this section states that samples were collected from depths up to 10 feet below land surface (bls). An explanation should be provided as to why samples were not collected below 10 feet (bls).

Response: *The Work Plan indicated that samples were to be collected to a depth of 10 feet bls during the initial screening event. Samples were not collected below this level because neither field screening or analysis of laboratory results indicated samples from greater depths would be necessary.*

27. **<u>Section 5.2.1, page 5-23</u>**: The last sentence of the first paragraph should be revised for clarity. The first sentence in the second paragraph should be revised for clarity. In the second sentence of the second paragraph, please add ", SB45 and SB46" at the end of the sentence.

Response: *The two sentences described were revised for clarity. The sample location IDs were added to the text.*

28. **<u>Section 5.3, Pages 5-43 and 5-44:</u>** Throughout this section, the text indicates that there are numerous areas of the site that have not been adequately defined or delineated. Since the purpose of the remedial investigation is to define the nature and extent of site related contamination, an explanation should be provided as to why numerous areas of Site 41 have not been defined.

Response: For the purposes of this RI any areas where there was a fixed base laboratory detection will be considered contaminated material.

29. **<u>Section 8.0, Page 8-1:</u>** The first paragraph of this section states that the sections of the RI report described the nature and extent of hazardous constituents in groundwater and that risk assessment examined the risk from exposure to groundwater. However, this RI report focused on investigation of onsite soils and not groundwater. Please correct the text accordingly.

Response: *The text was correct as requested.*

30. **<u>Section 8.2, Page 8-2</u>**: Please delete this section. Recommendations for further action should not be included in remedial investigation reports.

Response: *This section of text was deleted as requested.*

EPA Comments through Mr. Craig Benedict from Mr. Tim Frederick concerning the Human Health Chapter to Mr. Tread Kissam NAVFAC SE.

Comment No. 1: Section 6.1.1.2.2 Insufficient information is provided in the section describing the methodology for screening detected contamination concentrations against the background. The source of the data set has not been identified in this section. The statistic used to represent the background is also not identified in this section (i.e., is the background max detect, UTL 95, UCL 95, 2x the average, other?). The background concentration used to screen the soil data is also not presented in the screening tables. Instead a simple Yes/No selection is presented in the column "Site Above Background?". In addition, the footnote in that column states, "To determine whether metal concentrations were within the background levels, soil concentrations were compared to facility background levels as described in section 6.1.1.1." However, section 6.1.1.1 discusses Data Usability and laboratory validation, not background. As presented in the text, it is not possible to evaluate the background screening data of the soil data. The text should be revised to include greater detail and background screening.

Response: *Agreed. The text on pages 6-5 and 6-6 of the current document indicates that a background screen was performed as part of the chemical of potential concern (COPC) selection process. The comparison was conducted in accordance with the EPA and Navy guidance documents listed at the bottom of page 6-5. However, the reader was not directed to any particular tables or appendices providing the* ***details*** *of the methodology for and results of the background evaluations. Please note that such details are provided in attached Appendix D.3. In overview, the background screening involved statistical background data set to site data set comparisons rather than simple site concentration-to-background benchmark comparison such as comparing maximum site to concentrations to maximum background concentrations. (According to the guidance referenced at the bottom of page 6-5, simple number-to-number comparisons "can be used with very small data sets but are highly uncertain.") The conclusions of the background evaluations (detailed in Appendix D.3) are summarized in the COPC selection tables (Tables 6-1 and 6-2). The text and COPC selection tables will be revised to include a reference to Appendix D.3.*

Comment No. 2: Section 6.3.2. This section discusses calculation of the exposure concentration to be used in the risk calculations. The text indicates that FDEPs Florida UCL Calculator Tool (Version 1.0) was used to calculate the UCL 95. EPA recommends use of the ProUCL software (Version 4.00.02) for calculating the UCL 95. It is unclear how the methods might differ in the calculations might differ in the results generated. The text should be expanded to discuss the differences in the two methods and why one was selected over the other. The text should also discuss how the results in the calculations may have differed and the direction in bias that may result from the use of one calculator over the other.

Response: *The FDEP Florida UCL Calculator (FUCL) was used because it has been specifically requested by the State of Florida for site investigation seeking State approval/concurrence of a risk assessment. FUCL was developed with consideration of the methods and guidelines presented in the EPA's guidance document for Calculating UCLs for EPCs at Hazardous Waste Sites (December, 2002). Thus, in many respects the methodology incorporated into the software is very similar to the EPA's Pro-UCL software. The Navy's experience is that FUCL tends to not recommend the calculation of UCLs via non-parametric methods (e.g., boot strap methods) and FUCL pays particular attention to the handling censored results (i.e., non-detect results). Also, the Navy's experience using FUCL versus Pro-UCL is that, generally, EPCs developed using FUCL tend to be more conservative than (i.e., higher than) EPCs developed using Pro-UCL. This discussion will be added to Section 6.3.2.*

Comment No. 3: Section 6.4.1. The text identifies sources for toxicity criteria to be used in risk assessment calculations from "the following primary recommended EPA sources…." The bullet list identifies Tables 5A and 5B from FDEP 62-777 as one of the primary recommended USEPA sources. OSWER Directive 9285.7-53 (USEPA, 2003) identifies a three tiered approach for the selection of toxicity criteria. The Florida tables would fall under Tier 3 and are not specifically cited as this bullet list suggest. For clarity, the list should be revised.

Response: *Agreed. The wording in Section 6.4.1 will be adjusted as requested. The referenced toxicity criteria in the Florida tables (Tables 5a and 5b) will be listed under the "Other Toxicity Values" bullet and the text will note that such criteria are not specifically recommended or endorsed by the U.S. EPA.*

Comment No. 4: Section 8.0. The text states, "The preceding sections of the RI Report have described the nature and extent of hazardous constituents in groundwater…" However, no groundwater samples appear to have been collected as part of its investigation. The text should be corrected accordingly.

Response: *Agreed. The text will be corrected as suggested.*

EPA Comments through Mr. Craig Benedict from Mr. Brett Thomas concerning the Ecological Risk Chapter to Mr. Tread Kissam NAVFAC SE.

Per your request, I have reviewed the Remedial Investigation for Site 41, Former Pesticide Storage Building 1485C, at the Naval Air Station Whiting Field in Milton, Florida. The focus of my review was the adequacy of the ecological risk assessment for Site 41. I did identify a few exposure factors and assumptions that I do not agree with, however the overall assessment appears to be sound enough to support the conclusion of no unacceptable ecological risk Site 41. These conclusions are based upon my best review efforts in a reasonable time frame, having never visited the site. If more or clarifying information becomes available, these conclusions could change.

Response: As pointed out by Mr. Thomas, modification of the document based on the comments would not alter the outcome of the ecological risk assessment. For this reason Mr. Thomas's detailed comments are included following this section but no modifications were made to the ecological risk assessment.

APPENDIX F

RESPONSE TO COMMENTS: REVISION 2 - JUNE 2009

Chapter 6: The authors' original response to USEPA comments have been incorporated in the Rev.2 document. The detailed responses are located in Appendix F "Response to Comments".

Chapter 7, has been modified as follows:

Table 7-1: Was modified using the most recent Eco SSLs for PAHs and zinc, and the table was revised showing PAHs included in the food chain model evaluation.

Throughout the text, references to some Eco SSLs had the most recent date added.

Section 7.4 The number of PAHs considered as initial COPCs was reduced to benzo(a)pyrene and Total PAHs because of the use of the PAH Eco SSL. Additionally, acetone was the only chemical without and ESV.

Section 7.5.4.1.2: The discussion of PAHs was modified to reflect the PAH Eco SSL and the COPCs benzo(a)pyrene and total PAHs.

Section 7.5.4.1.3: A statement (**bold text**) was added to the sentence, "The dieldrin ESV exceedances are more widespread (approximately 140 feet x 90 feet)" **based on concentrations detected in analyzed samples**.

Section 7.5.4.1.4: The discussion of zinc was modified to reflect the zinc Eco SSL.

Section 7.5.4.2: Food chain modeling was included for PAHs and the discussion of EEQs was modified to reflect the PAH calculations. Benzo(a)pyrene and total PAHs had NOAEL EEQs greater than 1.0.

Section 7.6.2: A discussion was added in the uncertainty section regarding the lack of evaluation of reptiles and amphibians.

Tables 7-3 and 7-4: Were modified based on changes in the food chain models.

The Appendix E, BAF text, was modified to include a discussion of all BAFs not just pesticides. The BAF table was modified to show actual BAF values from the Eco SSLs except when a regression equation was used for the BAF. The BAF for dieldrin was updated using the values presented in the Eco SSL for Dieldrin. The text was changed regarding the dry weight BAF being divided by 0.16 to the wet weight was divided by 0.16.

The TRVs were updated for PAHs and any newer values from the Eco SSLs or other sources as well as the TRV source table and TRV references.

All receptor food chain models calculations were modified based on the above listed changes.

The food chain model calculation sheet showing the calculation for tissue concentrations was added to Appendix E.

The maximum zinc concentration was changed to 139 mg/kg.

Changes not made:
The FIR for the shrew used the food chain model is equivalent to 0.66681 kg/kg-day for the conservative model and 0.555 kg/kg-day for the average scenario.

The BAF for heptachlor in the EPA Combustion Guidance document is 1.4. The value used (3.0) is more conservative.

Table E-5 regarding statistical calculations should have been included in the Appendix to the Human Health Section, but will be provided.