N60200.AR.004781
NAS CECIL FIELD, FL
5090.3a

FINAL FEASIBILITY STUDY FOR OPERABLE UNIT 5 (OU 5) SITE 15 BLUE 10 ORDNANCE DISPOSAL AREA VOLUME 2 OF 3 APPENDICES A AND B NAS CECIL FIELD FL
4/1/2007
TETRA TECH NUS INC

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Feasibility Study Report for Operable Unit 5, Site 15 Blue 10 Ordnance Disposal Area

Volume II of III - Appendices A through B

Naval Air Station Cecil Field
Jacksonville, Florida

Contract Task Order 0039

April 2007

Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

APPENDIX A

A.1 GROUNDWATER TECHNICAL MEMORANDUM FOR NO FURTHER ACTION

A.2 SUPPLEMENT TO GROUNDWATER TECHNICAL MEMORANDUM FOR NO FURTHER ACTION

A.1 GROUNDWATER TECHNICAL MEMORANDUM FOR NO FURTHER ACTION

Technical Memorandum
for
No Further Groundwater Monitoring
at
OU 5, Site 15
Blue 10 Ordnance Disposal Area

Naval Air Station Cecil Field
Jacksonville, Florida

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

Contract Task Order 0039

August 2001

Revised December 2003

REVISION 1
DECEMBER 2003

TECHNICAL MEMORANDUM
FOR NO FURTHER GROUNDWATER MONITORING
OU 5, SITE 15
BLUE 10 ORDNANCE DISPOSAL AREA

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0039

AUGUST 2001

PREPARED UNDER THE SUPERVISION OF:

MARK SPERANZA, P.E.
TASK ORDER MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

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

This document that describes this Technical Memorandum for Operable Unit 5, Site 15, Blue 10 Ordnance Disposal Area at Naval Air Station Cecil Field, Jacksonville, Florida, has been prepared under the direction of a Florida-registered professional engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice.

_____

Mark P. Speranza, P.E.
Professional Engineer No. PE0050304

Date: _____

TABLE OF CONTENTS

SECTION **PAGE NO.**

CERTIFICATION ii

LIST OF ACRONYMS AND ABBREVIATIONS v

1.0 INTRODUCTION 1-1

2.0 SITE BACKGROUND 2-1
- 2.1 SITE DESCRIPTION 2-1
- 2.2 SITE HISTORY 2-6
- 2.3 SITE CHARACTERISTICS 2-7
- 2.3.1 Surface Hydrology 2-7
- 2.3.2 Geology 2-7
- 2.3.3 Hydrogeology 2-7

3.0 PREVIOUS INVESTIGATIONS 3-1
- 3.1 DESCRIPTION OF INVESTIGATIONS 3-1
- 3.2 SUMMARY OF RESULTS 3-14
- 3.2.1 Summary of RFI Results 3-14
- 3.2.2 Summary of the RI Field Investigations 3-14
- 3.3 POST-RI SAMPLING EVENTS 3-25
- 3.3.1 Extent of PAH and Lead Contamination 3-25
- 3.3.2 PAH Leachability to Groundwater 3-35

4.0 FIELD INVESTIGATION 4-1

5.0 NATURE AND EXTENT OF CONTAMINATION 5-1

6.0 CONCLUSIONS AND RECOMMENDATIONS 6-1
- 6.1 CONCLUSION 6-1
- 6.2 RECOMMENDATION 6-1

REFERENCES R-1

APPENDICES

- **A SAMPLING AND ANALYSIS WORK PLAN**
- **B SAMPLING LOGS**
  - **B.1 APRIL 2000 SAMPLING LOGS**
  - **B.2 MAY 2000 RE-SAMPLING LOGS**
  - **B.3 BORING LOGS AND MONITORING WELL SHEETS FOR NEW WELLS**
  - **B.4 JULY 2003 SAMPLE LOGS**
- **C ANALYTICAL LABORATORY RESULTS**
  - **C.1 APRIL 2000 SAMPLING ANALYTICAL LABORATORY RESULTS**
  - **C.2 MAY 2000 RE-SAMPLING ANALTYICAL LABORATORY RESULTS**
  - **C.3 JULY 2003 SAMPLING ANALYTICAL LABORATORY RESULTS**

TABLES

NUMBER		PAGE NO.
2-1	Hydraulic Conductivity Estimates for Upper Zone Surficial Aquifer	2-12
2-2	Summary of Aquifer Characteristics for Upper Zone Surficial Aquifer	2-13
3-1	Summary of Organic Compounds Detected in Surface Soil	3-15
3-2	Summary of Inorganic Compounds Detected in Surface Soil	3-17
3-3	Summary of Organic Compounds Detected in Subsurface Soil	3-19
3-4	Summary of Inorganic Compounds Detected in Subsurface Soil	3-20
3-5	Summary of Organic and Inorganic Compounds Detected in Groundwater	3-22
3-6	Summary of Organic and Inorganic Compounds Detected in Surface Water	3-24
3-7	Summary of Organic and Inorganic Compounds Detected in Sediment	3-26
3-8	Summary of PAHs Detected in Surface Soil, Site 15 February 2000 Post-RI Sampling	3-36
3-9	Summary of PAHs Detected in Surface Soil SPLP Extracts, Site 15 February 2000 Post-RI Sampling	3-37
5-1	April 2000 Groundwater Sampling Analytical Results	5-2
5-2	July 2003 Groundwater Sampling and Analytical Results	5-4
5-3	Monitoring Well Installation and Sampling Rationale	5-5

FIGURES

NUMBER		PAGE NO.
2-1	Site Location Map	2-2
2-2	Site Vicinity Map	2-3
2-3	General Site Arrangement	2-5
2-4	Potentiometric Map – September 1995	2-9
3-1	RI Soil and Sediment Samples Locations, PAHs Screening and Confirmatory Sampling	3-3
3-2	RI Soil and Sediment Samples Locations, Lead Screening and Confirmatory Sampling	3-5
3-3	RI Soil Samples Locations, TNT Screening and Confirmatory Sampling	3-7
3-4	RI Soil Samples Locations, TRPH Screening and Confirmatory Sampling	3-9
3-5	Location of Groundwater Monitoring Wells	3-23
3-6	April/June 1999 Post-RI Soil and Sediment Sampling Locations, PAHs Analysis	3-27
3-7	April/June 1999 Post-RI Soil and Sediment Sampling Locations, Lead Analysis	3-29
3-8	Locations of Surface Soil Samples with PAHs Concentrations Exceeding FDEP SCTLs for Residential Direct Exposure	3-31
3-9	Locations of Surface Soil Samples with Lead Concentrations Exceeding FDEP SCTLs for Residential Direct Exposure	3-33
4-1	Location of Existing and New Groundwater Monitoring Wells at Site 15	4-3

LIST OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc
BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FGS	Florida Geologic Survey
ft/ft	feet per foot
GCTL	Groundwater Cleanup Target Level (FDEP)
IBDS	Inorganic Background Data Set
HLA	Harding Lawson Associates
HMX	cyclotetramethylenetetranitramine
i	hydraulic gradient
IAS	Initial Assessment Study
IR	Installation Restoration
K	hydraulic conductivity
MCL	Maximum Contaminant Level (USEPA)
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
n	effective porosity
NACIP	Navy Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NC	no criterion
NGVD	National Geodetic Vertical Datum
NTU	nephelometric turbidity unit
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PEL	probable effect level

PETN	pentaerythritoltetranitrate
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SCTL	Soil Target Cleanup Level (FDEP)
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TEL	threshold effect level
TNB	trinitrobenzene
TNT	trinitrotoluene
TOC	total organic carbon
TRPH	total recoverable petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USDA	U.S. Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
UXO	unexploded ordnance
V	velocity
VOC	volatile organic compound
yd^3	cubic yard

1.0 INTRODUCTION

This Technical Memorandum for Operable Unit (OU) 5, Site 15, Blue 10 Ordnance Disposal Area (Site 15) at Naval Air Station (NAS) Cecil Field, has been prepared by Tetra Tech NUS, Inc. (TtNUS) for the Department of the Navy Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). The work was conducted under the Navy Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0039. The Base Realignment and Closure (BRAC) Cleanup Team (BCT) elected to resample and evaluate the groundwater at Site 15 for potential leaching of polynuclear aromatic hydrocarbons (PAHs), nitroaromatic compounds, and metals from contaminated soil.

TtNUS performed a field investigation at Site 15 in April/May 2000 AND IN July 2003 to supplement the results of previous investigations. The purpose of the April/May 2000 investigation was to collect groundwater samples from existing monitoring wells and evaluate the results to determine the extent of PAHs, nitroaromatic compounds, and metal contamination, if any. The purpose of the July 2003 investigation was to install new monitoring wells at locations with concentrations of soil contamination greater than the Florida Department of Environmental Protection (FDEP) Soil Cleanup Target Levels (SCTLs) for leachability to groundwater and to collect groundwater samples from these new wells to determine if the groundwater has been impacted by the soil contamination. The July 2003 investigation was conducted as a confirmatory sampling event to verify that there were no impacts to groundwater, as requested by the FDEP (FDEP, 2001 and BCT, 2003).

This technical memorandum presents information from the previous investigations conducted at Site 15 including the confirmation groundwater investigations conducted in April/May 2000 and July 2003 by TtNUS. This report also includes related field operations, results, conclusions, and recommendations associated with the groundwater at Site 15.

2.0 SITE BACKGROUND

The following sections describe the background of Site 15. Figure 2-1 provides a site location map. Figure 2-2 shows features in the vicinity of the site. Figure 2-3 provides the current, general arrangement of the site.

2.1 SITE DESCRIPTION

Site 15 is located in the southwest section of the Yellow Water Weapons Area (Figure 2-1). The area of investigation is approximately 85 acres with elevations ranging from approximately 79 feet National Geodetic Vertical Datum (NGVD) to 72 feet NGVD. The site is heavily forested, primarily with slash pine and understory vegetation and includes a paved access road, oriented northwest to southeast.

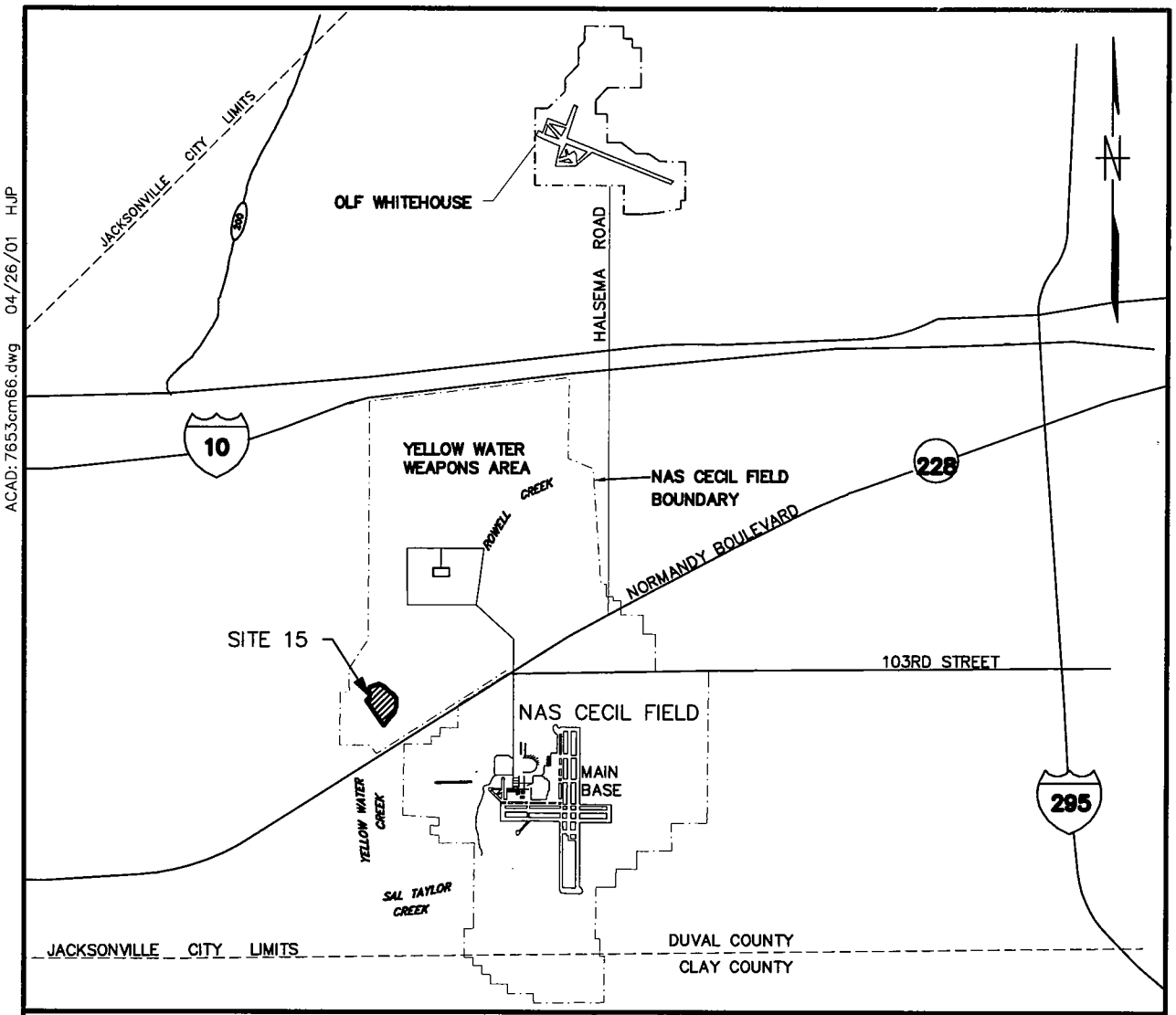
The ordnance burn chamber and static rocket firing pad are the only structures currently at the site. The burn chamber is a rounded, steel, tank-like container, approximately 10 feet in length and 4 feet in height. The chamber has a burn stack that rises approximately 3 feet above the body of the chamber. Access is gained to the chamber through a 2-foot by 2-foot hinged door. When full, the burn chamber can accommodate 1.5 cubic yards (yd^3) of material. The static rocket firing pad is an L-shaped concrete structure approximately 10 feet long by 4 feet wide by 6 feet high. Steel firing rods are seated into the concrete at 45-degree angles. Several concrete building foundations, remnants of buildings that supported skeet range activities, are located in the area surrounding the burn chamber and firing pad.

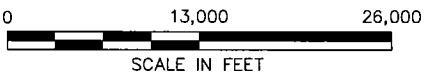
An area of stressed vegetation, referred to as the forest burn area, is present in the south-central portion of the site, approximately 900 feet south of the burn chamber and firing pad. Several slash pines are partially burned in this area. Controlled burns (burning of low-level vegetation in and around the trunks of slash pine) are commonly undertaken in this area to control understory growth in the planted pine forests. This is an area where elevated PAH concentrations were detected.

Drainage features are not distinct in the central portion of the site. The primary drainage feature is a stream located south of the ordnance disposal area that drains the southern part of the site into a low-lying, swampy area and eventually into Yellow Water Creek. The northern part of the site drains overland into a swamp, which drains into Caldwell Branch (located approximately 1,000 feet west of the site) and eventually into Yellow Water Creek.

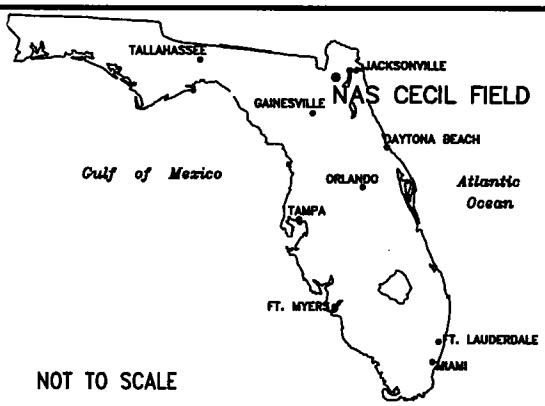
The majority of Site 15 remains dry throughout the year; however, the central area of the site may contain 2 to 4 inches of standing water during portions of the year. The historic area of Site 15 (ordnance burn chamber and firing pad) is approximately one-half acre in size and is located in the central-western part of

ACAD: 7653cm66.dwg 04/26/01 HJP





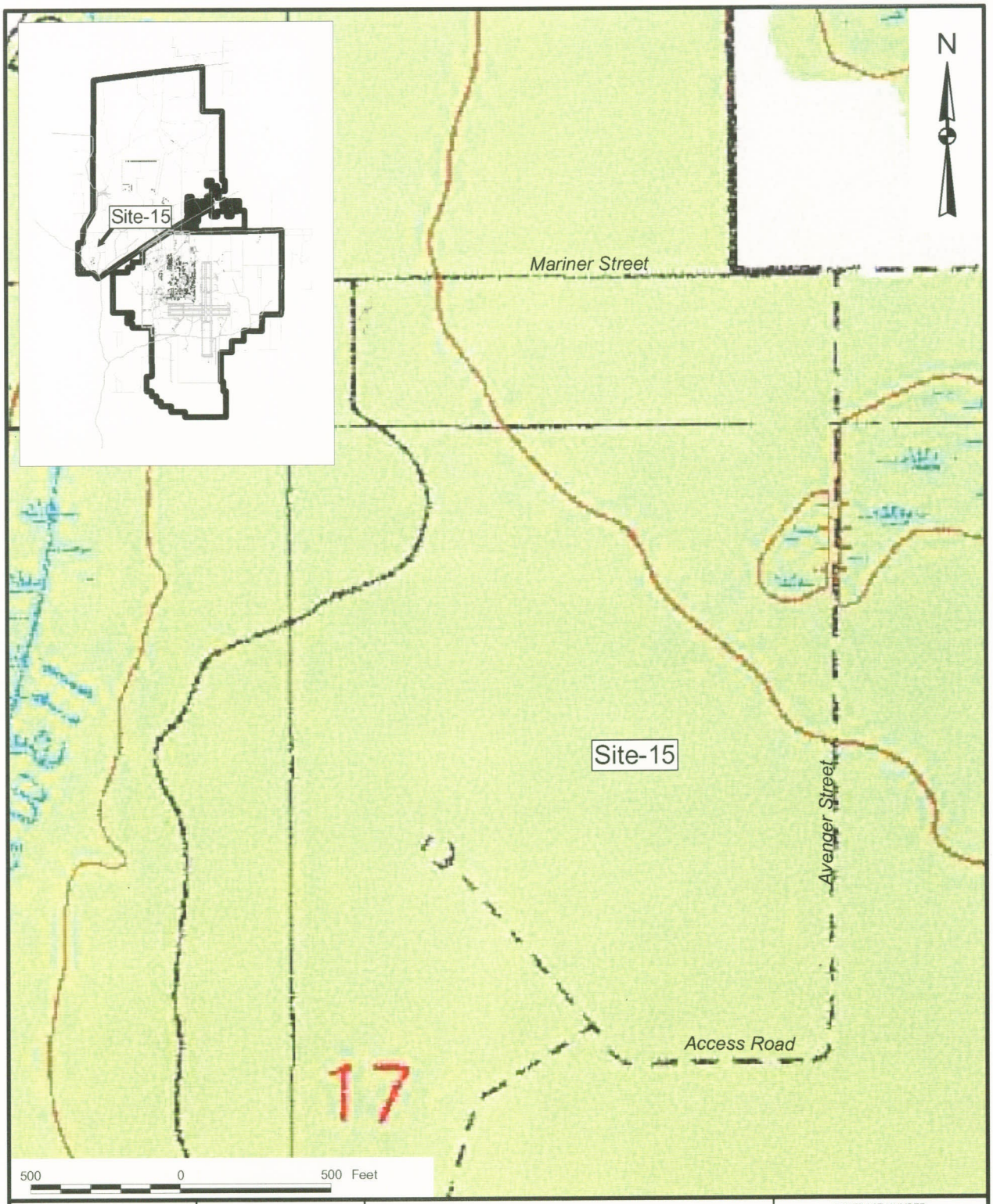
Source: Southern Division, Naval Facilities Engineering Command, 1988



NOT TO SCALE

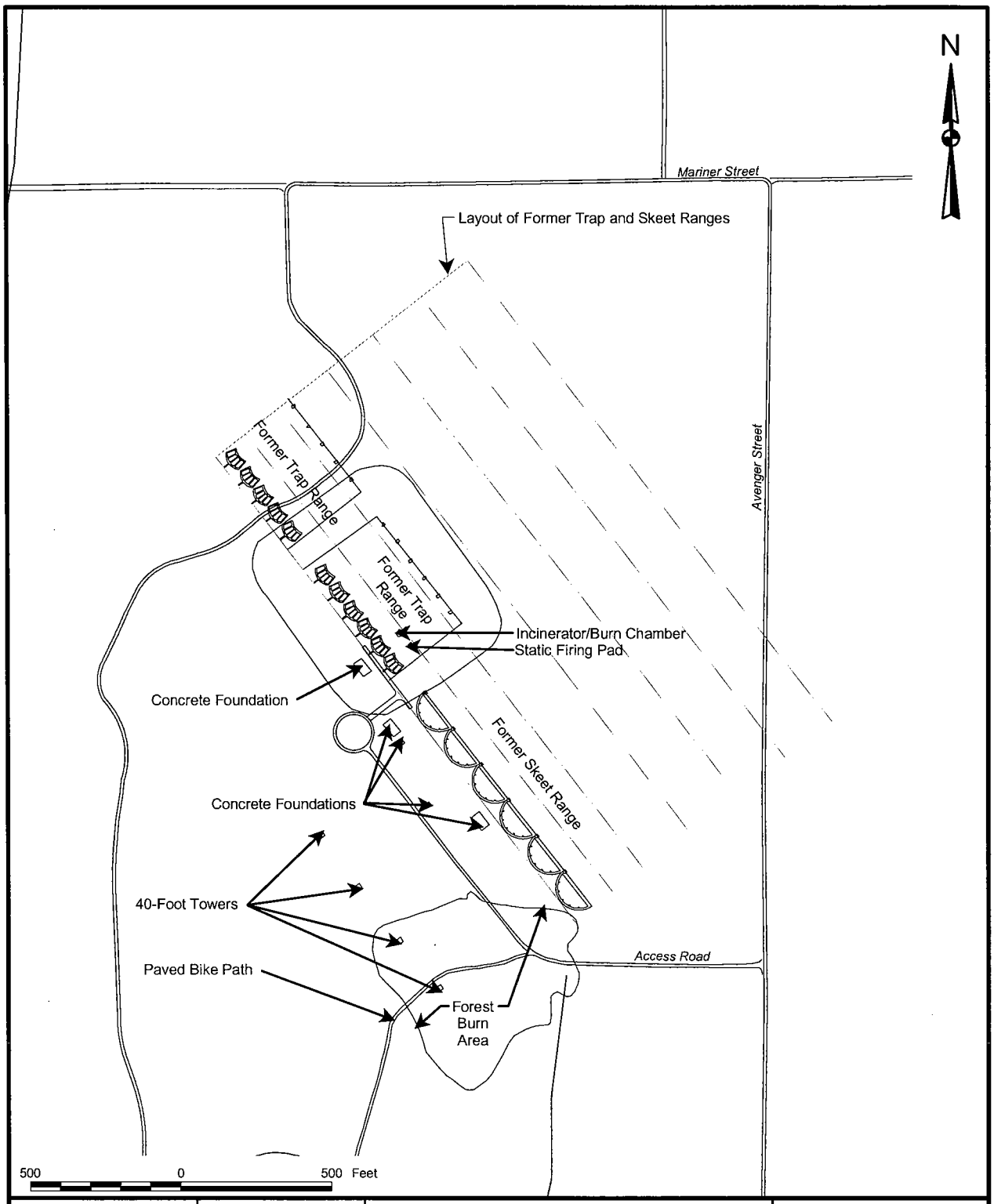
DRAWN BY HJP DATE 4/26/01	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMD	SITE LOCATION MAP SITE 15 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 7653
CHECKED BY DATE			APPROVED BY DATE 05/02/01
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2–1 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98



DRAWN BY MJJ	DATE 14Jan00	SITE VICINTY MAP SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY Thm DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 REV 0

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 01-Layout-SiteVicinityMap



DRAWN BY MJJ	DATE 14Jan00	GENERAL SITE ARRANGEMENT SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-3 REV 0

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 02-Layout-SiteArrangement

the skeet range that encompasses much of the eastern area of the site. However, evaluation of the surface soil screening data indicated surface soil contamination, which caused the site to increase in size to approximately 85 acres, extending radially around the burn chamber and firing pad and downrange of the shooting area. The trap and skeet range was included because it was interpreted that lead shot from shooting activities provided the main source of lead contamination. The forest burn area was included because combustion products of wood may produce organic residue similar to other organic burning reactions. This area is heavily planted with slash pines, and typically supports a 4- to 6-inch cover of duff (pine straw and other forest detritus) over the land surface. The primary residuals produced from wood and forest floor duff and litter burning would be PAHs.

2.2 SITE HISTORY

From the early 1940s to the mid-1950s, the site was used as a skeet range. The former skeet range was approximately 1,000 feet by 2,400 feet in size, with the long axis of the range being parallel to and east of the existing access road.

Ordnance was disposed of at Site 15 from the mid-1960s through 1977 and consisted of burning of ordnance materials in a large metal chamber and static firing of rockets (Envirodyne Engineers, 1985). The ordnance disposal structures were located west of the skeet range. The majority of ordnance disposed of at the site was burned and included small arms munitions up to 20 millimeters in size, parachute and distress flares, Mark IV signal cartridges, rocket ignitors, cartridge activated devices, and 2.75-inch and 5-inch rockets. Rocket propellant also was reportedly placed on the ground and ignited in the area of the burn chamber. Rockets were disposed of by static firing of both 2.75-inch and 5-inch rockets from a firing pad located south of the burn chamber. An estimated 2.5 tons of ordnance was disposed of at the site each month; overall an estimated 350 tons of ordnance was disposed of at the site while in operation.

Review of aerial photographs from 1952, prior to the initiation of ordnance disposal on Site 15, shows an active trap and skeet range facility located at the site. The area covered by the skeet range appears relatively large, approximately 50 acres in size, and is centered over the area in which the burn chamber and firing pad were constructed. Photographs taken in 1960 show the lineaments of the skeet range; however, the range did not appear to be active at that time. Photographs taken in 1980 no longer show any indication that a skeet range had once occupied the area. The site appears mostly forested in photographs taken in 1980, with a 3-acre open area immediately to the north of Site 15. No visual evidence of ordnance disposal was apparent at that time, which also supports the historical documentation. Forest burning has continued to take place in the southwestern corner of Site 15. The latest burning event took place in the spring of 1999 just prior to the latest Site 15 soil sampling event that occurred in June 1999.

2.3 SITE CHARACTERISTICS

2.3.1 Surface Hydrology

Drainage at Site 15 is limited because only two drainage pathways intersect the general area of the site. The primary pathway is a relatively short stream, 500 feet in length, that drains the south-central section of the site. It appears to be a natural drainage conduit, that begins in a shallow depression, 3 to 4 feet in depth and 10 to 12 feet in width. This shallow depression is located adjacent to and south of the paved road in the south-central portion of the site and drains south into a swampy area and ultimately into the Yellow Water Creek. Flow through the stream, although generally continuous, is dependent upon rainfall and could be fed by groundwater at certain times of the year. The second drainage pathway is a stream that flows past the northwest perimeter of the site. This stream is relatively shallow, 8 to 10 inches in depth and approximately 2 to 3 feet wide. Flow through the stream is continuous and the rate of flow depends upon rainfall. This stream drains southwest into Caldwell Branch and ultimately into Yellow Water Creek.

2.3.2 Geology

Three soil types cover Site 15 in nearly equal percentages, including the Olustee Fine Sand, the Leon Fine Sand, and Ridgeland Fine Sand. Each of the three soil types is described as a nearly level, poorly drained soil found in broad flatwood areas. Depth-to-water in the soil types ranges from less than 10 inches below ground surface (bgs) for two to four months of the year to 10 to 40 inches bgs during the remainder of the year. Permeability through the upper 6 inches of each soil type is moderate to rapid [U.S. Department of Agriculture (USDA), 1978].

The subsurface geologic materials recovered during monitoring well installation activities indicate that the site is underlain by undifferentiated, fine-grained sand. Lenses and stringers of silty or clayey material may be encountered intermittently. The stringers are generally less than 1 inch thick and are not continuous. Lithologic descriptions recorded during monitoring well installation indicate that sand is present from ground surface to 14 feet bgs, the total depth of the wells.

2.3.3 Hydrogeology

Three water-bearing systems are present beneath Site 15 according to the Florida code of hydrostratigraphic nomenclature as described in the Florida Geologic Survey (FGS) Special Publication 28 (FGS, 1986). These units include, in descending order, the Surficial Aquifer system, the Intermediate Aquifer or Secondary Artesian Aquifer and confining units, and the Floridan Aquifer system. Only the Surficial Aquifer was investigated at Site 15.

The Surficial Aquifer at Site 15 is composed predominantly of sand from ground surface to an approximate depth of 66 feet bgs. The water table is unconfined beneath the site and may range between 1 and 4 feet bgs during the year depending upon rainfall events. The maximum total depth of monitoring wells installed in the Surficial Aquifer at Site 15 is approximately 14 feet bgs. Sand was reported from the ground surface to total depth in each of the monitoring well lithologic logs. Each monitoring well was screened across the water table in the upper zone of the Surficial Aquifer.

2.3.3.1 Florida Groundwater Classification

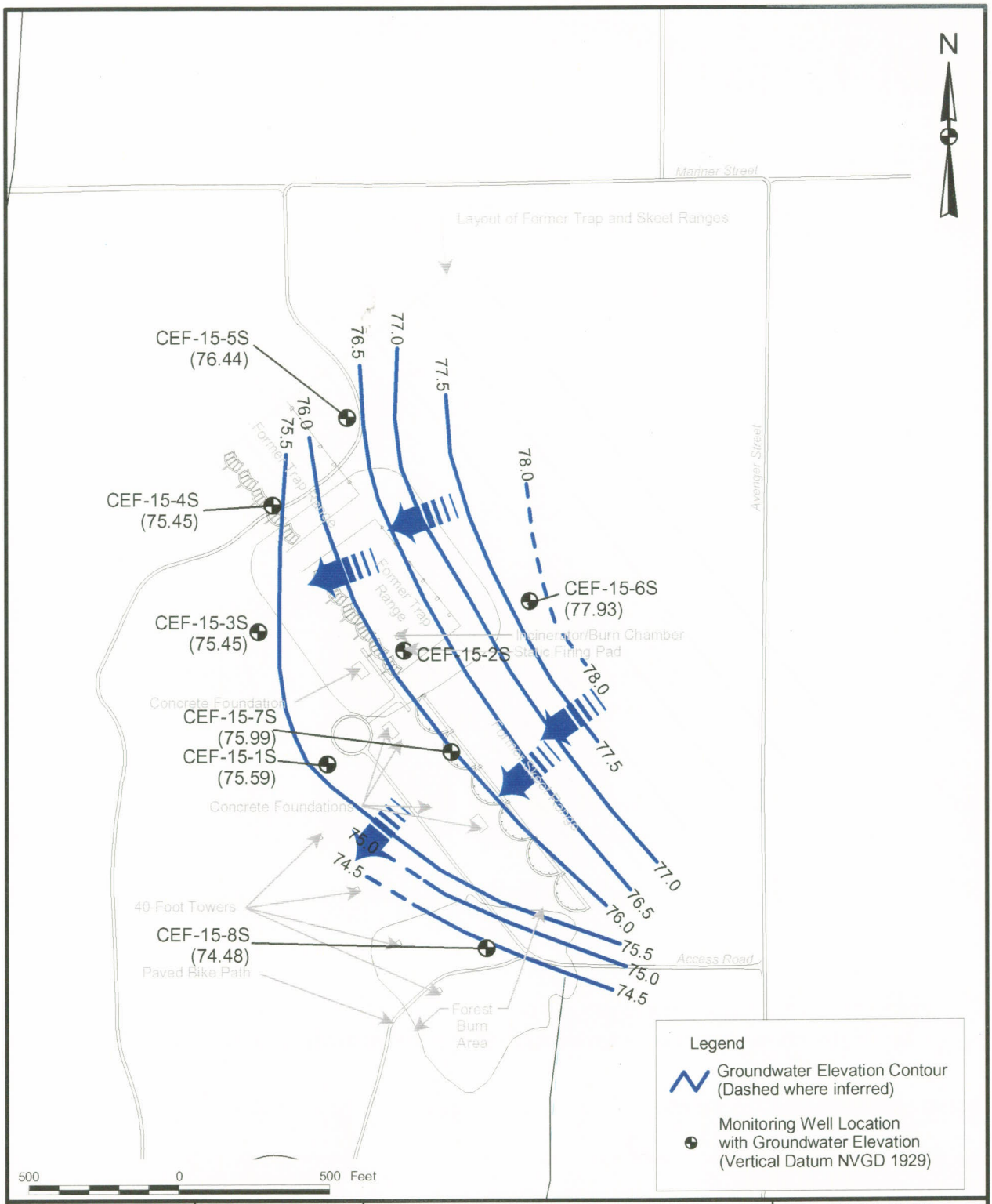
According to Florida Administrative Code (FAC) 62-520.410 (Classification of Ground Water, Usage, Reclassification), the Surficial Aquifer system in northeast Florida comes under the classification of G-II. The code's definition of G-II is as follows: "Potable water use, groundwater in aquifers which has a total dissolved solids content of less than 10,000 milligrams per liter (mg/L), unless otherwise classified by the Commission." The total dissolved solids levels of the Surficial Aquifer system in the area of NAS Cecil Field have been shown to be between 146 and 309 mg/L (Fairchild, 1972). Also, the Surficial Aquifer system is suitable for domestic use.

2.3.3.2 Aquifer Characteristics

During the Remedial Investigation (RI), the direction of groundwater flow in the Surficial Aquifer at Site 15 was assessed by collecting water-level elevation measurements from monitoring wells at the site. These data were utilized to estimate hydraulic gradient calculated from groundwater-level elevation data. Hydraulic conductivity, a quantitative measurement of permeability within an aquifer, also was estimated at each monitoring well location through collection and analysis of slug test data (Bouwer & Rice, 1976). Using these data and an estimated effective porosity of 0.20 [U.S. Geological Survey (USGS), 1996], flow rates within the Surficial Aquifer were estimated.

Groundwater-level elevation measurements were recorded periodically for piezometers and monitoring wells at Site 15. Review and evaluation of the water-level elevation data collected from four piezometers installed at the site indicated groundwater flow was to the west and southwest. Groundwater flow directions established from piezometric data were similar to the directions established as a result of monitoring well groundwater-level elevation data.

Two rounds of water-level elevation data were collected from Site 15 monitoring wells during the RI. The first round was collected on April 15, 1995, and the second round was collected on September 6, 1995. Since the flow direction established during each round was to the southwest, only data from the September event is shown on the potentiometric map in Figure 2-4. The horizontal gradient in the



DRAWN BY	DATE			CONTRACT NUMBER
MJJ	14Jan00			7653
CHECKED BY	DATE			APPROVED BY / DATE 05/02/01
COST/SCHEDULE-AREA				APPROVED BY / DATE
SCALE AS NOTED				DRAWING NO. FIGURE 2-4 / REV 0

POTENTIOMETRIC MAP SEPTEMBER 1995
SITE 15
TECHNICAL MEMORANDUM
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 03-Layout-PotentiometricMap

Surficial Aquifer at Site 15 was 0.0028 feet per foot (ft/ft) based on April 1995 data and 0.0030 ft/ft based on September 1995 data.

Also during the RI, slug tests were conducted on the Site 15 monitoring wells to estimate horizontal hydraulic conductivity (K). The calculated K values are summarized in Table 2-1 and the data sets and calculations for K are presented in Chapter 6.0 of the OU 5 RI report [ABB Environmental Services, Inc. (ABB-ES), 1997]. Hydraulic conductivity values ranged from 3.1 feet/day to 9.8 feet/day with an average K value across the site of 5.1 feet/day. These values are consistent with NAS Cecil Field Surficial Aquifer K values collected by the USGS (USGS, 1996) and at other NAS Cecil Field Installation Restoration (IR) sites.

The seepage velocity or the rate at which groundwater moves through the aquifer at Site 15 was calculated using a modified form of Darcy's equation:

$$V = Ki / n$$

Where,

V is the horizontal seepage velocity, ft/day
K is the horizontal hydraulic conductivity, ft/day
i is the hydraulic gradient, ft/ft
n is the effective porosity, dimensionless (assumed at 0.20 for fine sands)

Aquifer performance tests conducted at NAS Cecil Field by the USGS indicate that a hydraulic conductivity of 3 feet/day is a representative K value for the entire Surficial Aquifer (USGS, 1996). Using this estimated value for K, an estimated effective porosity (n) of 0.20 (USGS,1996) and hydraulic gradients (i) of 0.0028 ft/ft and 0.0030 ft/ft for Site 15, the seepage velocity was calculated to be 15 to 16 feet/year. When the site-specific hydraulic conductivity value of 5.1 feet/day (representing the upper zone of the Surficial Aquifer at Site 15) was used, the corresponding seepage velocity was calculated to be in the range of 26 to 28 feet/year. Hydrogeologic parameters are summarized in Table 2-2.

TABLE 2-1

HYDRAULIC CONDUCTIVITY ESTIMATES FOR UPPER ZONE SURFICIAL AQUIFER
OPERABLE UNIT 5, SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Monitoring Well	Hydraulic Conductivity (ft/day)
CF15MW1S	3.6
CF15MW2S	3.9
CF15MW3S	4.7
CF15MW4S	3.1
CF15MW5S	6.6
CF15MW6S	5.5
CF15MW7S	9.8
CF15MW8S	3.3
Average	**5.1**

NOTE:

Hydraulic conductivity in feet per day as measured from slug test data

TABLE 2-2

SUMMARY OF AQUIFER CHARACTERISTICS FOR UPPER ZONE SURFICIAL AQUIFER
OPERABLE UNIT 5, SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Parameter	Estimates
Hydraulic Gradient (feet per foot)	0.0028 to 0.0030
Average Hydraulic Conductivity (feet per day)	5.1
Effective Porosity (unitless)	0.20
Estimated Groundwater Seepage Velocity (feet per year)	15 to 16
Site-Specific Groundwater Seepage Velocity (feet per year)	26 to 28

3.0 PREVIOUS INVESTIGATIONS

3.1 DESCRIPTION OF INVESTIGATIONS

The following investigations were performed at Site 15. Figure 3-1 shows the PAH sampling locations selected during the RI screening and confirmatory sampling of Site 15 surface and subsurface soils and sediments. Figure 3-2 shows the lead sampling locations selected during the RI screening and confirmatory sampling of Site 15 surface and subsurface soils and sediments. Figures 3-3 and 3-4 show the trinitrotoluene (TNT) and total recoverable petroleum hydrocarbon (TRPH) sampling locations, respectively, selected during the RI screening of Site 15 surface soils.

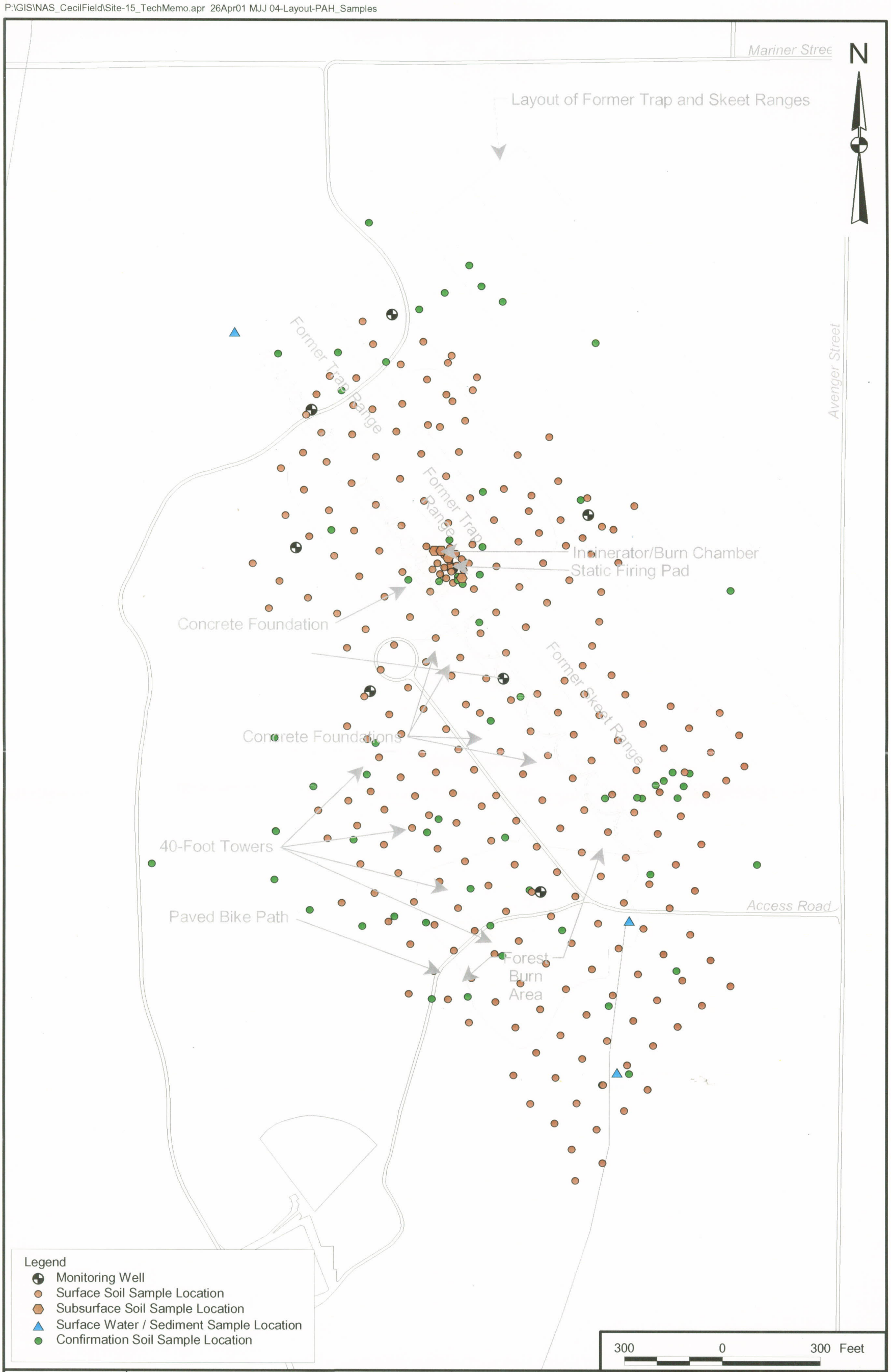
- 1985 - An Initial Assessment Study (IAS) was prepared (Envirodyne Engineers, 1985) under the Navy Assessment and Control of Installation Pollutants (NACIP) program, that was eventually replaced by the Navy's IR Program. The IAS consisted of the following stages: (1) records search, (2) onsite survey, (3) confirmation study ranking, (4) site ranking, and (5) confirmation study recommendations.

- 1988 - A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was performed [Harding Lawson Associates (HLA), 1988]. The goals of the RFI were to verify the existence of suspected hazardous constituents at various waste disposal sites, delineate the boundaries of potentially contaminated sites, investigate the surficial aquifer and potable water supply wells, and investigate selected surface areas for possible contamination. Only one surface soil sample was collected at Site 15 under the RFI. A geophysical survey was also conducted at this site.

- August 1994 to April 1995 - As part of the RI (ABB-ES, 1997), a field screening program consisting of an unexploded ordnance (UXO) survey, surface and subsurface soil screening, and the installation of piezometers was completed. The UXO survey was completed at the site prior to the sampling activities. No unexploded ordnance was found; however, several pieces of metal, shell casings, etc. were located and removed. The soil screening program was designed to delineate the nature and extent of PAH, lead, TNT, and TRPH contamination present in surface soil using onsite and offsite data analysis. Surface soil screening consisted of samples being collected from 0 to 1 foot bgs with spacing on 100-foot grid squares over an area approximately 2,000 feet by 3,000 feet except in the area around the burn chamber and static firing pad where the spacing density was increased to 25-foot grid squares over an area 100 feet by 100 feet. Collection and analysis of samples for a target screening parameter continued outward from the burn chamber and firing pad until a "no detection" result could be obtained for that particular parameter, thus delineating the extent of contamination for that parameter. When no detection of a compound was obtained, analysis for that compound ceased while analyses for other target parameters with detections continued outward.

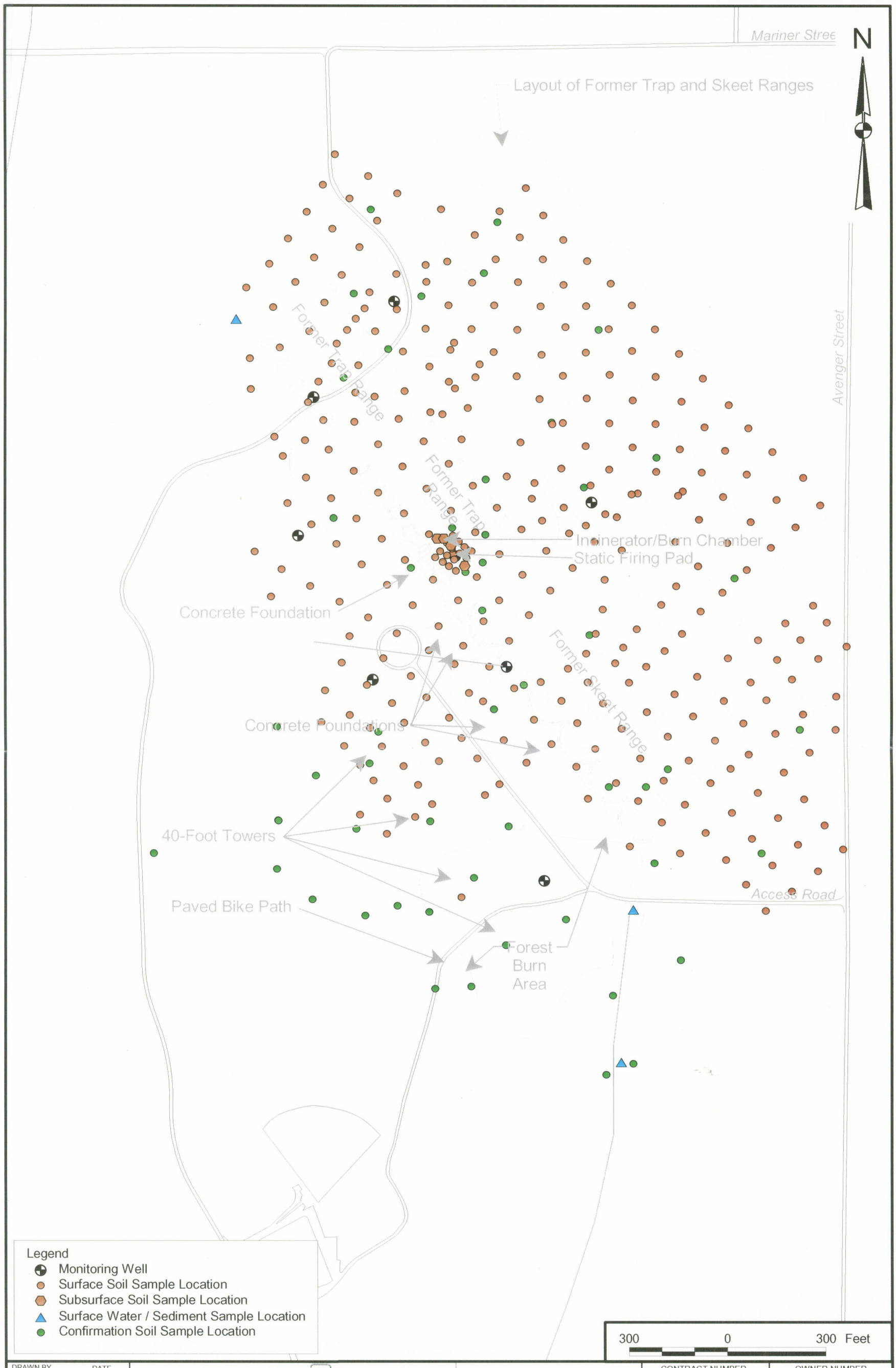
This page intentionally left blank

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 04-Layout-PAH_Samples



DRAWN BY MJJ — DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY — DATE	RI SOIL AND SEDIMENTSAMPLES LOCATIONS PAHs SCREENING & CONFIRMATORY SAMPLING SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY — DATE 05/02/01	
COST/SCHEDULE-AREA		APPROVED BY — DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 3-1	REV 0

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 05-Layout-Lead_Samples



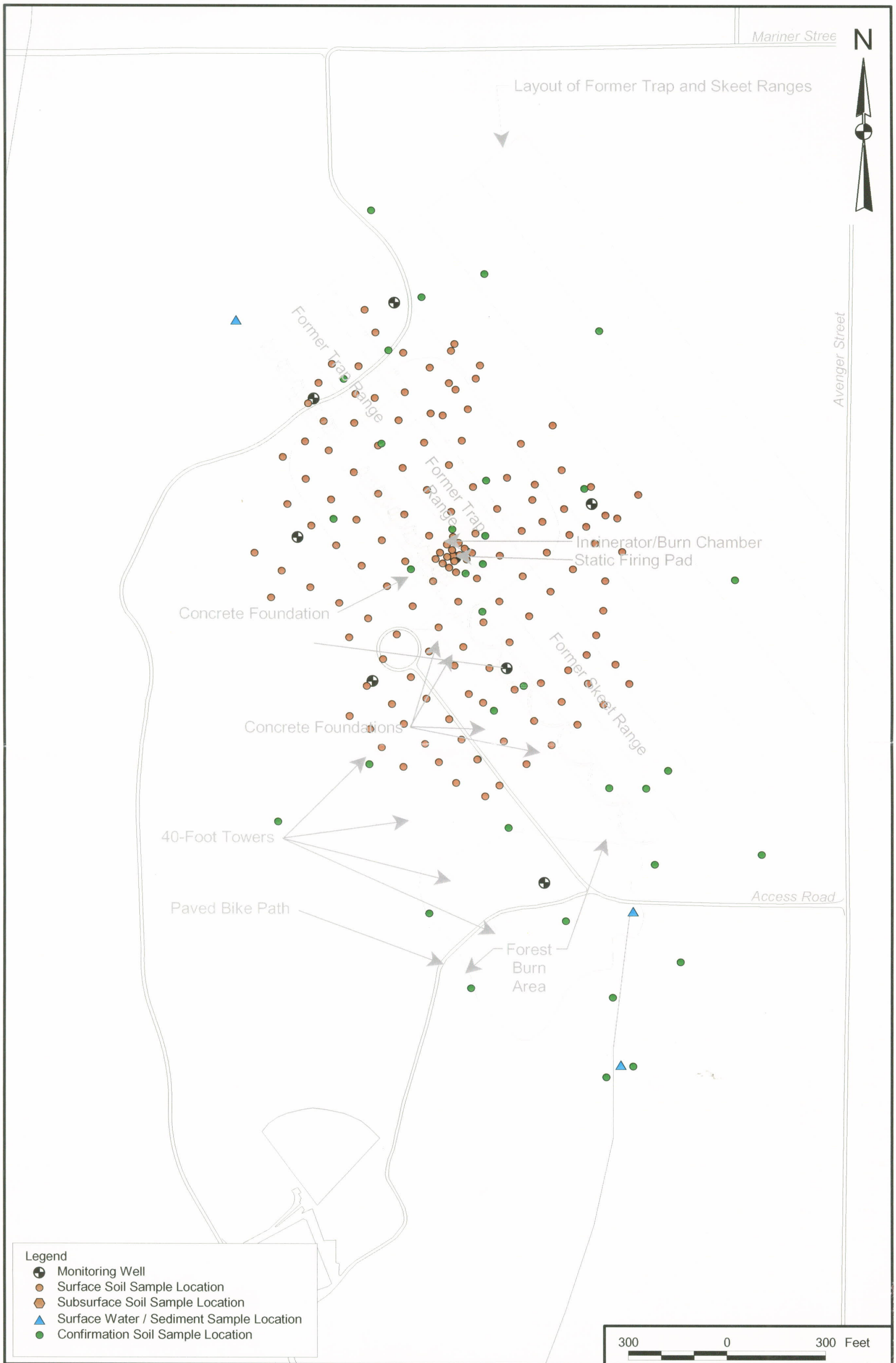
DRAWN BY MJJ	DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY	DATE	RI SOIL AND SEDIMENTSAMPLES LOCATIONS LEAD SCREENING & CONFIRMATORY SAMPLING SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-2	REV 0

REVISION 1
NOVEMBER 2003

050104/P

CTO 0039

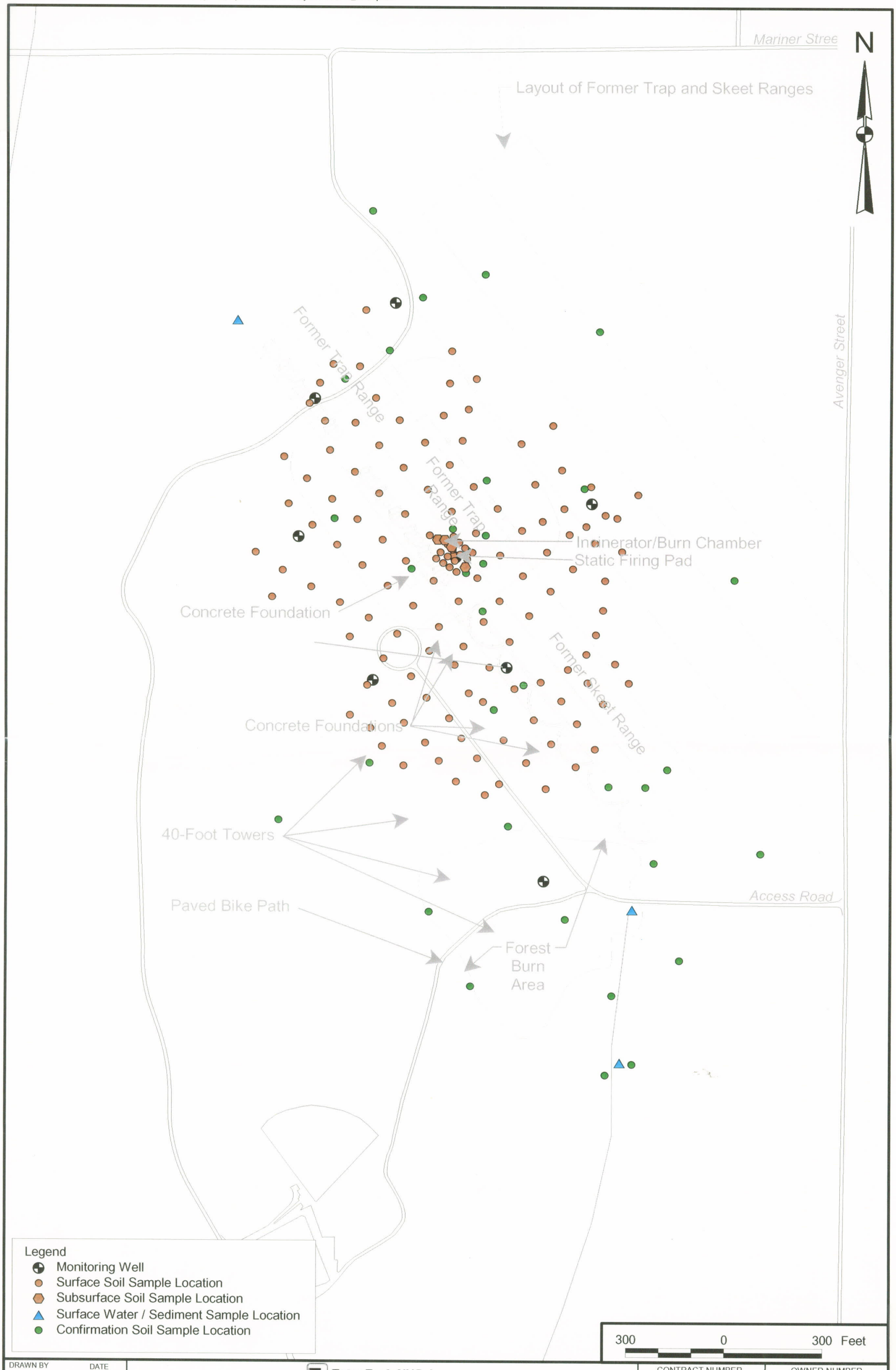
P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 06-Layout-TNT_Samples



DRAWN BY MJJ	DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY	DATE	RI SOIL SAMPLES LOCATIONS TNT SCREENING & CONFIRMATORY SAMPLING SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-3	REV 0

REVISION 1
NOVEMBER 2003

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 07-Layout-TRPH_Samples



DRAWN BY MJJ DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY DATE	RI SOIL SAMPLES LOCATIONS TRPH SCREENING & CONFIRMATORY SAMPLING SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 3-4	REV 0

REVISION 1
NOVEMBER 2003

This screening technique resulted in varying combinations of analyses for samples collected from the 409 locations. A total of 324 samples were collected for offsite lead analysis, 263 samples were collected for onsite PAH analysis, 146 samples were collected for onsite TNT analysis, and 136 samples were collected for onsite TRPH analysis during the surface soil screening program. Subsurface soil screening consisted of the collection of 16 subsurface soil samples from four soil borings advanced in the area of the burn chamber and static firing pad. Samples were collected a depths of 0 to 1 foot bgs, 1 to 3 feet bgs, 3 to 5 feet bgs, and 5 to 7 feet bgs at each of the four borings. Subsurface soil samples were analyzed offsite for lead and onsite for volatile organic compounds (VOCs), PAHs, and TRPH. Four temporary piezometers were installed to determine the direction of groundwater flow in the surficial aquifer. Evaluation of water level data collected on three separate occasions indicated that flow direction was to the southwest toward Yellow Water Creek. A groundwater screening program was not implemented at Site 15 because the potential contaminants of concern were known to be relatively immobile once sorbed to site soil. However, eight monitoring wells that would be used during the confirmatory sampling event, were selected based on the water level data and installed.

- July/August 1995 – Also as part of the RI (ABB-ES, 1997) a confirmatory sampling event was performed for surface and subsurface soil to verify the nature and extent of contamination in soil detected during the screening process. During this sampling round 34 surface soil samples were collected at depths of 0 to 1 foot bgs and analyzed for Target Compound List (TCL) organic compounds, Target Analyte List (TAL) inorganic compounds, TRPH, and nitroaromatic compounds. Six additional surface soil samples were analyzed for lead, four additional surface soil samples were analyzed for PAHs, and three additional surface soil samples were analyzed for nitroaromatic compounds. Two of the surface soil samples were also submitted for geotechnical analyses including pH, moisture content, sieve and hydrometer size distribution, bulk density, and cation exchange capacity. Also during this sampling round, 12 subsurface soil samples, collected at depths of 1 foot to 3 feet (immediately above the water table), were analyzed for TCL organic compounds, TAL inorganic compounds, TRPH, and nitroaromatic compounds. In addition, four of these samples were analyzed for total organic carbon (TOC). One additional subsurface soil sample was analyzed for PAHs only and one additional subsurface soil sample was analyzed for nitroaromatic compounds only. In addition, confirmatory groundwater samples collected from the eight Site 15 monitoring wells were submitted for analysis for TCL organic compounds, TAL inorganic compounds, TRPH, and nitroaromatic compounds. Selected groundwater samples were also submitted for TOC analysis and slug tests on the monitoring wells were performed. Finally, a confirmatory surface water and sediment sampling program was completed to assess potential contaminant migration through groundwater-surface water interaction, surface runoff and/or soil erosion, and to assess potential human health and ecological risks. One surface water/sediment sample upgradient from the site and

two downgradient surface water/sediment samples were collected and analyzed for TCL organic compounds, TAL inorganic compounds, TRPH, and nitroaromatic compounds. Analyses of surface water wet chemistry parameters including cyanide, hexavalent chromium, sulfide, total dissolved solids, alkalinity, hardness, total phosphate, and Kjeldahl nitrogen were also completed. Field measurements of surface water pH, temperature, turbidity, conductivity, and dissolved oxygen were recorded at each location at the time of sample collection.

- June 1996 - To support the toxicity testing, six soil samples were collected for whole-soil toxicity testing, including a reference sample. Two samples were also collected for definitive (dilution series) toxicity testing.

- February 1997 - To support the RI, 38 additional surface soil samples from 17 screening locations across the site were submitted for sieve and lead analysis. The objective of this additional sampling effort was to determine if it was feasible to separate the lead shot and lead shot fragments from the soil, if the remaining lead shot was responsible for high lead concentrations or if concentrations are due to lead leached into the soil, if the vertical profile of lead concentrations was localized at the ground surface, and if the soil would be considered under RCRA as characteristically hazardous if excavated. Four samples from each of the seven locations with the highest lead concentrations at the site were collected at 3 inch intervals from ground surface to a depth of one foot. Single samples were collected at a depth of 0 to 1 foot from the remaining ten locations of lesser lead concentrations, but still greater than the United States Environmental Protection Agency (U.S. EPA) soil screening value (400 mg/kg). The samples were submitted for lead analysis and toxicity characteristic leaching procedure (TCLP) lead analysis.

- May 1997 - Another sampling event for surface and subsurface soils involved the collection of 14 additional surface soil samples to be analyzed for lead, 9 additional surface soil samples to be analyzed for antimony and arsenic, and 8 additional subsurface soil samples to be analyzed for PAHs. This represented the last data that was included in the OU 5 (Site 15) RI Report (ABB-ES, 1997).

- December 1997 - Nine additional soil samples were collected from four locations. Existing documents do not address these samples. Seven of these samples were analyzed for antimony and arsenic while the other two samples were analyzed for PAHs.

- April/June 1999 – A post-RI surface soil and sediment sampling took place. The purpose of this sampling was to further determine the limits of lead and PAH contamination in the site surface soil and remove the necessity of having to extrapolate analytical data to verify the delineation of these

contaminants. This sampling event involved the collection of surface soil samples from 130 new locations. A total of 78 samples were collected for lead analysis and 60 samples were collected for PAH analysis. Eight of the 130 surface soil locations were analyzed for both PAHs and lead. During this sampling round, six sediment samples were also collected and analyzed for both PAHs and lead.

- February 2000 – A post-RI sampling event was conducted to determine site-specific leachability values for PAHs at the site. Five surface soil samples were collected from 0 to 1 foot bgs and analyzed for PAHs and Synthetic Precipitation Leaching Procedure (SPLP) PAHs.

- April 2000 - Groundwater samples were collected from the eight existing wells at the site. The samples were analyzed for PAHs, nitroaromatics, arsenic, antimony, and lead. Because of high turbidity, one of the wells was redeveloped and resampled for the inorganics. The results of the groundwater analysis were presented in a Technical Memorandum for No Further Groundwater Monitoring dated August 2001.

- June 2001 – A post-RI sampling event was conducted to confirm the previously detected soil lead concentrations for subsequent invertebrate sampling. Thirty-one surface soil samples were collected and analyzed for lead. The samples consisted of the first 3 inches of mineral soil and the overlying duff (decaying organic matter) above the mineral horizon. This investigation also included the collection of 15 invertebrate samples that were analyzed for lead. This investigation was conducted to generate ecological remediation goals for PAHs and lead in surface soil at Site 15.

- May 2003 – A post-RI soil sampling event was conducted to delineate the vertical extent of PAH and lead contamination and to delineate the horizontal extent of arsenic contamination. Thirty-eight surface soil samples were collected, 17 samples from 0 to 1 foot bgs and 21 samples from 1 to 2 feet bgs.

- June/August 2003 - A post-RI sampling event was conducted to delineate the vertical extent of TRPH and lead contamination and to delineate the horizontal extent of arsenic contamination in soil. Six soil samples were collected, 3 samples from 0 to 1 foot bgs, 1 sample from 1 to 2 feet bgs, and 2 samples from 2 to 3 feet bgs. This investigation also included the installation of six new monitoring wells and collection of groundwater samples from these new wells and one existing well. The new monitoring wells were installed in the locations where the highest levels of soil contaminant concentrations exceeding the FDEP SCTLs for leachability to groundwater criteria were detected.

3.2 SUMMARY OF RESULTS

3.2.1 Summary of RFI Results

The one surface soil sample collected at Site 15 during the RFI contained lead and 14 PAHs at concentrations above detection limits. The geophysical survey identified several anomalies that were located along the southwest edge of the site.

3.2.2 Summary of the RI Field Investigations

3.2.2.1 Surface Soil

In the field screening program, lead was detected in 255 of 324 samples at concentrations ranging from 12.6 to 65,500 milligrams per kilogram (mg/kg). The highest concentrations were detected downrange of the trap and skeet field and approximately 750 feet north of the ordnance disposal areas. Lead concentrations greater than the U.S. EPA recommended lead screening criterion of 400 mg/kg were distributed over a wide area associated with the trap-and-skeet range. PAHs were detected in 171 of 263 samples at concentrations ranging from 0.2 to 13,000 mg/kg (expressed as total PAHs). These results indicated a widespread distribution of PAHs with the highest concentrations in samples collected in the burn chamber and static firing pad area, and in the forest burn area. TNT was detected in 30 of 146 samples at concentrations ranging from 1.0 to 68 mg/kg. The highest concentrations of TNT were detected about 100 feet north of the burn chamber and static firing pad areas. TRPH was detected in 26 of 136 samples at concentrations ranging from 10 to 430 mg/kg. The highest concentrations of TRPH were detected along the southwest side of the former trap and skeet range.

The confirmatory sampling program verified that surface soil contamination at the site is generally continuous and widespread, covering an area of approximately 37 acres, with discrete areas of higher concentrations not always coincident for each of the contaminants. Two VOCs, including acetone and xylenes; three nitroaromatic compounds, including cyclotetramethylenetetranitramine (HMX), 3-nitrotoluene, and 4-nitrotoluene; and six pesticides, including endosulfan II, dieldrin, endrin, 4,4'-DDE, 4,4'-DDT, and methoxychlor, were detected in surface soil samples.

Several PAHs including benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene, and three metals including antimony, arsenic, and lead were detected at concentrations greater than the FDEP SCTLs. One other organic, carbazole, was detected at a concentration greater than its FDEP SCTL. Tables 3-1 and 3-2 summarize the frequency of detection, the concentration ranges, and the cleanup goals for organic and inorganic compounds, respectively, that were positively detected in either the screening or confirmatory sampling of surface soil. The Florida cleanup goals are considered to be the

TABLE 3-1

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 1 OF 2

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels (1)
Volatile Organic Compounds, mg/kg			
Acetone	1/39	0.006	2.8
Xylenes, total	1/39	0.002	0.2
Semivolatile Organic Compounds, mg/kg			
1-Methylnaphthalene	12/68	0.057 - 1.4	2.2
2-Methylnaphthalene	25/132	0.022 - 3.7	6.1
Acenaphthene	75/421	0.031 - 3,100	2.1
Anthracene	98/421	0.0068 - 14,000	2,500
Benzo(a)anthracene	196/421	0.0058 - 93,000	1.4
Benzo(a)pyrene	179/421	0.0066 - 110,000	0.1
Benzo(b)fluoranthene	187/421	0.0079 - 150,000	1.4
Benzo(g,h,i)perylene	132/421	0.0074 - 57,000	2,300
Benzo(k)fluoranthene	160/421	0.0069 - 55,000	15.0
Bis(2-ethylhexyl)phthalate	11/57	0.027 - 1.8	76.0
Butylbenzylphthalate	10/57	0.082 - 0.44	310
Carbazole	27/57	0.021 - 9,600	0.6
Chrysene	213/421	0.0138 - 100,000	77
Dibenzo(a,h)anthracene	69/421	0.022 - 19,000	0.1
Dibenzofuran	14/57	0.035 - 2,000	15.0
Di-n-butylphthalate	37/57	0.061 - 6.7	47
Fluoranthene	220/421	0.008 - 160,000	1,200
Fluorene	46/421	0.043 - 2,600	160
Indeno(1,2,3-cd)pyrene	122/421	0.0054 - 51,000	1.5
Naphthalene	52/421	0.024 - 2,200	1.7
Phenanthrene	164/421	0.0056 - 60,000	250
Pyrene	212/421	99,000	880
Pesticides/Herbicides, mg/kg			
4,4'-DDD	1/45	0.000053	4
4,4'-DDE	3/45	0.00016 - 0.0013	3.3
4,4'-DDT	4/45	0.0069 - 0.021	3.3
Aldrin	11/45	0.00021 - 0.0019	0.07
Dieldrin	2/45	0.00037 - 0.0024	0.004
Endosulfan II	5/45	0.00014 - 0.0019	3.8
Endrin aldehyde	1/45	0.0027	NC
Endrin Ketone	1/45	0.0027	NC
Gamma Chlordane	2/45	0.016 - 0.019	3.1
Methoxychlor	1/45	0.049	160

TABLE 3-1

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SURFACE SOIL
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 2 OF 2

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels (1)
Nitroaromatic Compounds, mg/kg			
Cyclotetramethylenetetranitramine (HMX)	1/42	3.001	NC
Trinitrotoluene (TNT)	30/146	1.0 - 68	0.06
3-Nitrotoluene	1/42	5.08	2.4
4-Nitrotoluene	2/42	1.17 - 4.34	3.3
Miscellaneous Parameters, mg/kg			
TRPH	58/175	10.0 - 450	340
TOC	14/14	3,700 - 46,000	NC

NOTES: The following samples were used for the data in this table.

For VOCs and Pesticides
CF15-SS1 through CF15-SS32
CF15-SS46 through CF15-SS47
For Nitroaromatics (Except TNT)
CF15-SS1 through CF15-SS32
CF15-SS42 through CF15-SS44
CF15-SS46 through CF15-SS47
For SVOCs (non PAHs)
CF15-SS1 through CF15-SS32
CF15-SS46 through CF15-SS47

For PAHs
CF15-SS1 through CF15-SS32
CF15-SS39 through CF15-SS41
CF15-SS45 through CF15-SS47
CF15-SS49 through CF15-SS50
Plus 263 Screening Samples
For TNT
CF15-SS1 through CF15-SS32
CF15-SS42 through CF15-SS44
CF15-SS46 through CF15-SS47
Plus 146 Screening Samples
For TRPH
CF15-SS1 through CF15-SS32
CF15-SS46 through CF15-SS47
Plus 136 Screening Samples

1 - FAC 62-777. The FDEP SCTL is considered to be the most restrictive of the residential direct exposure or leachability to groundwater SCTL value.

NC - No Criteria

TABLE 3-2

SUMMARY OF INORGANIC COMPOUNDS DETECTED IN SURFACE SOIL
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels (1)	Background Screening Concentrations (2)
Inorganic Analytes, mg/kg				
Aluminum	39/41	24.9 - 7,140	72,000	4,430
Antimony	32/57	0.46 - 2,440	5.0	9.44
Arsenic	36/57	0.91 - 451	0.8	2.04
Barium	40/41	0.88 - 107	110	14.4
Cadmium	7/41	0.30 - 2.4	8.0	1.72
Calcium	30/41	38.3 - 102,000	NC	9.44
Chromium	10/41	0.49 - 26.9	38.0	7.75
Cobalt	6/41	0.27 - 0.35	4,700	3.11
Copper	11/41	1.1 - 21.2	110	5.97
Iron	39/41	68.8 - 1,340	23,000	1,490
Lead	492/523	65,500	400	197
Magnesium	11/41	60.6 - 631	NC	329
Manganese	27/41	0.45 - 32.2	1,600	22.0
Mercury	4/41	0.15 - 0.80	2.1	0.16
Nickel	11/41	0.69 - 2.2	110	3.89
Potassium	16/41	21.7 - 1,340	NC	102
Selenium	3/41	1.2 - 1.7	5.0	1.68
Silver	2/41	0.61 - 0.62	17.0	2.13
Sodium	16/41	118 - 881	NC	343
Thallium	1/41	0.45	NC	2.84
Vanadium	36/41	0.28 - 5.2	15.0	6.3
Zinc	3/41	28.3 - 32.6	6,000	37.0
Cyanide	4/39	0.20 - 0.27	30.0	1.19

NOTES: The following samples were used for the data in this table.

For Inorganics (Except Sb, As, Pb)
CF15-SS1 through CF15-SS32
CF15-SS46 through CF15-SS47
For Arsenic and Antimony
CF15-SS1 through CF15-SS32
CF15-SS46 through CF15-SS47
CF15-SS51 through CF15-SS59
For Lead
CF15-SS1 through CF15-SS38
CF15-SS46 through CF15-SS47
CF15-SS60 through CF15-SS73
Plus 324 Screening Samples

1 - FAC 62-777. The FDEP SCTL is considered to be the most restrictive of the residential direct exposure or leachability to groundwater SCTL value.

2 - NAS Cecil Field Inorganic Background Data Set (HLA, 1998).

NC - No Criteria

most restrictive of residential direct exposure or leachability to groundwater SCTLs. Table 3-2 also shows the NAS Cecil Field Inorganic Background Data Set (IBDS) concentrations for inorganic compounds (HLA, 1998).

Additional sampling was done in February of 1997 to evaluate the leachability of lead and particulate distribution characteristics of lead contamination at the site. The results of this sampling effort indicated that most of the lead shot at the site has oxidized and is now associated with medium to fine-grained sand with smaller amounts associated with silt and clay soil fractions. As a result there would be little benefit in sieving out the remaining lead shot from Site 15 soil. The data also showed that although the lead concentrations decreased with depth, decreases are not significant enough to warrant remediation to a depth of less than one foot. Finally, based on the results of lead TCLP data, soil samples containing lead concentrations greater than 700 mg/kg generally failed to meet the TCLP lead regulatory level of 5.0 mg/L for classifying potential solid waste (excavated contaminated soil) as hazardous waste.

3.2.2.2 Subsurface Soil

In the field screening program no VOCs were detected. Total PAHs were detected in 15 of the samples with concentrations ranging from 4.0 to 140 mg/kg to a depth of 7 feet bgs. Generally, PAH concentrations decreased with depth. TRPH showed sporadic detection in 5 of 16 subsurface samples collected with concentrations ranging from 12 to 570 mg/kg. Lead was detected in 11 of 16 samples to a depth of 7 feet bgs. Subsurface lead concentrations ranging from 15 to 210 mg/kg were generally several orders of magnitude lower than corresponding surface soil samples.

The confirmatory sampling event indicated the presence of two VOCs, acetone and xylenes, several SVOCs, and 13 inorganic analytes in the subsurface soil at Site 15. Tables 3-3 and 3-4 summarize the frequency of detection, the concentration ranges, and the cleanup goals (the most restrictive of the residential direct exposure or leachability to groundwater SCTL) for organic and inorganic compounds, respectively, that were positively detected in either the screening or confirmatory sampling of subsurface soil. Table 3-4 also shows the IBDS concentrations for the inorganic compounds.

3.2.2.3 Groundwater

One SVOC [bis(2-ethylhexyl)phthalate], three pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT), three nitroaromatic compounds [cyclotrimethylenetrinitramine (RDX), 3-nitrotoluene, and nitrobenzene], and several inorganic compounds were detected in groundwater samples from the site. Bis(2-ethylhexyl)phthalate was detected in four of eight wells at concentrations ranging from 1.0 to 220 micrograms per liter (µg/L) which exceeds the Florida maximum contaminant level (MCL) and GCTL of 6 µg/L. The three pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) were detected in one of eight

TABLE 3-3

SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels (1)
Volatile Organic Compounds, mg/kg			
Acetone	2/14	0.009 - 0.013	2.8
Xylenes, total	3/31	0.003 - 0.004	0.2
Semivolatile Organic Compounds, mg/kg			
2-Methylnaphthalene	2/27	0.051 - 0.110	6.1
Acenaphthene	16/45	0.340 - 50	2.1
Anthracene	16/45	0.032 - 9.2	2,500
Benzo(a)anthracene	21/45	0.030 - 36	1.4
Benzo(a)pyrene	35/45	0.035 - 35	0.1
Benzo(b)fluoranthene	36/45	0.045 - 53	1.4
Benzo(g,h,i)perylene	19/45	0.034 - 14	2,300
Benzo(k)fluoranthene	29/45	0.040 - 24	15.0
Bis(2-ethylhexyl)phthalate	2/18	0.052 - 0.053	76.0
Butylbenzylphthalate	1/18	0.056	310
Carbazole	7/18	0.027 - 4.3	0.6
Chrysene	20/45	0.040 - 40	77
Dibenzo(a,h)anthracene	11/45	0.028 - 5.2	0.1
Dibenzofuran	2/18	0.085 - 0.460	15.0
Di-n-butylphthalate	13/18	0.099 - 5.7	47
Fluoranthene	36/45	0.039 - 63	1,200
Fluorene	4/45	0.110 - 1.1	160
Indeno(1,2,3-cd)pyrene	20/45	0.024 - 14	1.5
Naphthalene	7/45	0.064 - 1.1	1.7
Phenanthrene	33/45	0.033 - 27	250
Pyrene	35/45	0.041 - 51	880
Miscellaneous Parameters, mg/kg			
TRPH	15/30	12 - 570	340
TOC	6/6	1,600 - 5,800	NC

NOTES: The following samples were used for the data in this table.

For VOCs and TRPH
CF15-SB7 through CF15-SB13
CF15-SB17 through CF15-SB19
CF15-SB21, CF15-SB25
Plus 16 Screening Samples

For SVOCs
CF15-SB7 through CF15-SB13
CF15-SB17 through CF15-SB19
CF15-SB21, CF15-SB25

For PAHs
CF15-SB7 through CF15-SB13
CF15-SB17 through CF15-SB19
CF15-SB21, CF15-SB25, CF15-SB45
CF15-SB49 through CF15-SB56
Plus 16 Screening Samples

For TOC
CF15-SB7, CF15-SB10
CF15-SB18, CF15-SB19

1 - FAC 62-777. The FDEP SCTL is considered to be the most restrictive of the residential direct exposure or leachability to groundwater SCTL value.

NC - No Criteria

TABLE 3-4

SUMMARY OF INORGANIC COMPOUNDS DETECTED IN SUBSURFACE SOIL
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels (1)	Background Screening Concentrations (2)
Inorganic Analytes, mg/kg				
Aluminum	14/14	224 - 2,360	72,000	4,430
Antimony	5/14	0.93 - 4.2	5.0	9.44
Barium	13/14	0.75 - 17.4	110	14.4
Calcium	11/14	62.7 - 2,510	NC	9.44
Chromium	3/14	1.9 - 2.7	38.0	7.75
Cobalt	1/14	0.35	4,700	3.11
Iron	14/14	66.6 - 298	23,000	1,490
Lead	25/30	1.10 - 210	400	197
Manganese	10/14	0.82 - 3.0	1,600	22.0
Nickel	10/14	0.73 - 1.4	110	3.89
Potassium	2/14	22.7 - 27.6	NC	102
Sodium	3/14	156 - 251	NC	343
Vanadium	14/14	0.49 - 2.2	15.0	6.30

NOTES: The following samples were used for the data in this table.

For Inorganics (Except Lead)
CF15-SB7 through CF15-SB13
CF15-SB17 through CF15-SB19
CF15-SB21, CF15-SB25

For Lead
CF15-SB7 through CF15-SB13
CF15-SB17 through CF15-SB19
CF15-SB21, CF15-SB25
Plus 16 Screening Samples

1 - FAC 62-777. The FDEP SCTL is considered to be the most restrictive of the residential direct exposure or leachability to groundwater SCTL value.

2 - NAS Cecil Field Inorganic Background Data Set (HLA, 1998).

NC - No Criteria

groundwater samples, but were not detected in the associated duplicate sample from the same well. Only 4,4'-DDE (0.26 µg/L) exceeded its FDEP Groundwater Cleanup Target Level (GCTL) of 0.1 µg/L. 3-Nitrotoluene was detected in the eight groundwater samples at concentrations ranging from 1.87 to 3.89 µg/L, but did not exceed the FDEP GCTL for this compound (250 µg/L). None of the other nitroaromatic compounds exceeded their respective FDEP GCTLs.

Thallium, detected in two of eight groundwater samples at concentrations of 5 and 6.1 µg/L, exceeded Federal and State MCLs of 2 µg/L, but was less than the IBDS concentration in groundwater (13.3 µg/L) and was not detected in the surface or subsurface soil samples. Concentrations of aluminum and iron, which were detected in all eight monitoring wells, exceeded their respective secondary MCL values, but neither exceeded the IBDS concentrations. No lead or PAHs were detected in the eight monitoring wells sampled. Table 3-5 summarizes the frequency of detection, the concentration ranges, and the cleanup goals for organic and inorganic compounds detected in groundwater. Table 3-5 also shows the IBDS concentrations for inorganic compounds. Figure 3-5 shows the locations of the eight Site 15 groundwater monitoring wells that were sampled during the RI.

3.2.2.4 Surface Water and Sediment

No VOCs or pesticides were found in the three surface water samples analyzed for these constituents. Four nitroaromatic compounds (1,3,5-trinitrobenzene, 3-nitrotoluene, 4-nitrotoluene, and tetryl) and several inorganic compounds were found in the surface water. However, only lead, which was present in the seven samples analyzed, copper, which was present in only one out of three samples, and iron, which was below the IBDS concentration, exceeded its Florida surface water criterion. Generally, the highest concentration of these metals occurred in the surface water sample collected approximately 1,700 feet south of the ordnance disposal area. Table 3-6 summarizes the frequency of detection, the concentration ranges, and the Florida water criteria for organic and inorganic compounds detected in surface water. Table 3-6 also shows the IBDS concentrations for the inorganic compounds.

One VOC, several SVOCs (including one nitroaromatic and twelve PAHs), four pesticides, TRPH, and several inorganic compounds were detected in sediment samples. Concentrations of seven PAHs (pyrene, phenanthrene, fluoranthene, benzo(a)anthracene, dibenzo(a,h)anthracene, benzo(a)pyrene, and chrysene), and two pesticides (4,4'-DDD and 4,4'-DDE) were greater than their respective threshold effects levels (TELs), but were less than their respective probable effects levels (PELs). Pesticides were detected at one sample location approximately 1,200 feet away from the ordnance disposal area and are therefore not believed to be related to past detonation activities. Also, concentrations of these pesticides detected in sediments at Site 15 were comparable to those detected at other Cecil Field locations and therefore it is most likely that they are the result of previous basewide applications for pest control. Lead was the only inorganic analyte that was detected at concentrations exceeding its TEL. Lead also

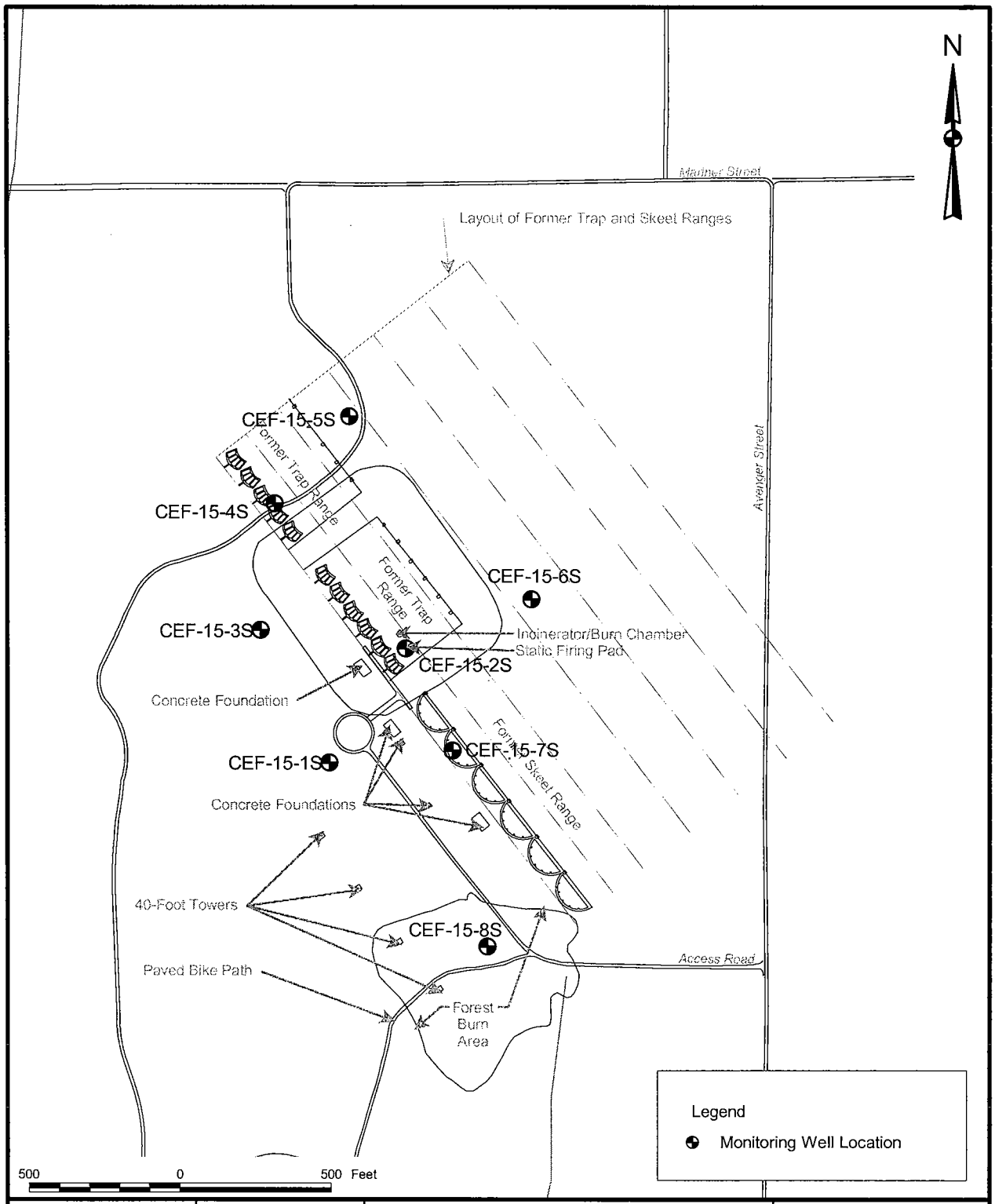
TABLE 3-5

SUMMARY OF ORGANIC AND INORGANIC COMPOUNDS DETECTED IN GROUNDWATER
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP GCTL or MCLs (1)	Background Screening Concentrations (2)
Semivolatile Organic Compounds, µg/L				
Bis(2-ethylhexyl)phthalate	4/8	1.0 - 220	6.0	NA
Pesticides, µg/L				
4,4'-DDD	1/8	0.065	0.1	NA
4,4'-DDE	1/8	0.18	0.1	NA
4,4'-DDT	1/8	0.067	0.1	NA
Nitroaromatic Compounds, µg/L				
3-Nitrotoluene	8/8	1.87 - 3.39	250	NA
Cyclotrimethylenetrinitramine (RDX)	1/8	0.451	1	NA
Nitrobenzene	1/8	0.228	4	NA
Inorganic Analytes, µg/L				
Aluminum	8/8	205 - 635	200	13,100
Antimony (total)	1/8	2	6.0	44.5
Antimony (dissolved)	3/3	2.5 - 8.1	6.0	44.5
Arsenic (total)	0/8	4 U	50.0	7.1
Arsenic (dissolved)	0/3	4 U	50.0	7.1
Barium	8/8	14.3 - 28.7	2,000	88.2
Beryllium	1/8	1.0	4.0	3.5
Calcium	2/8	5,620 - 6,380	NC	81,100
Cobalt	3/8	1.4 - 1.8	420	12.8
Copper	6/8	4.7 - 8.7	1,000	12.5
Iron	8/8	633 - 3,140	300	7,760
Lead (total)	0/8	2 U	15	5.35
Lead (dissolved)	0/3	2 U	15	5.35
Magnesium	8/8	598 - 1,500	49	10,000
Manganese	8/8	8.4 - 49.6	50.0	150
Nickel	1/8	17.5	100	24.5
Potassium	1/8	2,010	NC	4,330
Sodium	5/8	5,510 - 10,800	160,000	16,500
Thallium	2/8	5.0 - 6.1	2.0	13.3
Vanadium	1/8	1.8	NC	20.2
Zinc	3/8	92.0 - 246	5,000	76.8
Cyanide	3/8	3.1 - 3.8	200	22.0

NOTES: The following samples were used for the data in this table: CF15MW1 to CF15MW8

1 - Based on primary or secondary MCL value. In cases where no MCL is available, the FDEP GCTL value (FAC 62-777) is used.
2 - NAS Cecil Field Inorganic Background Data Set (HLA, 1998).
NA - Not Applicable
NC - No Criteria
U - Not Detected at Indicated Detection Limit



DRAWN BY MJJ	DATE 21Jan00	LOCATION OF GROUNDWATER MONITORING WELLS SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY — DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-5 — REV 0

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 08-Layout-MonitoringWells

TABLE 3-6

SUMMARY OF ORGANIC AND INORGANIC COMPOUNDS DETECTED IN SURFACE WATER
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP Surface Water Criteria (Freshwater) (1)	Background Screening Concentrations (3)
Nitroaromatic Compounds, µg/L				
1,3,5-Trinitrobenzene	1/3	6.73	19	NA
3-Nitrotoluene	1/3	4.95	375	NA
4-Nitrotoluene	3/3	1.11 - 46.1	550.0	NA
Tetryl	2/3	18.4	NC	NA
Miscellaneous, mg/L				
TRPH	1/3	0.6	5000 (2)	NA
Inorganic Analytes, µg/L				
Aluminum	3/3	444 - 649	13	1,040
Aluminum, Filtered	3/3	426 - 585	13	1,040
Arsenic	3/3	4.4 - 12.0	50(2)	5.45
Arsenic, Filtered	2/3	5.6 - 12.2	50(2)	5.45
Barium	3/3	10.1 - 17.1	48 (4)	43.7
Barium, Filtered	3/3	8.8 - 14.9	48 (4)	43.7
Calcium	3/3	620 - 4,510	NC	43,000
Calcium, Filtered	3/3	538 - 3,765	NC	43,000
Copper	1/3	6.0	3.6 *	7.35
Iron	3/3	612 - 1,980	1000 (2)	3,030
Iron, Filtered	3/3	490 - 1,650	1000 (2)	3,030
Lead	3/3	91.0 - 275	3.2 *	5.35
Lead, Filtered	3/3	79.5 - 225	3.2 *	5.35
Magnesium	3/3	429 - 503	NC	5,580
Magnesium, Filtered	3/3	396 - 458	NC	5,580
Potassium	1/3	247	NC	2,060
Potassium, Filtered	1/3	331	NC	2,060
Sodium	3/3	4,000 - 4,435	18,300 (5)	12,200
Sodium, Filtered	3/3	3,600 - 4,070	18,300 (5)	12,200
Vanadium	1/3	3.3	NC	4.5

NOTES: The following samples were used for the data in this table. CF15SW1 to CF15SW3

1 - FAC 62-777. Surface Water Criteria based on freshwater classification.
2 - FAC 62-302.530. Surface Water Criteria based on Class III freshwater.
3 - NAS Cecil Field Inorganic Background Data Set (HLA, 1998).
4 - Less than 10% above background, per FAC 62-777.
5 - Less than 50% above background, per FAC 62-777.
* - Hardness Dependent, values shown based on hardness of 25 mg/L

NC - No Criteria
NA - Not Applicable

exceeded its PEL concentration. Table 3-7 summarizes the frequency of detection, the concentration ranges, and the FDEP guidance values for organic compounds and inorganic compounds that were positively detected in the confirmatory sampling of Site 15 sediments. IBDS concentrations are also shown in Table 3-7 for the inorganic compounds.

3.3 POST-RI SAMPLING EVENTS

Several post-RI sampling events were conducted at Site 15. The purpose of these events was to further delineate the extent of the PAH, arsenic, lead, and TRPH contamination of surface soil and sediment. One sampling event also involved the collection and analysis of invertebrate samples that were used with the soil data to generate ecological remediation goals for PAHs and lead in the soil at the site. These post-RI sampling events also included evaluation of the site-specific leachability of PAHs from surface soil to groundwater and collection of groundwater samples to determine if the PAH-, arsenic-, lead-, or nitroaromatic-contaminated soil has impacted groundwater.

3.3.1 Extent of PAH and Lead Contamination

In April 1999, 30 surface soil samples and 6 sediment samples were collected and analyzed for PAHs, and 55 surface soil and 6 sediment samples were collected and analyzed for lead. In June 1999, 30 additional surface soil samples were collected and analyzed for PAHs and 23 additional surface soil samples were collected and analyzed for lead. Since the purpose of these sampling programs was to further delineate the lead and PAH contamination at perimeter areas of the site, no statistical tables for this data have been provided but the PAH and lead data has been incorporated in Tables 3-1 and 3-2, respectively, for surface soil and in Table 3-7 for sediment. However, the sampling locations for PAH and lead analyses with respect to the historical sample locations for the same analyses during the RI field investigations are shown on Figures 3-6 and 3-7, respectively. Figures 3-8 and 3-9 show for PAHs and lead, respectively, areas of surface soil with concentrations in excess of the FDEP SCTLs for residential direct exposure based on results from samples collected during both the RI field investigations and the post-RI sampling programs.

During the period of May through August 2003, another 44 surface and subsurface soil samples were collected and analyzed for PAHs, arsenic, lead, and TRPH. The purpose of these sampling programs was to further delineate the vertical extent of PAH, lead, and TRPH contamination in the soil and to delineate the horizontal extent of arsenic contamination in soil. The statistical tables for these data will be prepared and included in the Site 15 Feasibility Study report.

TABLE 3-7

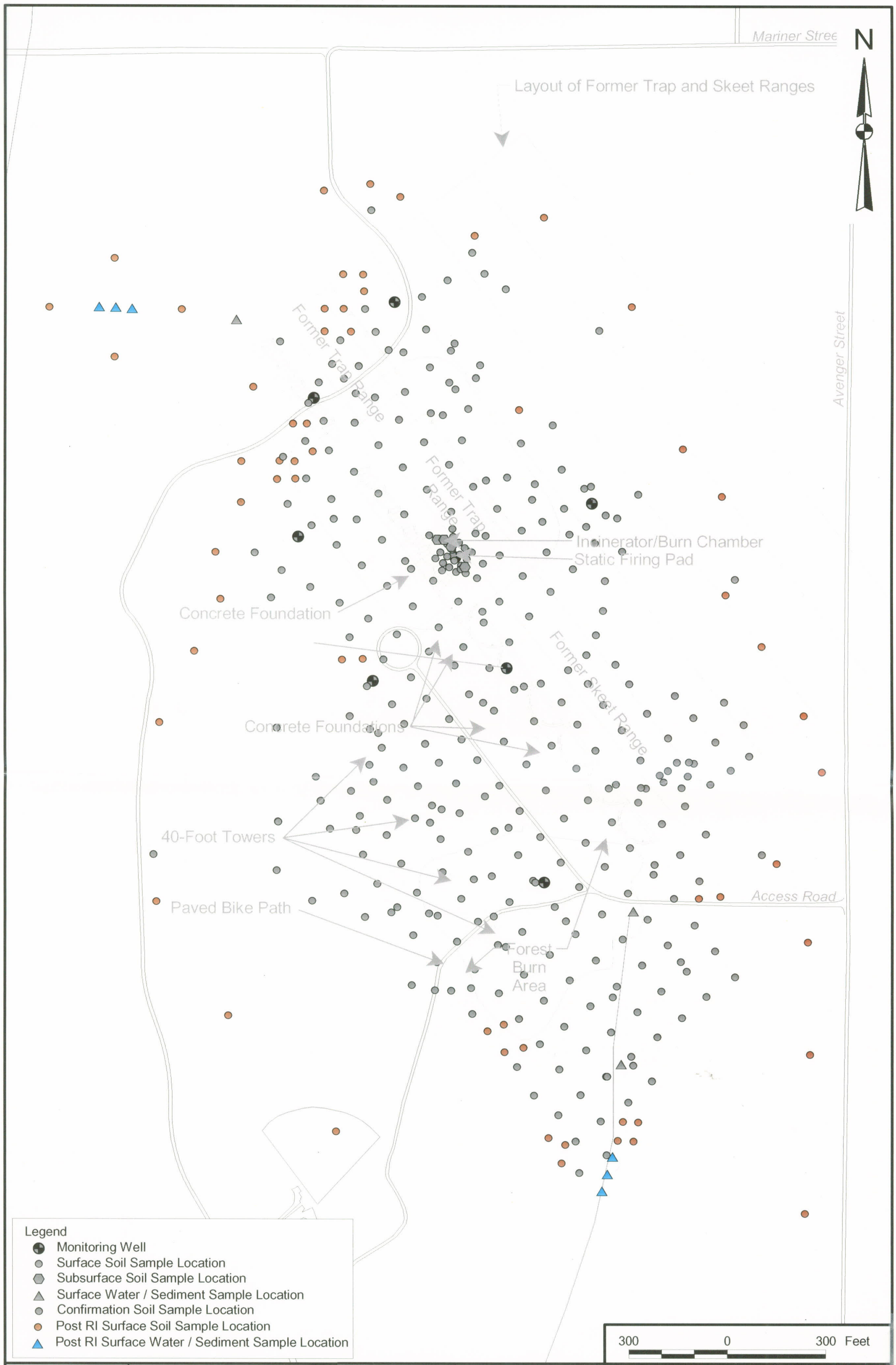
SUMMARY OF ORGANIC AND INORGANIC COMPOUNDS DETECTED IN SEDIMENT
SITE 15
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Chemical	Frequency of Detection	Range of Detection	FDEP Soil Cleanup Target Levels[1]	Background Screening Concentrations[2]
Volatile Organic Compounds, mg/kg				
2-Butanone	2/3	0.009 - 0.018	17	NA
Semivolatile Organic Compounds, mg/kg				
2-Methylnaphthalene	3/9	0.189 - 17.9	6.1	NA
Acenaphthene	4/9	0.069 - 26.1	2.1	NA
Acenaphthylene	2/9	0.100 - 0.160	27	NA
Anthracene	3/9	0.043 - 2.35	2,500	NA
Benzo(a)anthracene	8/9	0.013 - 2.86	1.4	NA
Benzo(a)pyrene	9/9	0.023 - 28.1	0.1	NA
Benzo(b)fluoranthene	8/9	0.020 - 22.8	1.4	NA
Benzo(g,h,i)perylene	7/9	0.108 - 1.71	2,300	NA
Benzo(k)fluoranthene	8/9	0.059 - 6.54	15	NA
Carbazole	1/3	0.058	0.6	NA
Chrysene	9/9	0.056 - 3.66	77	NA
Dibenzo(a,h)anthracene	3/9	0.038 - 0.110	0.1	NA
Di-n-butylphthalate	3/3	0.380 - 3.10	47	NA
Fluoranthene	8/9	0.106 - 42.6	1,200	NA
Fluorene	4/9	0.030 - 12.2	160	NA
Indeno(1,2,3-cd)pyrene	5/9	0.100 - 0.340	1.5	NA
Phenanthrene	6/9	0.086 - 13.7	250	NA
Pyrene	8/9	0.026 - 37.4	880	NA
Nitroaromatic Compounds, mg/kg				
4-Nitrotoluene	1/3	37.5	3.3	NA
Pesticides, mg/kg				
Dieldrin	1/3	0.00046	0.004	NA
4,4'-DDD	2/3	0.0036 - 0.011	4	NA
4,4'-DDE	2/3	0.0034 - 0.0083	3.3	NA
4,4'-DDT	2/3	0.0004 - 0.0081	3.3	NA
Miscellaneous, mg/kg				
TRPH	3/3	15 - 114	340	NA
TOC	3/3	5,600 - 13,000	NC	NA
Inorganic Analytes, mg/kg				
Aluminum	3/3	543 - 2,630	72,000	10,200
Barium	3/3	2.30 - 3.85	110	36.1
Calcium	3/3	62.8 - 90.5	NC	5,920
Chromium	1/3	3.10	38.0	16.0
Iron	3/3	88 - 207	23,000	3,330
Lead	9/9	29 - 574	400	44.6
Magnesium	2/3	29.5 - 58.8	NC	379
Sodium	3/3	145 - 221	NC	388
Vanadium	3/3	0.72 - 2.40	15.0	15.0

NOTES: The following samples were used for the data in this table. CF15SD1, CF15SD2, CF15SD3, CEF-015-SD-100, CEF-015-SD-101, CEF-015-SD-102, CEF-015-SD-103, CEF-015-SD-104, CEF-015-SD-105

1 FAC 62-777. The FDEP SCTL is considered to be the most restrictive of the residential direct exposure or leachability to groundwater SCTL value.
2 NAS Cecil Field Inorgaic Background Data Set (HLA, 1998).
NA - Not Applicable
NC - No Criteria

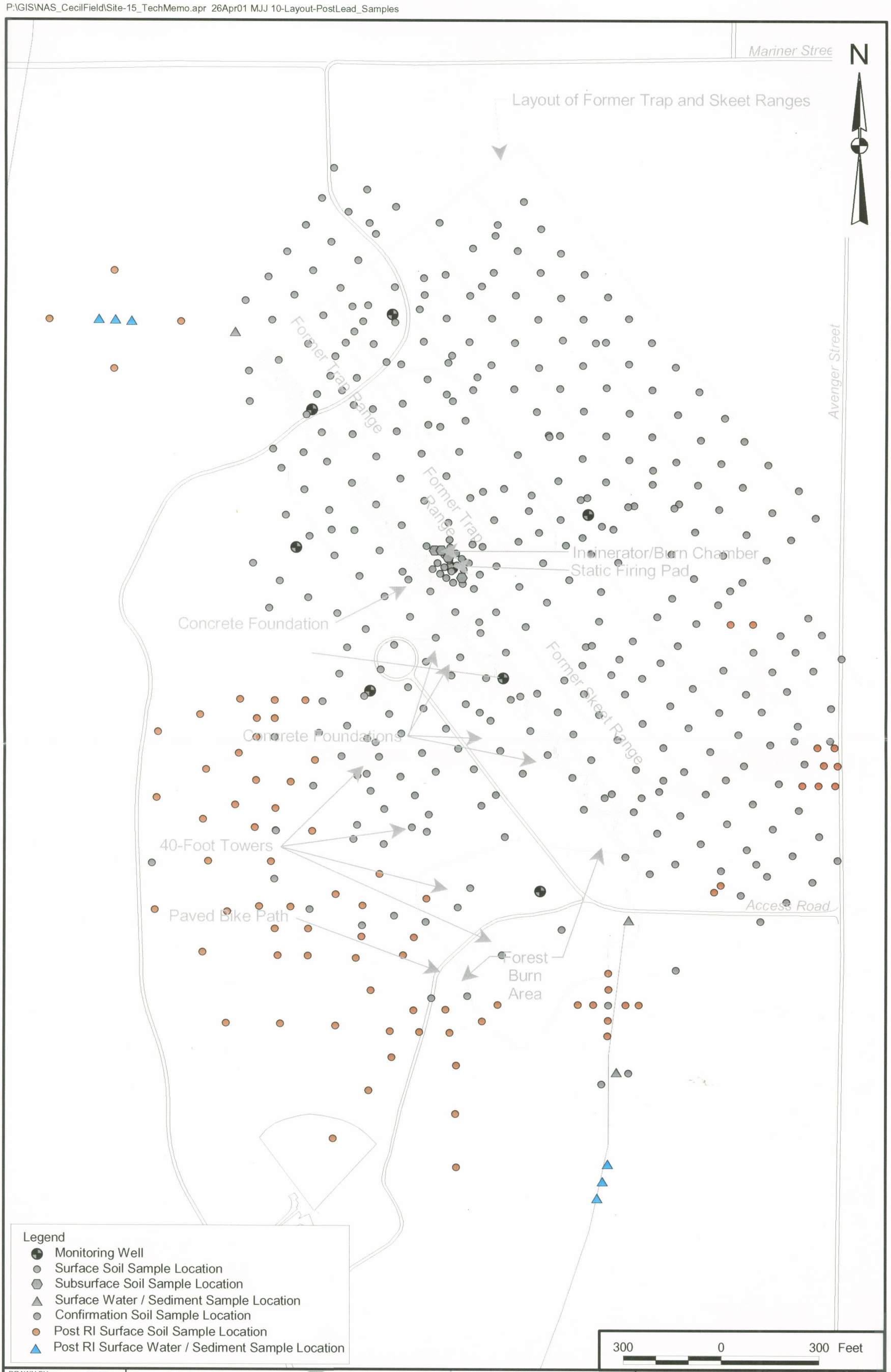
P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 09-Layout-PostPAH_Samples



DRAWN BY MJJ DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY DATE	APRIL/JUNE 1999 POST RI SURFACE SOIL AND SEDIMENT SAMPLING LOCATIONS, PAHs ANALYSIS SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 3-6	REV 0

REVISION 1
NOVEMBER 2003

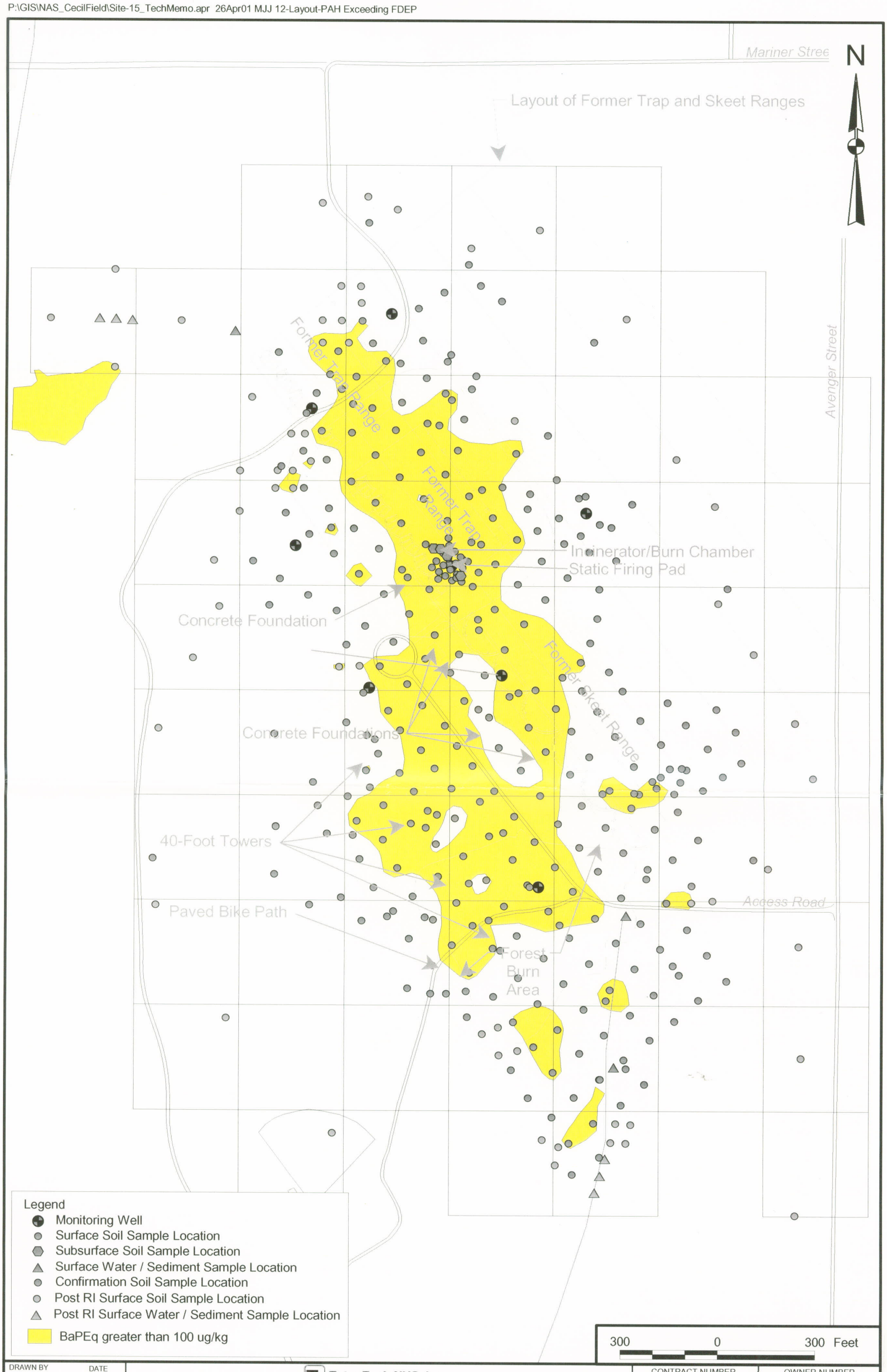
P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 10-Layout-PostLead_Samples



DRAWN BY MJJ — DATE 21Jan00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY — DATE	APRIL/JUNE 1999 POST RI SURFACE SOIL AND SEDIMENT SAMPLING LOCATIONS, LEAD ANALYSIS SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY — DATE 05/02/01	
COST/SCHEDULE-AREA		APPROVED BY — DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 3-7	REV 0

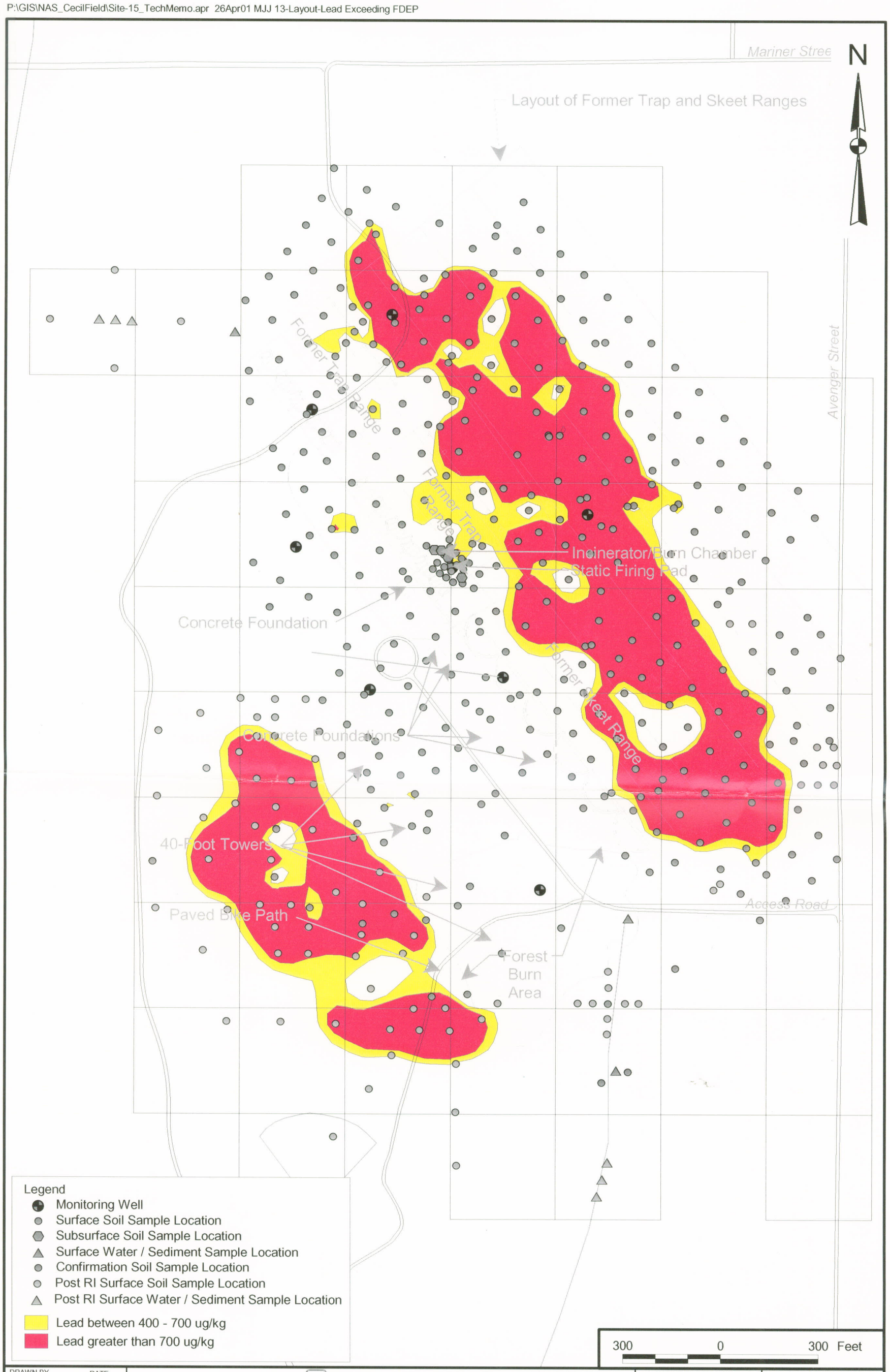
REVISION 1
NOVEMBER 2003

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 26Apr01 MJJ 12-Layout-PAH Exceeding FDEP



DRAWN BY MJJ DATE 09Feb00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY DATE	LOCATIONS OF SURFACE SOIL SAMPLES WITH PAHs CONCENTRATIONS EXCEEDING FDEP SCTLs FOR RESIDENTIAL EXPOSURE SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 3-8	REV 0

REVISION 1
NOVEMBER 2003



DRAWN BY MJJ	DATE 09Feb00	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7653	OWNER NUMBER —
CHECKED BY	DATE	LOCATIONS OF SURFACE SOIL SAMPLES WITH LEAD CONCENTRATIONS EXCEEDING FDEP SCTLs FOR RESIDENTIAL EXPOSURE SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	APPROVED BY	DATE 05/02/01
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-9	REV 0

REVISION 1
NOVEMBER 2003

3.3.2 PAH Leachability to Groundwater

In February 2000, four surface soil samples were collected and analyzed for PAHs. The same samples were then submitted to an SPLP and the extract from that procedure was also analyzed for PAHs to evaluate the leachability of these contaminants to groundwater. Results of the soil and SPLP extract analyses are summarized in Table 3-8 and Table 3-9, respectively. Table 3-8 also compares the PAHs concentrations measured in soil to the FDEP SCTLs for direct residential exposure and for leachability to groundwater. Table 3-9 also compares the PAHs concentrations measured in the SPLP extracts to the FDEP GCTLs.

As shown on Table 3-8, concentrations of several PAHs detected in three of the four surface soil samples (CEF-015-SS-702, CEF-015-SS-703, and CEF-015-SS-704) exceeded either the FDEP SCTL for direct residential exposure or for leachability to groundwater or both of these criteria. As shown on Table 3-9, the PAHs concentrations detected in the SPLP extract from two of the four collected surface soil samples (CEF-015-SS-702 and CEF-015-SS-703) exceeded the FDEP GCTLs.

TABLE 3-8

SUMMARY OF PAHS DETECTED IN SURFACE SOIL
SITE 15, FEBRUARY 2000 POST-RI SAMPLING
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FOLRIDA

Constituents	FDEP SCTL Residential Direct Contact	FDEP SCTL Leachability to Groundwater	Sampling Locations				
			CEF-15-SS-701	CEF-15-SS-702	CEF-15-SS-703	CEF-15-SS-703 Dup	CEF-15-SS-704
PAHs (µg/kg)							
Acenaphthene	1,900,000	2,100	723	162,000	90,800	64,700	11,500
Acenaphthylene	1,100,000	27,000	99 U	17,000	16,000	6.420	2,370
Anthracene	18,000,000	2,500,000	110	63,200	31.100	18,800	3,120
Benzo(a)anthracene	1,400	3,200	796	**193,000**	**129,000**	**71,600**	**22,200**
Benzo(a)pyrene	100	8,000	**857**	**120,000**	**89,600**	**67,600**	**23,100**
Benzo(b)fluoranthene	1,400	10,000	904	**130,000**	**96,800**	**62,600**	**24,100**
Benzo(g.h,I)perylene	2,300,000	32,000,000	462	4,260	22,000	15,100	7,160
Benzo(k)fluoranthene	15,000	25,000	147	**63,000**	**45,000**	**29,300**	10,200
Chrysene	140,000	77,000	797	**155,000**	123,000	62,200	24,500
Dibenzo(a,h)anthracene	100	30,000	27	**6,520**	**6,580**	**5,010**	**1,830**
Fluoranthene	2,900,000	1,200,000	2,240	505,000	312,000	173,000	48,400
Fluorene	2,200,000	160,000	1,400 U	15,000	9,910	2,560	1,400 U
Indeno(1,2,3-cd)pyrene	1,500	28,000	970	**42,500**	**38,400**	**29,500**	**12,600**
1-Methylnaphthalene	68,000	2,200	410	**168,000**	**94,300**	53,200	13,500
2-Methylnaphthalene	83,000	6,100	417	**204,000**	**108,000**	61,800	14,100
Naphthalene	40,000	1,700	99 U	12,200	7,040	4,090	1,930
Phenanthrene	2,000,000	250,000	516	155,000	102,000	47,900	11,200
Pyrene	2,200,000	880,000	1,080	319,000	207,000	109,000	35,100

NOTES:

Bolding indicates exceedance of the FDEP SCTL for residential direct contact
Shading indicates exceedance of the FDEP SCTL for leachability to groundwater
U undetected at the indicated detection limit

TABLE 3-9

SUMMARY OF PAHS DETECTED IN SURFACE SOIL SPLP EXTRACTS
SITE 15, FEBRUARY 2000 POST-RI SAMPLING
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FOLRIDA

Constituents	FDEP GCTL	Sampling Locations			
		CEF-15-SS-702	CEF-15-SS-703	CEF-15-SS-703 Dup	CEF-15-SS-704
PAHs (µg/L)					
Acenaphthene	20	2.3	1.2	1.5	1 U
Acenaphthylene	210	1 U	1 U	1 U	1 U
Anthracene	2,100	1.1	1 U	1 U	1 U
Benzo(a)anthracene	0.2	1.3	0.63	0.69	0.2 U
Benzo(a)pyrene	0.2	1.8	0.8	0.58	0.2 U
Benzo(b)fluoranthene	0.2	2	0.89	0.91	0.2 U
Benzo(g.h,I)perylene	210	1.4	0.8	0.68	0.2 U
Benzo(k)fluoranthene	0.5	0.73	0.34	0.38	0.2 U
Chrysene	4.8	1.8	0.93	0.93	0.21
Dibenzo(a,h)anthracene	0.2	0.2 U	0.2 U	0.2 U	0.2 U
Fluoranthene	280	5.9	4.6	5	1
Fluorene	280	1 U	1 U	1 U	1 U
Indeno(1,2,3-cd)pyrene	0.2	1.3	0.65	0.66	0.2 U
1-Methylnaphthalene	20	1	1 U	1 U	1.5
2-Methylnaphthalene	20	2.2	1.7	1.6	1 U
Naphthalene	20	2	1 U	1 U	1.4
Phenanthrene	210	5.8	2.3	2.6	1 U
Pyrene	210	5	2.5	2.6	0.6

NOTE:

Shading indicates exceedance of the FDEP GCTL
U undetected at the indicated detection limit

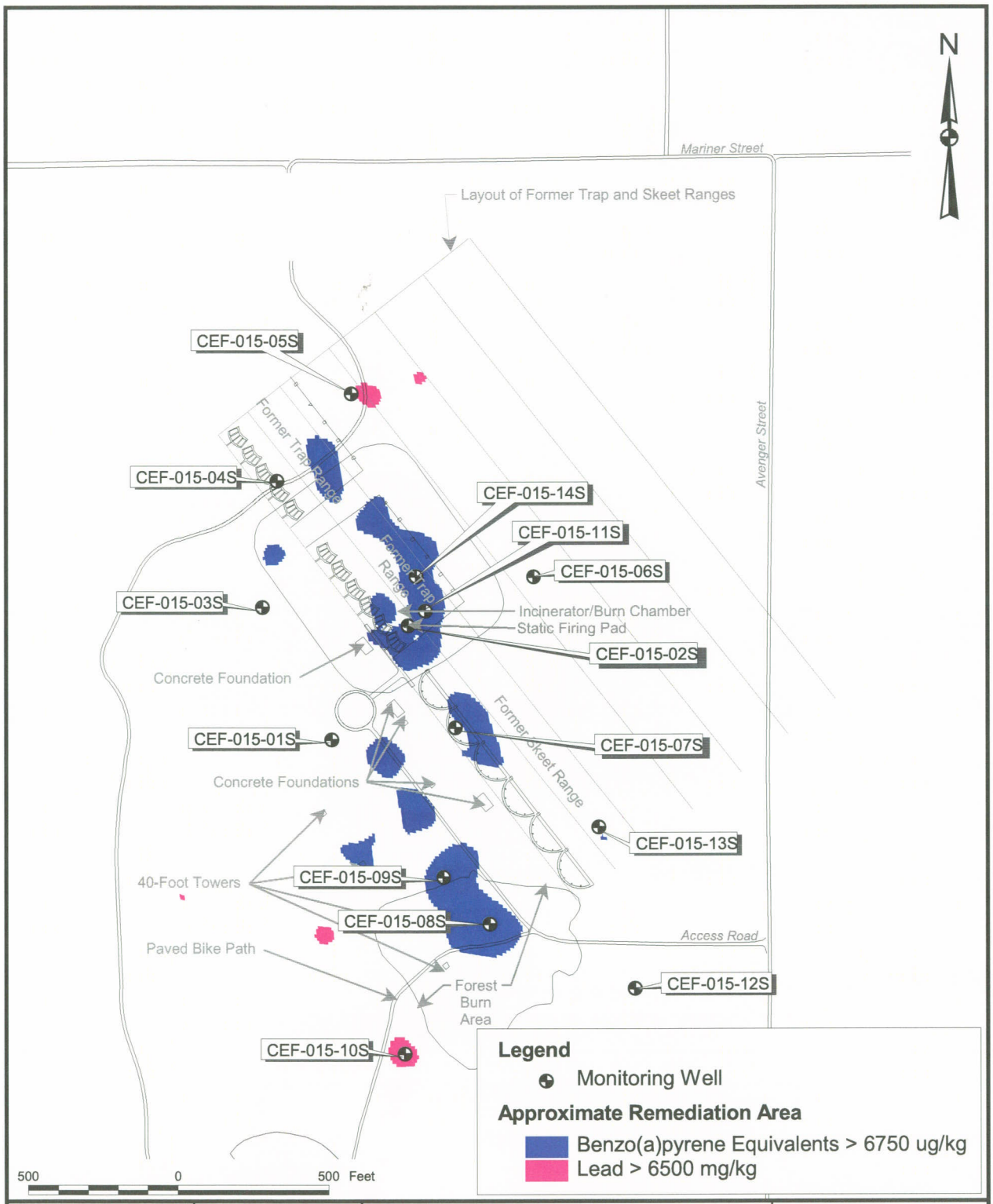
4.0 FIELD INVESTIGATION

Three groundwater sampling events were conducted. The first sampling event was conducted in April 2000 and consisted of collecting groundwater samples from eight existing monitoring wells (CEF-015-01S to CEF-015-08S). One duplicate groundwater sample was collected for quality assurance/quality control (QA/QC) purposes at CEF-015-01S. The field investigation was performed in accordance with the Site 15 Sampling and Analysis Work Plan provided in Appendix A. The second sampling event was conducted in May 2000 and consisted of re-developing and re-sampling existing well CEF-015-01S that had exhibited a relatively high turbidity [501 nephelometric turbidity units (NTUs)] during the first sampling event. Locations of the sampled monitoring wells are shown on Figure 3-5. Groundwater sampling logs are provided in Appendix B.

The third investigation was conducted, as requested by the FDEP (FDEP, 2001 and BCT, 2003), as a confirmatory sampling event to determine if the groundwater has been impacted by the soil contamination. The third sampling event was conducted in July 2003 and consisted of collecting groundwater samples from one existing monitoring well (CEF-015-02S) and from six new monitoring wells (CEF-015-09S to CEF-015-14S) installed at locations with the highest concentrations of contamination greater than the FDEP SCTLs for leachability to groundwater. One duplicate groundwater sample was collected for quality assurance/quality control (QA/QC) purposes at CEF-015-11S. The field investigation was performed in accordance with the Site 15 Phase X Sampling and Analysis Work Plan Revision 1 provided in Appendix A. Locations of the existing and new monitoring wells are shown on Figure 4-1. Groundwater sampling logs are provided in Appendix B.

Groundwater samples for the first and second sampling events were collected in general agreement with the procedures described in the U.S. EPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (U.S. EPA Region 4, 1996) and the NAS Cecil Field Base-Wide Generic Work Plan (TtNUS, 1998). The groundwater samples for the third sampling event were collected in general agreement with the procedures described in the FDEP Standard Operating Procedure FS2200 (FDEP, 2002), the Remedial Investigation Report for Sites 36 and 37 (TtNUS, 1999), and current TtNUS standard operating procedures. FAC Quality Assurance Rule (FAC 62-160) was updated in April 2002 and incorporates new SOPs developed and adopted by the FDEP for the collection and analysis of environmental media. The groundwater sampling activities for the third event were conducted in general agreement with FS2200, which reference additional applicable SOPs as necessary. As agreed by the BCT, no rinsate and trip blank samples were collected.

This page intentionally left blank.



DRAWN BY MJJ	DATE 29Sept03	LOCATION OF GROUNDWATER MONITORING WELLS SITE 15 TECHNICAL MEMORANDUM NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY RFO	DATE 9/29/03		APPROVED BY MJJ / DATE 12/1/03
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 4-1 / REV 0

P:\GIS\NAS_CecilField\Site-15_TechMemo.apr 29Sept03 MJJ 14-Layout-MonitoringWells

Samples from the first event were analyzed for PAHs; nitroaromatic compounds; and total and filtered antimony, arsenic, and lead using U.S. EPA SW-846 Methods 8310, 8330, and 6010B, respectively. The sample from the second event was only analyzed for antimony, arsenic, and lead. Samples from the third event were analyzed for PAHs, nitroaromatic compounds, total arsenic, and/or total lead. Accutest SouthEast in Orlando, Florida performed the analyses.

5.0 NATURE AND EXTENT OF CONTAMINATION

Analytical results for the groundwater samples collected during the first (April 2000) field investigation are presented on Table 5-1 and compared to their associated FDEP GCTLs. Analytical results for metals are also compared to their associated NAS Cecil Field IBDS values. Complete analytical laboratory results are provided in Appendix C.

As shown on Table 5-1, concentrations of PAHs and nitroaromatic compounds were below analytical detection limits. Positive detections of total and filtered antimony were recorded in only two wells with maximum concentrations of 42.9 and 46.2 µg/L, respectively, measured in well CEF-015-08S. This later concentration very slightly exceeded the IBDS value of 44.5 µg/L. There were no positive detections of either total or filtered arsenic in the wells. The results of the groundwater analysis did not identify groundwater PAH contamination in excess of any FDEP GCTLs. The results were below the method detection limit. Positive detections of total lead were recorded in only two wells, with a maximum concentration of 21.7 µg/L measured in well CEF-015-01S. This concentration exceeded both the FDEP GCTL of 15 µg/L and the IBDS value of 5.35 µg/L. However, there were no positive detections of filtered lead in the wells and the turbidity measured in well CEF-015-01S was 501 NTUs which is very high. It was thus hypothesized that a significant portion of the total lead concentration measured in well CEF-015-01S was in fact associated with suspended solids rather than groundwater. To verify this, a second sampling of well CEF-015-01S was performed in May 2000 and the well was developed until measured turbidity was approximately 20 NTUs. A sample was then collected and analyzed for total and filtered lead. Analytical results showed that concentration of filtered lead was below the detection limit and concentration of total lead was 9 µg/L. This concentration is above the IBDS value but well below the FDEP GCTL.

Analytical results for the groundwater samples collected during the third (July 2003) field investigation are presented on Table 5-2 and compared to their associated FDEP GCTLs. Analytical results for metals are also compared to their associated NAS Cecil Field IBDS values. The rationale for the location of the new monitoring wells and the rationale for sampling monitoring well CEF-015-02S are provided in Table 5-3. Complete analytical laboratory results are provided in Appendix C.

As shown in Table 5-2, positive detections of total arsenic were recorded in one well; arsenic was detected at a concentration of 13.7 µg/L in monitoring well CEF-015-13S. This arsenic concentration slightly exceeds the IBDS value of 7.1 µg/L but is less than the FDEP GCTL of 50 µg/L. None of the other metals were detected above the detection limits. The detection limits were below the FDEP GCTLs

TABLE 5-1

APRIL 2000 GROUNDWATER SAMPLING ANALYTICAL RESULTS
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FOLRIDA
PAGE 1 OF 2

Constituents	FDEP GCTL	NAS CF IBDS	Well Locations CEF-015-								
			-01S	-01S Dup	-02S	-03S	-04S	-05S	-06S	-07S	-08S
PAHs (µg/L)											
Acenaphthene	20	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Acenaphthylene	210	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2. 2 U	2.2 U
Anthracene	2100	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Benzo(a)anthracene	0.2	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Benzo(a)pyrene	0.2	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Benzo(b)fluoranthene	0.2	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Benzo(g.h,I)perylene	210	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Benzo(k)fluoranthene	0.5	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Chrysene	4.8	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Dibenzo(a,h)anthracene	0.2	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Fluoranthene	280	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Fluorene	280	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Indeno(1,2,3-cd)pyrene	0.2	NA	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Naphthalene	20	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
1-Methylnaphthalene	20	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
2-Methylnaphthalene	20	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Phenanthrene	210	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Pyrene	210	NA	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Nitroaromatic Compounds (µg/L)											
2-amino-4,6-Dinitrotoluene	NC	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
4-amino-2,6-Dinitrotoluene	NC	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
1,3-Dinitrobenzene	8	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
2,4-Dinitrotoluene	0.1	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
2,6-Dinitrotoluene	0.1	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
HMX	350	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
Nitrobenzene	4	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
o-Nitrotoluene	250	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
m-Nitrotoluene	250	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
p-Nitrotoluene	250	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
PETN	1	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
RDX	10	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
Tetryl	NC	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U

TABLE 5-1

APRIL 2000 GROUNDWATER SAMPLING ANALYTICAL RESULTS
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FOLRIDA
PAGE 2 OF 2

Constituents	FDEP GCTL	NAS CF IBDS	Well Locations CEF-015-								
			-01S	-01S Dup	-02S	-03S	-04S	-05S	-06S	-07S	-08S
1,3,5-Trinitrobenzene	210	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
2,4,6-Trinitrobenzene	NC	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
2,4,6-Trinitrotoluene	10	NA	3.9 U	3.9 U	5.0 U	5.0 U	5.2 U	5.2 U	5.0 U	18 U	6.5 U
Total Metals (µg/L)											
Antimony	6	44.5	2.4 U	2.4 U	2.4 U	2.9 B	2.4 U	3.3 B	2.4 U	2.4 U	42.9
Arsenic	50	7.1	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.9 B	3.4 U	3.4 U	3.4 U
Lead[1]	15	5.35	19.8	21.7	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	2.3 B
Filtered Metals (µg/L)											
Antimony	6	44.5	2.4 U	2.4 U	2.9 B	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	46.2
Arsenic	50	7.1	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Lead	15	5.35	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U

NOTES:

Shading denotes an exceedance of cleanup target levels

1 Groundwater from CEF-015-01S had very high turbidity (501 NTUs) during April 2000 sampling. Redevelopment of this well in May 2000 yielded much lower turbidity readings (10 to 20 NTUs) and lead concentrations (9.0 µg/L total, 1.6 U µg/L filtered).

FDEP Florida Department of Environmental Protection
GCTL Groundwater Cleanup Target Level
HMX Cyclotetramethylenetetranitramine
IBDS Inorganic Background Data Set
NA not available
NAS CF Naval Air Station Cecil Field
NC no criterion
PAHs polycyclic aromatic hydrocarbons
PETN pentaerythrioltetranitrate
RDX Cyclotrimethylenetrinitramine
U undetected at indicated analytical detection limit

TABLE 5-2

JULY 2003 GROUNDWATER SAMPLING ANALYTICAL RESULTS
SITE 15, BLUE ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Constituent	FDEP GCTL (1)	NAS CF IBDS (2)	Well CEF-015-							
			-02S	-09S	-10S	-11S	-11S Dup	-12S	-13S	-14S
Polynuclear Aromatic Hydrocarbons (ug/L)										
1-Methylnaphthalene	20	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
2-Methylnaphthalene	20	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Acenaphthene	20	NC	0.53 U	0.52 U	NA	0.53 U	0.53 U	NA	NA	NA
Acenaphthylene	210	NC	0.53 U	0.52 U	NA	0.53 U	0.53 U	NA	NA	NA
Anthracene	2100	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Benzo(a)anthracene	0.2	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Benzo(a)pyrene	0.2	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Benzo(b)fluoranthene	0.2	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Benzo(g,h,i)perylene	210	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Benzo(k)fluoranthene	0.5	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Chrysene	4.8	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Dibenzo(a,h)anthracene	0.2	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Fluoranthene	280	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Fluorene	280	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Naphthalene	20	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Indeno(1,2,3-cd)pyrene	0.2	NC	0.11 U	0.1 U	NA	0.11 U	0.11 U	NA	NA	NA
Phenanthrene	210	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Pyrene	210	NC	0.27 U	0.26 U	NA	0.26 U	0.27 U	NA	NA	NA
Carbazole (ug/L)										
Carbazole	4	NC	NA	NA	NA	1.1 U	1.1 U	NA	NA	NA
Nitroaromatics Compounds (ug/L)										
1,3,5-Trinitrobenzene	210	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
1,3-Dinitrobenzene	8	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
2,4,6-Trinitrotoluene	10	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
2,4-Dinitrotoluene	0.1	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
2,6-Dinitrotoluene	0.1	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
2-amino-4,6-Dinitrotoluene	NC	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
4-amino-2,6-Dinitrotoluene	NC	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
HMX	350	NC	NA	NA	NA	0.081 U	0.08 U	0.081 U	NA	0.081 U
Nitrobenzene	4	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
3-Nitrotoluene	250	NC	NA	NA	NA	0.054 U	0.053 U	0.054 U	NA	0.054 U
4-Nitrotoluene	250	NC	NA	NA	NA	0.081 U	0.08 U	0.081 U	NA	0.081 U
RDX	1	NC	NA	NA	NA	0.081 U	0.08 U	0.081 U	NA	0.081 U
Tetryl	NC	NC	NA	NA	NA	0.081 U	0.08 U	0.081 U	NA	0.081 U
Total Metals (ug/L)										
Arsenic	50	7.1	NA	NA	NA	NA	NA	NA	**13.7**	NA
Lead	15	5.35	NA	NA	3.4 U	NA	NA	NA	NA	NA

Notes:

U = Undetected at indicated analytical detection limit
NA = Not analyzed.
NC = No criterion.
(1) Florida Department of Environmental Protection Groundwater Cleanup Target Levels, FAC 62-777 (FDEP, 1999).
(2) NAS Cecil Field Inorganic Background Data Set (HLA, 1998).

TABLE 5-3

MONITORING WELL INSTALLATION AND SAMPLING RATIONALE
SITE 15, BLUE ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Monitoring Well Location	Sampling Rationale
CEF-015-02S	Area of high PAH concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine PAH concentrations and potential impacts to groundwater.
CEF-015-09S	Area of high PAH concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine PAH concentrations and potential impacts to groundwater.
CEF-015-10S	Area of high lead concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine lead concentrations and potential impacts to groundwater.
CEF-015-11S	Area of high carbazole and nitroaromatic concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine carbazole and nitroaromatic concentrations and potential impacts to groundwater.
CEF-015-12S	Area of high nitroaromatic concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine nitroaromatic concentrations and potential impacts to groundwater.
CEF-015-13S	Area of high arsenic concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine arsenic concentrations and potential impacts to groundwater.
CEF-015-14S	Area of high nitroaromatic concentrations in soil. Soil concentrations are greater than FDEP SCTL for leachability to groundwater criteria. A sample was collected from this well to determine nitroaromatic concentrations and potential impacts to groundwater.

Concentrations of PAHs, carbazole, and nitroaromatic compounds were less than analytical detection limits, as shown on Table 5-2. The results of the groundwater analysis did not identify groundwater PAH, carbazole, or nitroaromatic concentrations in excess of FDEP GCTLs.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSION

Based upon the findings of the field investigation discussed in Section 5.0, it can be concluded that, although the Site 15 soil contains PAHs, carbazole, nitroaromatic, and inorganic compounds at concentrations that exceed the FDEP SCTL for leachability to groundwater, these contaminants have not impacted groundwater quality at the site. The results of the groundwater analysis indicate that these contaminants have not leached from the soil into the groundwater. Based on the groundwater analysis, the BCT has determined that these contaminants will not pose a concern for groundwater if they remain at the site.

6.2 RECOMMENDATION

Based upon the above conclusion, it is recommended that no further groundwater monitoring be required at Site 15. Because the results of the groundwater analysis did not show exceedances of FDEP GCTLs, it is recommended that No Further Action for the groundwater at Site 15 is required.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997. *Remedial Investigation, Operable Unit 5, Sites 14 and 15.* Prepared for Southern Division Naval Facilities Engineering Command (SOUTHDIVNAVFACENGCOM), North Charleston, South Carolina. October.

BCT [Base Realignment and Closure (BRAC) Cleanup Team], 2003. *BCT Meeting Minute No. 1919 and Decision No. 624*, Meeting of April 9, 2003.

Bower, H. and H. C. Rice, 1976. *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells.* Water Resources Research 12(3):423-28.

Envirodyne Engineers, 1985. *Initial Assessment Study of Naval Air Station Cecil Field, Jacksonville, Florida.* Prepared for Naval Energy and Support Activity, NEESA 13-073. Port Hueneme, California.

Fairchild, R.W., 1972. *The Shallow-Aquifer System in Duval County, Florida.* Bureau of Geology, Florida Department of Natural Resources, Tallahassee, Florida.

FDEP (Florida Department of Environmental Protection), 1999a. *Groundwater Cleanup Target Levels and Soil Cleanup Target Levels.* Florida Administrative Code (FAC) Chapter 62-777. August.

FDEP, 1999b. *Primary and Secondary Drinking Water Quality Criteria.* FAC Chapter 62-550. September.

FDEP, 2001. *FDEP Technical Review of the Technical Memorandum for No Further Groundwter Monitoirng at U5, Site 15, Naval Air Station Cecil Field.* Letter to Mr. Mark Davidson from Mr. David Grabka. August 30.

FDEP, 2002. *FDEP Standard Operating Procedures FS2200.* FAC Chapter 62-160, Quality Assurance Rule, April.

FGS (Florida Geological Survey), 1986. *Hydrogeological Units of Florida.* Compiled by the Southeastern Geological Society Ad Hoc Committee.

HLA (Harding Lawson Associates), 1998. *NAS Cecil Field Inorganic Background Data Set.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina. July.

TtNUS (Tetra Tech NUS, Inc.), 1998. *Base-Wide Generic Work Plan at NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHDIVNAVFACENGCOM, North Charleston, South Carolina. October.

TtNUS, 1999. *Remedial Investigation Report for Sites 36 and 37, NAS Cecil Field, Jacksonville, Florida.* Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, August.

TtNUS, 2000. *Sampling and Analysis Plan, Site 15, Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field.* March.

TtNUS, 2003. *Phase X Sampling and Analysis Plan Revision 1, Site 15, Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field.* June.

USDA (U.S. Department of Agriculture), 1978. *Soil Survey of City of Jacksonville, Duval County, Florida.* Soil Conservation Service.

U.S. EPA Region 4 (United States Environmental Protection Agency Region 4), 1996. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.* Athens, GA. May.

USGS (U.S. Geological Survey), 1996. *Ground-Water Flow in the Surficial Aquifer System and Potential Movement of Contaminants From Selected Waste-Disposal Sites at Cecil Field Naval Air Station, Jacksonville, Florida.* Administrative release.

APPENDIX A

SAMPLING AND ANALYSIS WORK PLANS

Sampling and Analysis Work Plan
Site 15, Operable Unit 5
Naval Air Station Cecil Field
Jacksonville, Florida

March 29, 2000

Sampling and analysis of existing monitoring wells is proposed to investigate groundwater at Site 15. The locations of the existing wells are as shown in Figure A. The groundwater sampling effort is being conducted to determine if soil contamination in excess of the established leachability criteria has impacted groundwater. Previous soil investigations identified contamination in excess of FDEP Soil Cleanup Target Level for leachability for PAHs, lead, antimony, arsenic, 2,4,6-trinitrotoluene, 3-nitrotoluene, and 4-nitrotoluene.

The groundwater sampling activities and procedures described in this Work Plan will be performed in accordance with the U.S. EPA Region 4 Environmental Investigation Standard Operating Procedures and Quality Assurance Manual (EISOPQAM) and the Base-Wide Generic Work Plan for Naval Air Station (NAS) Cecil Field. Specifically, the Base-Wide Generic Work Plan includes procedures for management of investigation-derived wastes in Volume I and standard operating procedures in the Project Operations Plan in Volume II. **Purging of the wells prior to collection of the sample will be conducted in accordance with the SOP and it is important that the turbidity requirement are met. The groundwater will be sampled using low-flow techniques.** Due to the potentially remote locations of the monitoring wells to be sampled, it may be necessary to place the IDW drums in an area other than next to the wells so they are accessible by truck.

Personnel protection equipment and other waste trash (e.g. disposable trowels) will not be considered hazardous and will be disposed in a municipal landfill. Such trash will be collected in a plastic bag and disposed in a suitable trash receptacle.

Sampling handling, bottleware, preservation, and holding time requirements for the analysis proposed for this sampling event are as identified in the following table:

Analysis (1)	Analytical Method	Bottleware	Preservation	Holding Time(2)
PAHs	SW-846 8310	2 1-liter amber glass; Teflon-lined lid	Cool to 4°C	7 days to extraction; 40 days to analysis
Lead, arsenic, and antimony	SW-846-6010B	1 1-liter HDPE	Cool to 4° C pH < 2 with NHO_3	180 days to analysis
Energetics / Nitroaromatics (2,4,6-trinitrotoluene, 3-nitrotoluene, and 4-nitrotoluene	SW-846-8330	1 2-liter amber glass	Cool to 4°C	7 days to extraction; 40 days to analysis

(1) Verify detection limits achieve GCTLs.
(2) Holding times are measured from the date/time of sample collection.

Analytical results will be provided on a 14-day turn around basis.

The laboratory contracted to do this work is as follows:

ACCUTEST SOUTHEAST
4405 Vineland Road, Suite C-15
Orlando, Florida 32881
Attention: Linda Williams
(407) 425-6700 Fax: (407) 425-0707

As agreed upon by the BCT, the collection of rinsate and trip blanks has been eliminated at NAS Cecil Field. In addition, field blanks will not be collected during this sampling program because there will be no decontamination of sampling equipment. In accordance with these changes, the following table summarizes the frequency and type of field Quality Assurance/Quality Control (QA/QC) samples to be collected for this sampling program.

Type of Samples	Frequency	Samples to be Collected
Field Duplicate	1/10 sample/matrix	1 groundwater
Lab MS/MSD	1/20 samples	1 groundwater [1]

[1] MS/MSD is a laboratory QA/QC requirement, separate sample not required, only additional volume.

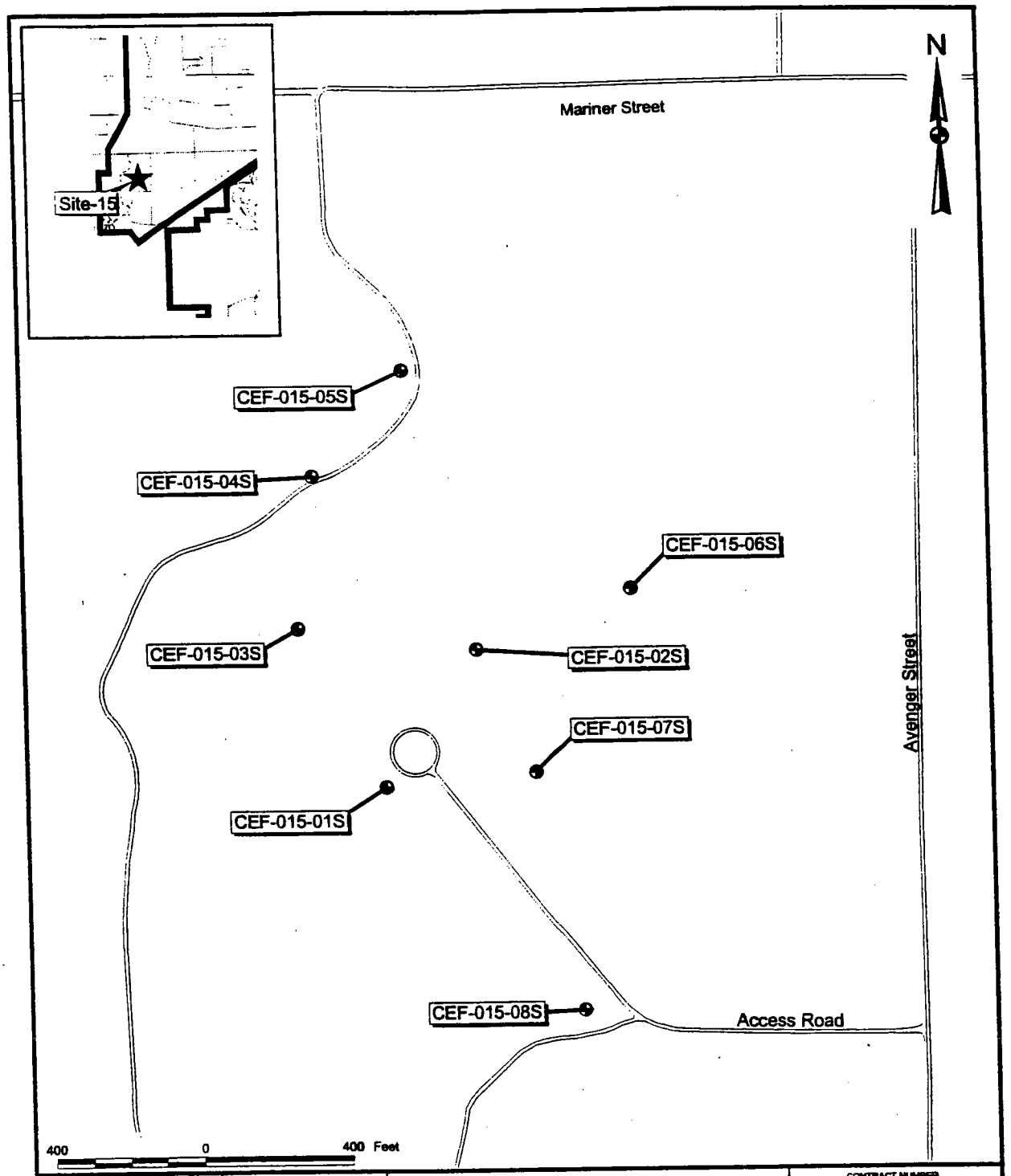
As agreed upon by the BCT, formal data validation has been eliminated from the installation restoration program at NAS Cecil Field. However, the analytical data packages generated by the analytical laboratory will be reviewed by Tetra Tech NUS personnel to eliminate false positives and false negative results.

Table 1

Groundwater Sampling and Analysis
Site 15, OU5

Sample ID	Location	Analysis			
		Energetics / Nitroaromatics (2,4,6-trinitrotoluene, 3-nitrotoluene, and 4-nitrotoluene)	PAHs	Lead, arsenic, and antimony	
				Filtered	Unfiltered (1)
CEF-015-GW-01S-01	Existing Monitoring Well CEF-015-01S	X	X	X	X
CEF-015-GW-02S-01	Existing Monitoring Well CEF-015-02S	X	X	X	X
CEF-015-GW-03S-01	Existing Monitoring Well CEF-015-03S	X	X	X	X
CEF-015-GW-04S-01	Existing Monitoring Well CEF-015-04S	X	X	X	X
CEF-015-GW-05S-01	Existing Monitoring Well CEF-015-05S	X	X	X	X
CEF-015-GW-06S-01	Existing Monitoring Well CEF-015-06S	X	X	X	X
CEF-015-GW-07S-01	Existing Monitoring Well CEF-015-07S	X	X	X	X
CEF-015-GW-08S-01	Existing Monitoring Well CEF-015-08S	X	X	X	X

(1) Filter using a 1-micron filter during collection of the sample.



DRAWN BY / DATE		MONITORING WELL LOCATIONS SITE 15, OPERABLE UNIT 5 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER —
CHECKED BY / DATE			APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV 0

P:\GIS\CECIL\site-15_groundwater.apr 27Mar00 MJJ Layout1

TABLE

SUMMARY OF FIXED-BASED LABORATORY PARAMETERS
SITE 15
NAS CECIL FIELD, JACKSONVILLE, FLORIDA

Analysis	Analytical Method	Sample Volume	Bottleware	Preservation[1]	Holding Time[2]
SITE 15 (8 Monitoring Wells: CEF-15-01S, CEF-15-02S, CEF-15-03S, CEF-15-04S, CEF-15-05S, CEF-15-06S, CEF-15-07S, and CEF-15-08S plus duplicate)					
14 day Turnaround					
PAHs	SW-846 8310	2 x 1 L	Amber glass; Teflon-lined cap	Cool to 4°C; dark	Extraction 7 days; analysis within 40 days
Energetics/Nitroaromatics • 3-Nitrotoluene • 4-Nitrotoluene • 2,4,6-Trinitrotoluenel	SW-846 8330	2 x 1 L	Amber glass; Teflon-lined cap	Cool to 4°C; dark	Extraction 7 days; analysis within 40 days
Select Inorganics (Total and Dissolved) • Antimony • Arsenic • Lead	SW-846 6010B/ 7000A Series	1 L	Polyethylene bottle, plastic cap, plastic liner	HNO_3 to pH<2	Within 180 days

1 HNO_3 - Nitric acid
2 Holding times are measured from the date/time of sample collection.
NA - Not applicable.

Phase X Sampling and Analysis Work Plan Rev. 1
Site 15, Blue 10 Ordnance Disposal Area
Naval Air Station Cecil Field
Jacksonville, Florida

June 24, 2003

The objective of this sampling is to further delineate the horizontal extent of arsenic in soil, vertically delineate TRPH in soil and to install and sample six monitoring wells to characterize groundwater conditions in areas where soil contaminant concentrations exceed FDEP leachability to groundwater criteria. The proposed sampling locations are based on prior sampling events conducted by ABB and TtNUS that include over 500 samples. During this investigation, 2 soil samples will be collected from 0 to 1 foot below ground surface (bgs), 1 soil sample will be collected from 1 to 2 foot below ground surface (bgs) and seven groundwater samples will be collected from the six new monitoring wells and one existing monitoring well. Approximate locations are identified on Figure A and described in Table 1.

The well installation and sampling activities, quality assurance/quality control (QA/QC) procedures, and data validation requirements for field activities described in this work plan are in general agreement with the U.S. EPA Region IV Environmental Investigation Standard Operating Procedures (SOPs) and Quality Assurance Manual (EISOPQAM), FDEP SOPs FS3000, Remedial Investigation report for Sites 36 and 37, and current Tetra Tech NUS, Inc. (TtNUS) SOPs. Florida Administrative Code (FAC) Quality Assurance Rule (FAC 62-160) was updated in April of 2002 and incorporates new SOPs developed and adopted by the FDEP for the collection and analysis of environmental media. Accordingly, the soil and groundwater activities that will be conducted in this work plan will abide by SOPs FS3000 (for soil) and FS2200 (for groundwater), both of which reference additional applicable SOPs as necessary.

Prior to the installation of the monitoring wells, utilities must be located or cleared by TtNUS.

The monitoring wells shall be installed in the shallow groundwater zone and shall be identified as indicated on Table 1. The well screen will be 0.010-inch slot, with a screen length of ten feet from 5' to 15' bgs. The well will be constructed of certified-clean material including a 2-inch, flush-threaded PVC well screen and riser. The locations and top of casing elevations will be surveyed by a registered surveyor.

The surface soil samples (0 to 1 foot bgs and 1 to 2 foot bgs) will be collected as grab samples using plastic, disposable trowels. The proposed soil sample locations shall be surveyed by a registered land surveyor prior to sampling and marked with a wooden stake or pin flag labeled with the sample identification as listed in Table 1.

Personnel protection equipment and other waste trash (e.g. disposable trowels) will not be considered hazardous and will be disposed in a municipal landfill. Such trash will be collected in a plastic bag and disposed in a suitable trash receptacle. Removed soil from the surface soil sampling in excess of sampling volume requirements will be placed back on the ground.

Requirements for sample handling, bottleware, preservation, and holding time for the analyses proposed for this sampling event are as identified in the following table:

Analysis	Analytical Method	Bottleware	Preservation	Holding Time(1)
		SOIL		
ARSENIC	SW-846 6010B	4 oz. glass jar	Cool to 4°C	180 days to extraction
TRPH	Florida PRO	8-oz. glass jar	Cool to 4° C	14 days to analysis
		GROUNDWATER		
PAHs plus Carbazole	SW-846 8310	2 1-liter amber glass; Teflon-lined cap	Cool to 4° C	7 days to extraction; 40 days to analysis
Nitro Aromatics	SW-846 8330	2 1-liter amber glass; Teflon-lined cap	Cool to 4° C	7 days to extraction; 40 days to analysis
Total Lead	SW-846 6010B/7000A Series	1 1-liter glass or polyethylene; Teflon-lined lid	HNO3 to pH<2, Cool to 4° C	180 days to analysis
Total Arsenic	SW-846 6010B/7000A Series	1 1-liter glass or polyethylene; Teflon-lined lid	HNO3 to pH<2, Cool to 4° C	180 days to analysis

(1) Holding times are measured from the date/time of sample collection.

PAHs = Polynuclear aromatic hydrocarbons.
TRPH = Total recoverable petroleum hydrocarbons.
PRO = Petroleum Range Organic method.

Analytical results will be reported on a *14-day* turn around basis.

The laboratory contracted to do this work is as follows:

ACCUTEST SOUTHEAST
4405 Vineland Road, Suite C-15
Orlando, Florida 32881
Attention: Linda Williams
(407) 425-6700
Fax: (407) 425-0707

As agreed upon by the BCT, the collection of rinsate and trip blanks has been eliminated at NAS Cecil Field. In addition, field blanks will not be collected during this sampling program because there will be minimal decontamination of sampling equipment. In accordance with these changes, the following table summarizes the frequency and type of field Quality Assurance/Quality Control (QA/QC) samples to be collected for this sampling program.

Type of Samples	Frequency	Samples to be Collected
Field Duplicate	1/10 sample/matrix	1 soil / 1 groundwater
Lab MS/MSD	1/20 samples/matrix	1 soil (1)/ 1 groundwater (1)

(1) MS/MSD is a laboratory QA/QC requirement, separate samples not required, only additional volume (2x).

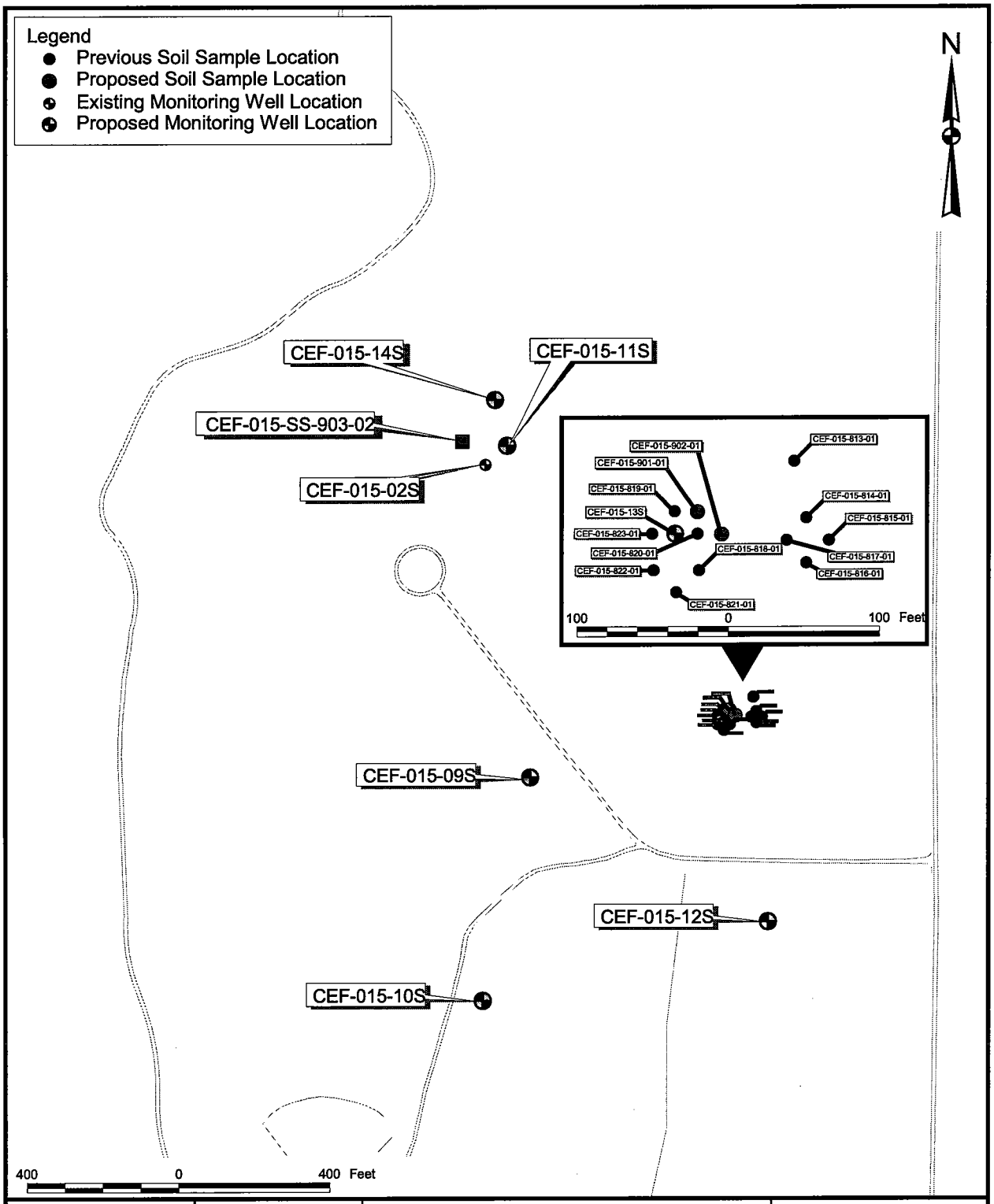
As agreed upon by the BCT, formal data validation has been eliminated from the installation restoration program at NAS Cecil Field. However, the analytical data packages generated by the analytical

laboratory will be reviewed by Tetra Tech NUS personnel to eliminate false positives and false negative results.

Table 1

Phase X Sampling and Analysis Work Plan
Site 15, Blue 10 Ordnance Disposal Area

Sample ID CEF-015-	Location	Sample Interval (bgs)	Analysis					
			Arsenic	PAHs	Carbazole	TRPH	Nitro Aromatics	Lead
SOIL								
SS-901-01	15 feet north of previous sample location CEF-015-820-01	0'-1'	●					
SS-902-01	15 feet east of previous sample location CEF-015-820-01	0'-1'	●					
SS-903-02	Previous sample location CEF-015-827-02	1'-2'	●			●		
GROUNDWATER								
GW-02S-02	Existing well CEF-015-02S			●				
GW-09S-02	Proposed Well CEF-015-09S			●				
GW-10S-02	Proposed Well CEF-015-10S							●
GW-11S-02	Proposed Well CEF-015-11S			●	●		●	
GW-12S-02	Proposed Well CEF-015-12S						●	
GW-13S-02	Proposed Well CEF-015-13S		●					
GW-14S-02	Proposed Well CEF-015-14S						●	



DRAWN BY MJJ	DATE 20Jun03	PROPOSED PHASE X SAMPLE LOCATIONS OU 5, SITE 15 NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE A / REV 0

P:\GIS\NAS_CecilField\Site-15_200301.apr 20Jun03 MJJ Layout8

APPENDIX B

SAMPLING LOGS

B.1 APRIL 2000 SAMPLING LOGS

B.2 MAY 2000 RE-SAMPLING LOGS

B.3 BORING LOGS AND MONITORING WELL SHEETS FOR NEW WELLS

B.4 JULY 2003 SAMPLE LOGS

B.1 APRIL 2000 SAMPLING LOGS

TITLE Site 15

PROJECT NO. 7653
BOOK NO. 1299

Work continued from Page /

0818 Louie Knight departed in POV for Cecil Field.
Merv Dale departed in F250 for same.
Plan of Day at Site 15. Groundwater Sampling. (OWS)
Work Plan dated 3/29/00.
Wells CEF-015-GW-015 thru 085 for PAHs (8310), Lead (Pb), Arsenic (As) and Antimony (Sb) (6010B) and energetics (8330). (METALS - total + dissolved)

0900 At PWC Bldg. 1, load truck with supplies. Calibrate horibas (2). # 906024 & 804048. Rented from Response Rentals. Peristaltic Pumps (3) (from Pine Env.) 00734 and 00823. Water level indicators (HERON) (from Response Rentals) - 100 foot tape (2). Loaded per sampling field checklist.

0930 Paul Calligan arrives @ PWC. PLAN to meet with Nick Agolini (South Div Proj. Eng.). HASP briefing per 4/99 HASP.

0945 P.C. leave to get N.U. @ Cecil Field runway.
M.D. and L.K. to Site 15 to begin locating wells.

1030 P.C./N.U. at Site 15 to pick up M.D. L.K. will continue to uncap (only wells 35 and 78 remain to locate) wells.
Leaving cell ph. with L.K.
N.U./P.C./M.D. to town sites for CTO 121.

1128 L.K. begins water levels (see sheet for details). (H.STOC)

15	5.77
25	6.97
35	7.17
45	7.39
55	4.64
65	6.39
75	7.66
85	5.35

1230 M. Dale call L.K. He's about through taking levels, so we will finish our tour and meet back at PWC.

1330 Back at PWC. L.K. at Rae's for lunch. N.U. and P.C. go to Rae's for lunch. M.D. stay at PWC for lunch.

1400 L.K. pick M.D. up at PWC. Proceed to Site 15.

Work continued to Page 138

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE Merwin Dale DATE 4/17/00

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TITLE Site 15 / RR current ~~CTO 78~~ MD **PROJECT NO.** 7653 **BOOK NO.** 1299 **139**

Work continued from Page —

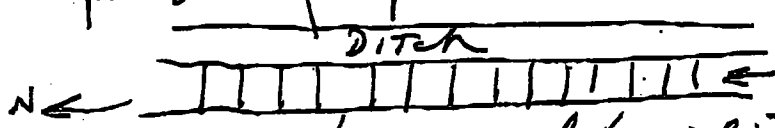
0704 MERV DALE (M.D.) AND ERIC PARKER (E.P.) DEPART IN FESO.
PLAN OF DAY - COMPLETE SAMPLING AT SITE 15 (YELLOW WATER WEAPONS AREA OF CECIL FIELD, JAX, FL.
CELL Ph 614 4443.

EQUIPMENT
(2) HORIBAS (U-10)
(2) HERON WATER LEVEL INDICATORS
(2) Peristaltic Pumps

0847 TRUCK CORRED per checklist. Horibas and D.O calibrated. See Cal. sheet.
Proceed to Site 15. HASP tailgate talk.

0917 E.P. unloaded and set at well 35. M. Dale leave cell ph with E.P. and go to north end of RR to look for ARC Investigators.

0939 Found siding on north end immediately adjacent (east) of main line. Didn't notice RR wood ties/spike plates before. The start almost at north end and parallel at for 0.45 Miles. I marked the north and south end by blue/white striped survey tape.



note: RR ties touch the ballast line! ~~The ties are about as wide as the ballast road. (Top of ballast to toe of ballast). (~9-11' wide).~~ and Ties are about 6-7' long.

1000 BACK AT SITE 15 (circle) WALK TO ERIC and get phone.
ARC called to apologize for missing us. The crew went to the wrong end of the RR. Will try again tomorrow.

1031 M.D. packing over to well 65.

1733 M.D. And E.P. depart Site 15. Drum 15-1 about 40 gallons full from purge water from wells 15 thru 75.
For purge data see gal logs and 10-flow purge sheets.
Sample times as follows:

Work continued to Page 140

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE Merv Dale DATE 4/18/00

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TITLE SITE 15/ SAMPLE MW-85 **PROJECT NO.** 7653 **BOOK NO.** **141**

Work continued from Page

0910 - At field office w/ Alan Pate (AP) & Charles Webber (CW).

TODAY'S AGENDA:
PSC 15- SAMPLE MW-85
PSC 25-
PSC 45-
PSC 21
} COLLECT WATER LEVELS

EQUIPMENT: 2 HORIBAS/PID/ WL INDICATOR/ PERISTALTIC PUMP/ ACCESSORIES

WEATHER: CLEAR: 70s/80s

0920 .. CALIBRATING INSTRUMENTS (PID, 2 HORIBAS)

1018 .. Setting up at MW-085 (PSC 15) ..

DTW MW-85 → (5.60)
(PID READING = 10)
(BZ = 0)

1102 - MW-85 pumping clear at 400 ml/min ..
CW gone back to field house to get 4 more 1-L ambers.

1215 .. Still pumping MW-85 .. TURB ~150 at last reading .. MELV calling PITTSBURGH to discuss protocol.
CW taking round of levels at PSC 45.

1228 - Begin collecting LAB samples (12 1-L ambers & 6 1-L plastics (2 MSMSD sets + regular set)
All these samples labeled "1300" for 'TIME'
1310 - Have now collected 16 of 18 liters from MW-85 .. now collecting filtered samples .. G. Root called to assure no of tick danger out here at PSC 15.
1420 .. At office after lunch .. CW has opened PSC-45 wells

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60606 MADE IN USA

SIGNATURE [signature] DATE
DISCLOSED TO AND UNDERSTOOD BY DATE 4.19.00 WITNESS DATE

TETRA TECH NUS, INC.
7018 AC Skinner Parkway #250
Jacksonville, FL 32256
Telephone: (904) 281-0400
Facsimile: (904) 281-0070

FAX

To: [redacted]	Date: 4/19/00
Company: TTNUS	
Location: Pittsburgh	
Fax Number: 412 921 4040	
From: M. Dane	
No. of Pages Including Cover: 18	

Comments:

Water levels and log sheets for Site 15 g.w. sampling.

Dup.

Note: Duplicate was taken at well 15 and MSMSD at well 85.

Please pass on QA data to Lee Lacks.

Thanks
Marvin

This facsimile contains PRIVILEGED AND CONFIDENTIAL INFORMATION intended only for the use of the Addressee(s) named above. If you are not the intended recipient of this facsimile, or the employee or agent responsible for delivering it to the intended recipient, you are hereby notified that any dissemination or copying of this facsimile is strictly prohibited. If you have received this facsimile in error, please immediately notify us by telephone and return the original facsimile to us at the above address via U.S. Postal Service. Thank you.

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

Sample ID No.: CEF-15-GW-15-01
Sample Location: CEF-15-15

Sampler: ERIC PARKER

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4/18/00								
Time: ~~1400~~ 1600								
Method: Peristaltic	Beni	5.23	.109	21.3	501	1.82	—	—

PURGE DATA

Date: 4/18/00
Method: Peristaltic
Monitor Reading (ppm): 0.0
Well Casing Diameter: 2 in.
Well Casing Material: PVC
Total Well Depth (TD in feet): 15.30
Static Water Level (WL in feet): 5.77
One Casing Volume (gal.): 1.5
Start Purge (hrs): 1350
End Purge (hrs): 1550
Total Purge Time (min): 120
Total Vol. Purged (gal.): 30.5

See Attached Low Flow Purge Data Sheet for Purge Data

15.30
5.77
~9.5 feet factor column

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-500 ml bottle	Accutest	
Pb, As, Sb	SW846 6010B	HNO3	1-500 ml bottle	Accutest	
Energetics	SW846 8330	none	2-1 ~~1-2 liter bottle~~	Accutest	

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

LABS

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15-041910

LAB:
COC #:

Check if Collected:

[ ] ~~MS/MSD~~ [✓] DUPLICATE / ID No.: CEF-15-GW-DUP-01

Signature(s): Eric Parker

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

Sample ID No.: CEF- 15-GW-25-01
Sample Location: CEF- 15-25

Sampler: Mervin Dale

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

SAMPLING DATA

		Color	pH S.U.	S.C. mS/cm	Temp. °C.	Turbidity NTU	DO mg/L	ORP mV	
Date:	4/18/00								
Time:	1428								
Method:	Peristaltic	clear	4.91	0.052	20.3	4	1.09	—	

PURGE DATA

Date:	4/18/00
Method:	Peristaltic
Monitor Reading (ppm):	
Well Casing Diameter:	2 IN.
Well Casing Material:	PVC
Total Well Depth (TD in feet):	15.70
Static Water Level (WL in feet):	6.97
One Casing Volume(gal):	5.4
Start Purge (hrs):	1318
End Purge (hrs):	1425
Total Purge Time (min):	67
Total Vol. Purged (gal):	19.1

See Attached Low Flow Purge Data Sheet for Purge Data

8.83 ft standing water
~5.4L to 1 vol.
5.4x3 = 16.2 L

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-~~500 ml~~ bottle	Accutest	
Pb, As, Sb	SW846 6010B	HNO3	1-~~500 ml~~ bottle	Accutest	
Energetics	SW846 8330	none	2-1/~~1-2~~ liter bottle MD	Accutest	

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

Tubing about 2 feet off bottom.

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15-041700

LAB:
COC #:

Check if Collected:

[ ] MS / MSD [ ] DUPLICATE / ID No.: none

Signature(s): Mervin W. Dale

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sample ID No.: CEF- 15-GW-35-01
Sample Location: CEF- 15-35
Sampler: E. PARKER

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4-18-00								
Time: 1115								
Method: Peristaltic	Cloudy	4.30	.064	18.6	52	0.75	—	

PURGE DATA

Date: 4-18-00
Method: Peristaltic
Monitor Reading (ppm): 0.0
Well Casing Diameter: 2"
Well Casing Material: PVC
Total Well Depth (TD in feet): 16.18
Static Water Level (WL in feet): 7.17
One Casing Volume (gal): 1.4
Start Purge (hrs): 0915
End Purge (hrs): 1105
Total Purge Time (min): 110
Total Vol. Purged (gal): 28.0

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	4:00
Pb, As, Sb (F) -	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle Plastic	Accutest	↓
Pb, As, Sb	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle Plastic	Accutest	↓
Energetics	SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	↓

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15-04/900
LAB:
COC #:

Checklist Collected:
[ ] MS / MSD [ ] DUPLICATE / ID No.: TMW

Signature(s): [signature]

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

Sample ID No.: CEF- 15-45-01 GW
Sample Location: CEF- 15-45
Sampler: M. Dark

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4/17/00								
Time: 1730								
Method: Peristaltic	clear	4.56	0.050	20.5	10	0.54	—	

PURGE DATA

Date:	4/17/00
Method:	Peristaltic
Monitor Reading (ppm):	127
Well Casing Diameter:	2 IN
Well Casing Material:	PVC
Total Well Depth (TD in feet):	15.63
Static Water Level (WL in feet):	7.39
One Casing Volume (gal/L):	1.3 gal 4.9L
Start Purge (hrs):	1525
End Purge (hrs):	1728
Total Purge Time (min):	123
Total Vol. Purged (gal/L)	22.9

See Attached Low Flow Purge Data Sheet for Purge Data

15.63
- 7.39
8.24

3 vols = 3.9 GALS
or
14.7 LITER

4.9 / 24.5 5 vols = 24.5 L

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle MB	Accutest	yes
Pb, As, Sb	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle	Accutest	yes
Energetics	SW846 8330	none	2- ~~1-1-2~~ 1 liter bottle MB	Accutest	yes

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

start tubing 1 foot off bottom of well

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15- 041800

LAB:
COC #:

Check if Collected:

[ ] MS / MSD [ ] DUPLICATE / ID No.: None

Signature(s): Mervin Dale

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field - Site 15
Project No.: N7653.CA0.05A.440

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sample ID No.: CEF- 15-55
Sample Location: CEF- 15-GW-055-01
Sampler: Louis Knight

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4/17/00								
Time:								
Method: Peristaltic	CLEAR	3.79	.059	19.3	0-2	0.93	N/A	

PURGE DATA

Date: 4/17/00
Method: Peristaltic
Monitor Reading (ppm): 0.0
Well Casing Diameter: 2 in.
Well Casing Material: PVC
Total Well Depth (TD in feet): 13.53
Static Water Level (WL in feet): 4.69 (4.69)
One Casing Volume (gal/L): 1.52
Start Purge (hrs): ~~1555~~ 1455
End Purge (hrs): 1550
Total Purge Time (min): 55
Total Vol. Purged (gal/L): ~56

See Attached Low Flow Purge Data Sheet for Purge Data

2 in
13.53
4.64
8.89

3 vol = 4.5

±1°C
±.1 Ph
±10% cond.
10 NTUs

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)*	SW846 6010B	HNO3	1-500 ml bottle	Accutest	yes
Pb, As, Sb	SW846 6010B	HNO3	1-500 ml bottle	Accutest	yes
Energetics	SW846 8330	none	1-2 liter bottle	Accutest	yes

OBSERVATIONS / NOTES

* F = filtered with 1 micron filter

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15- 041800
LAB:
COC #:

Check if Collected:
[ ] MS / MSD [ ] DUPLICATE / ID No.:

Signature(s): Louis Knight

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15

Project No.: N7653.CA0.05A.440

Sample ID No.: CEF- 15-GW-65'-01

Sample Location: CEF- 15-65

Sampler: M. DAZE

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4/18/00								
Time: 1208								
Method: Peristaltic	Clear	4.82	0.035	19.5	0	0.55	—	

PURGE DATA

Date: 4/18/00
Method: Peristaltic
Monitor Reading (ppm): 0.0
Well Casing Diameter: 2 IN.
Well Casing Material: PVC
Total Well Depth (TD in feet): 15.34
Static Water Level (WL in feet): 6.39
One Casing Volume(gal): 5.6
Start Purge (hrs): 1118
End Purge (hrs): 1205
Total Purge Time (min): 47
Total Vol. Purged (gal): 18.2

See Attached Low Flow Purge Data Sheet for Purge Data

15.34
6.39
~ 9 FT

5.6 x 3 = 16.8 L needs for 3 volumes.

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-500 ml bottle	Accutest	↓
Pb, As, Sb	SW846 6010B	HNO3	1-500 ml bottle	Accutest	
Energetics	SW846 8330	none	1-2 liter bottle	Accutest	

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

tubing about 1 foot off bottom.

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811

COC #: 15-04/1900

LAB:

COC #:

Check if Collected

[ ] MS / MSD [ ] DUPLICATE / ID No.: None

Signature(s): [illegible]

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

Sample ID No.: CEF-15-GW-75-01
Sample Location: CEF-15-75

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: Merv Dale

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4/18/00								
Time: 1645								
Method: Peristaltic	clear	4.64	0.056	19.5	3	0.14	—	

PURGE DATA

Date:	4/18/00
Method:	Peristaltic
Monitor Reading (ppm):	0.3
Well Casing Diameter:	2 IN.
Well Casing Material:	PVC
Total Well Depth (TD in feet):	17.34
Static Water Level (WL in feet):	7.72
One Casing Volume(gal/L):	
Start Purge (hrs):	1540
End Purge (hrs):	1639
Total Purge Time (min):	59
Total Vol. Purged (gal/L):	17.7

See Attached Low Flow Purge Data Sheet for Purge Data

17.34
7.72
9.62 ft.
5.8 to 6 bottle per vol
~~1.83 L per 3 vol~~
17.7 to 18 per 3 vols.

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-500 ml bottle	Accutest	↓
Pb, As, Sb	SW846 6010B	HNO3	1-500 ml bottle	Accutest	
Energetics	SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

Tubing about 2 ft. off bottom

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15-048900
LAB:
COC #:

Check if Collected:

[ ] MS / MSD [ ] DUPLICATE / ID No.: None

Signature(s): Merwin W. Dale

Tetra Tech NUS, Inc. GROUNDWATER SAMPLE LOG SHEET

Project / Site: Cecil Field Site 15
Project No.: N7653.CA0.05A.440

Sample ID No.: CEF-15-GW-85-01
Sample Location: CEF-15-85

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: L. Knight

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 4.19.00								
Time: 1300								
Method: Peristaltic	brown	6.01	0.094	22.0	131	0.82	N/A	

PURGE DATA

Date: 4.19.00
Method: PERISTALTIC
Monitor Reading (ppm): 0.0
Well Casing Diameter: 2 in
Well Casing Material: PVC
Total Well Depth (TD in feet): 14.87
Static Water Level (WL in feet): 5.60
One Casing Volume (gal/L): 1.5
Start Purge (hrs): 1034
End Purge (hrs): 1220
Total Purge Time (min): 106
Total Vol. Purged (gal/L): 11

See Attached Low Flow Purge Data Sheet for Purge Data

14.87
-5.60
9.27

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	yes
Pb, As, Sb (F)	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle	Accutest	↓
Pb, As, Sb	SW846 6010B	HNO3	1-~~500 ml~~ 1L bottle	Accutest	↓
Energetics	SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	↓

OBSERVATIONS / NOTES

F = filtered with 1 micron filter

LAB INFO.

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 15-041900
LAB:
COC #:

Check if Collected:
[X] MS / MSD [ ] DUPLICATE / ID No.: None

Signature(s): M. Lab for L.K.

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER 15-041900 | PAGE 1 OF 2

PROJECT NO: 7653

SITE NAME: Site 15

PROJECT MANAGER AND PHONE NUMBER: Rob Simcik 412-921-8163

LABORATORY NAME AND CONTACT: Accutest H. Behzadi

SAMPLERS (SIGNATURE): [signature]

FIELD OPERATIONS LEADER AND PHONE NUMBER: Merv Dale 904-281-0400

ADDRESS: 4405 Vineland Rd, C-15

CARRIER/WAYBILL NUMBER: FEDEX 8185 2037 5039 / 8185 2037 5326

CITY, STATE: Orlando, FL 32811

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

DATE (YEAR 2000)	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	PAH SW 846 8310	Pb, As, Sb SW 846 6010B Unfilter	Pb, As, Sb SW 846 6010B Filter	Energetics Nitroaromatics					COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G(2)	P	P	G(2)					
PRESERVATIVE USED						None	HNO3	HNO3	None					
4/18	1600	CEF-15-GW-1S-01	GW	G	5	✓	✓		✓					Cool to 4°C
4/18	1600	CEF-15-GW-1S-01-F	GW	G	1			✓						
4/18	1428	CEF-15-GW-2S-01	GW	G	5	✓	✓		✓					Work Release 13
4/18	1428	CEF-15-GW-2S-01-F	GW	G	1			✓						
4/18	1115	CEF-15-GW-3S-01	GW	G	5	✓	✓		✓					Energetics is
4/18	1115	CEF-15-GW-3S-01-F	GW	G	1			✓						SW 846 8330
														(2,4,6 trinitrotoluene
														3-nitrotoluene
														4-nitrotoluene
														Pb = lead
														As = Arsenic
														Sb = Antimony

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY [signature]	4-19-00	1800	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY		

COMMENTS: 117653 CAO 05A 440

PINK (FILE COPY)

3/89

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER 15-[illegible]/1800 | PAGE 1 OF 2 MB

PROJECT NO: 7653
SITE NAME: [illegible] 15
SAMPLERS (SIGNATURE): [illegible]

PROJECT MANAGER AND PHONE NUMBER: Rob [illegible] 407 721 8163
FIELD OPERATIONS LEADER AND PHONE NUMBER: Mark Dale 904 281 0400
CARRIER/WAYBILL NUMBER: FEDEX 2155 2037 3028

LABORATORY NAME AND CONTACT: Accutest [illegible]
ADDRESS: 4405 Vineland Rd, E-15
CITY, STATE: ORLANDO, FL 32811

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☑ 14 day

DATE YEAR	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	PH	PB, AS, SB	PB, AS, SB	PB, AS, SB					COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)						G	P	P	G					
PRESERVATIVE USED						None	HNO3	HNO3	None					
TYPE OF ANALYSIS							Filtered	Unfiltered	Filtered					
		~~CFF-15-GW-15'-01~~	GW	G		✓	✓		✓					Cont. 42
		~~CFF-15-GW-15'-01-F~~	GW	G				✓						
		~~CFF-15-GW-25'-01~~	GW	G		✓	✓		✓					Wrong Bottle
		~~CFF-15-GW-25'-01-F~~	GW	G				✓						
		~~CFF-15-GW-35'-01~~	GW	G		✓	✓		✓					Forgotten in [illegible]
		~~CFF-15-GW-35'-01-F~~	GW	G				✓						
4/17	1730	CFF-15-GW-45'-01	GW	G	5	✓	✓		✓					Cont. turned [illegible] 3 [illegible]
4/17	1730	CFF-15-GW-45'-01-F	GW	G	1			✓						4 [illegible]
4/17	[illegible]	CFF-15-GW-55'-01	GW	G	5	✓	✓		✓					
4/17	[illegible]	CFF-15-GW-55'-01-F	GW	G	1			✓						
														Pb: Lead
														As: Arsenic
														Sb: Antimony

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: [illegible]	4/16/00	1900	1. RECEIVED BY		
2. RELINQUISHED BY			2. RECEIVED BY		
3. RELINQUISHED BY			3. RECEIVED BY		

B.2 MAY 2000 RE-SAMPLING LOGS

172 Site 15

0700 - Briefing for day's activities at office w/ Mr. Dale, C. Waller, & A. Pate present.

- Load truck (F250) w/ equipment needed

0730 - Depart office for Cecil field

0800 - Arrive at Cecil Field

- Give 1 set Gold Tiger well keys & Dolphin well keys to ARC surveying at Site 16

- Proceed to Bldg. 1

0810 - Calibrate PID 2020 Pre-cal: 118 ppm
Post-cal: 120 ppm

- Calibrate Horiba U-22 Pre-cal: 3.99
MFG #: 9292036 Post-cal: 4.00

0823 - Depart Bldg. 1, Finished calibrating PID 2020 & Horiba U-22. Loaded buckets & other materials for well development.

0825 - Load Drum 21-12 & 4 empty drums from drum corral.

0842 - Leave Drum 21-12 at Site 21 (Golf Course) on North side of Bldg. 238.

- Proceed to Site 15

0856 - Arrive Site 15

Personnel: A. Pate & C. Waller

Equipment: 2 submersible pumps, 1 Horiba U-22, 1 W.L.I., 1 surge plunger on loan from Partridge Drilling Co.

Weather: Sunny, partly cldy., hi 80's

Objective: Develop well CEF-15-15

0900 - Begin setting up for well development of CEF-15-15

- Used surge plunger for ~4-5 minutes on well CEF-15-15

0925 - Begin developing well CEF-15-15

- Pump is ~ 1-2' off of bottom. Only pumps for 1-2 min before shutting off.

C. A. Waller 5/16/00

TITLE Site 15

PROJECT NO. 7653

BOOK NO. 1299

Work continued from Page 172

- See Monitoring Well Development Record sheet for details.

1205 - Well has stabilized to produce continuously at ~ 2 gals./min
- continuing development

1535 - End Development of well CEF-15-1S
Break down equipment & load up
Drums # 15-2, 15-3, & 15-4 used for development water & staged next to 15-1 on the SE corner of the circular road. All 3 drums are full (55 gals. each).

1600 - Arrive Bldg. 1
Decon submersible pump, place PID on charge

1630 - Proceed to Site 25 to inspect slopes of land for runoff direction. Arrows drawn on map of Site 25 indicate the overland flow

1658 - Depart Cecil Field for office

1721 - Drop surge plunger off to Partridge Drilling Co. on US. 17.

1750 - Arrive office.

CW.

Work continued to Page

SCIENTIFIC BINDERY PRODUCTIONS CHICAGO 60608 MADE IN USA

SIGNATURE Charles Walker DATE 5/16/00

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-15-1S
Site: Site 15
Date Installed: NOT KNOWN
Date Developed: 05/16/2000
Dev. Method: Surge&Pump
Pump Type: Submersible

Depth to Bottom (ft.): 15.30
Static Water Level Before (ft.): 7.09
Static Water Level After (ft.): 9.61
Screen Length (ft.): 10
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: C. Waller and A. Pate
Drilling Co.: NOT KNOWN
Project Name: NAS CECIL FIELD
Project Number: 7653

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units ~~mS/cm~~)	Turbidity (NTU)	Remarks (odor, color, etc.)
0925		3g	7.09	20.6	5.35	0.090	>999.0	DARK BROWN
0934		8g	9.12	20.5	5.32	0.087	>999.0	" "
0942		9.5	10.12	20.4	5.22	0.081	>999.0	" "
0953		11.0	12.05	20.4	4.89	0.077	>999.0	" "
1005		14.0	10.30	20.4	5.20	0.076	>999.0	" "
1015		20.0	11.71	20.4	5.20	0.073	>999.0	" "
1025		23.5	11.76	20.5	5.19	0.070	>999.0	" "
1035		30.0	11.35	20.7	5.08	0.067	>999.0	" "
1045		35.0	12.29	20.6	5.01	0.066	>999.0	" "
~~1055~~ 1055		38.5	11.02	20.5	5.02	0.066	>999.0	" "
1105		40.5	10.68	20.7	5.02	0.065	>999.0	" "
1115		45.0	11.31	20.5	4.95	0.064	>999.0	" "
1125		50.0	11.48	20.5	4.96	0.060	>999.0	" " ~~NEW DRUM~~ A-UP
1135		55.0	12.03	20.5	5.01	0.060	>999.0	" " NEW DRUM
1145		3.5	11.72	20.5	5.02	0.068	>999.0	Clearing
1155		10.0	12.68	20.7	4.87	0.062	709.0	"
1205		15.0	12.51	20.8	4.88	0.064	521.0	
1215		20.0	12.28	20.8	4.88	0.063	946.0	

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-15-1S
Site: Site 15
Date Installed: NOT KNOWN
Date Developed: 05/16/2000
Dev. Method: Surge&Pump
Pump Type: Submersible

Depth to Bottom (ft.): 15.30
Static Water Level Before (ft.): 7.09
Static Water Level After (ft.): 9.61
Screen Length (ft.): 10
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: C. Waller and A. Pate
Drilling Co.: NOT KNOWN
Project Name: NAS CECIL FIELD
Project Number: 7653

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1225		25.0	12.30	20.5	4.87	0.063	317.0	BROWN
1235		30.0	12.13	20.6	4.85	0.062	265.0	BROWN
1245		35.0	12.08	20.6	4.85	0.062	226.0	BROWN
1255		40.0	11.85	20.8	4.84	0.061	182.0	BROWN
1305		45.0	11.93	20.9	4.85	0.062	163.0	BROWN
1315		48.0	11.83	20.6	4.85	0.062	153.0	Lt. BROWN
1325		53.0	11.65	20.8	4.82	0.062	133.0	Lt. BROWN
1335		2.0	11.56	20.9	4.80	0.062	116.0	Lt. Brown, New Drum
1351		16.0	11.45	21.0	4.83	0.062	107.0	Lt. BROWN,
1405		18.0	11.45	21.0	4.83	0.061	101.0	Lt. Brown
1415		20.0	11.49	20.6	4.82	0.061	103.0	Lt. Brown, clearing
1425		24.0	11.36	21.1	4.83	0.061	83.8	Lt. Brown, clearing
~~1425~~ FOW		29.0	11.36	21.0	4.81	0.061	74.7	Lt. Brown, clearing
1445		34.0	11.19	20.9	4.82	0.061	158.0	Lt. Brown, clearing
1455		37.0	11.10	21.20	4.81	0.061	53.8	Lt. Brown, clearing
1505		41.0	10.55	21.30	4.82	0.061	33.8	Lt. Brown, clearing
1515		45.0	10.43	21.20	4.85	0.062	21.3	Lt. brown, clearing
1525		49.0	10.21	21.30	4.85	0.062	17.0	Lt. brown, clearing
1535		53.0	9.60	21.80	4.80	0.063	15.60	Lt. brown, clearing

B.3 BORING LOGS AND MONITORING WELL SHEETS FOR NEW WELLS

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15 Phase 10
PROJECT NUMBER: N7653
DRILLING COMPANY: Pro Sonic
DRILLING RIG: DT 66 Geoprobe

BORING NUMBER: CEF-015-09S (MW-09S) RID
DATE: 6/26/03
GEOLOGIST: Scott McGuire
DRILLER: Maurice Carpenter

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**
				0-3"			Blk+Gray Fi sa						
				3"-4'			DK Brn Fi sa					0	0
				4-10'			DK Brn Fi sa					0	0
				10-15'			DK Brn Fi sa					0	0
							EOB @ 15' bls						

* 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): 0

Converted to Well: Yes X No ____ Well I.D. #: CEF-015-09S

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15, Phase 10
BORING NUMBER: CEF-015-10S (MW-~~02~~ 10S) RFD
PROJECT NUMBER: N7653
DATE: 6/26/03
DRILLING COMPANY: Prosonic
GEOLOGIST: Scott McGuire
DRILLING RIG: Geoprobe DT-66
DRILLER: Maurice Carpenter

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**
				0-1'			Lt Gray Fine Sand						
				1-2'			Very Pale Brown Fi Sand					0	0
				2-3'			Pale Brn to BlK Fi Sa		H_2O 3'				
				3-4'			BlK to Lt Brn Fi Sa					0	0
				4-12'			BlK Fine sand					0	0
							EOB @ 12' bls						

* When rock coring, enter rock brokeness.

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

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes X No _____ Well I.D. #: CEF-015-~~09S~~ 10S

MD

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15, Phase 10
BORING NUMBER: CEF-015-011-S (MW-~~05~~ 115) RFD
PROJECT NUMBER: N7653
DATE: 6/27/03
DRILLING COMPANY: Pro Sonic
GEOLOGIST: Scott McGuire
DRILLING RIG: DT66 Trac
DRILLER: R. Dayton

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**
				0-6"			Gray Fine Sand						
				6"-1'			Pale Brn Fi sa					0	0
				1'-1.5'			Blk Fi sa						
				1.5-3'			Lt Brn to Orng Fi sa					0	0
				3-3.5'			Lt Brn Fi sa					0	0
				3.5-12'			Blk sa					0	0
							EOB @ 12' bls.						

* When rock coring, enter rock brokeness.

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

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes X No _____ Well I.D. #: CEF-015-115

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15, Phase 10
BORING NUMBER: CEF-015-12S (MW-~~04~~ 12S) RAD
PROJECT NUMBER: N7653
DATE: 6/26/03
DRILLING COMPANY: Prosonic
GEOLOGIST: Scott McGuire
DRILLING RIG: DT66 Trac
DRILLER: Maurice Carpenter

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**
				6"-12'		BlK	Fine Sand		w/ organics		·	0	0
									H_2O 3'				
							EOB @ 12' bls.						

* 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): 0

Converted to Well: Yes X No ____ Well I.D. #: CEF-015-12S

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15, Phase 10
BORING NUMBER: CEF-015-135 (MW-~~05~~ 135) RFD
PROJECT NUMBER: N7653
DATE: 6/27/03
DRILLING COMPANY: Pro Sonic
GEOLOGIST: Scott McGuire
DRILLING RIG: DT 66 Trac
DRILLER: R. Dayton

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**
				0-4			DK BIK Sa		H_2O 1.5'			0	0
				4-12'			BIK Fine sand					0	0
							EOBe 12' bls						

* When rock coring, enter rock brokeness.

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

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes X No ____ Well I.D. #: CEF-015-135

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: SITE 15, PHASE 10
BORING NUMBER: CEF-015-145 (MW-~~DG~~ 145) RFO
PROJECT NUMBER: 7653
DATE: 6/27/03
DRILLING COMPANY: Pro Sonic
GEOLOGIST: SCOTT McGUIRE
DRILLING RIG: ~~DT~~ DT 66
DRILLER: Ray Dayton

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**
				0-1'			DK to LT BRN Fi Sa					0	0
				1-2.5'			LT Brn Fi sa						
				2.5'-3'			Orange/Brn Fi sa						
				3-4'			LT Brn Fi sa		H_2O 4'			0	0
				4-10'			~~DK~~ BLK Fi sa					0	0
				10-12'			BLK Fi sa					0	0
							EOB @ 12' bls						

* When rock coring, enter rock brokeness.

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

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes X No ____ Well I.D. #: CEF-015-145

Tetra Tech NUS, Inc.

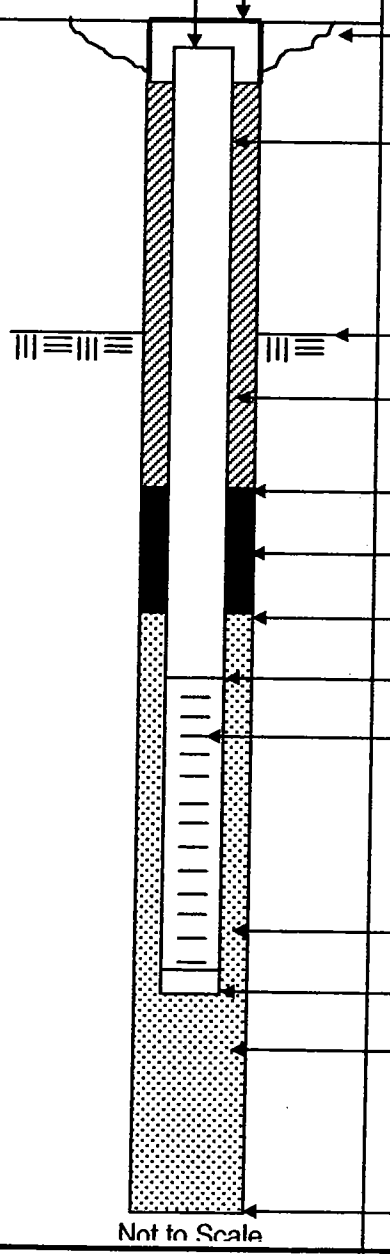
WELL No.: MW-~~07~~ 095 RFD

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-095
PROJECT No.:	~~0039~~ 7653	DRILLER:	Maurice Carpenter	DATE COMPLETED:	6/26/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ Ht. of Top of Riser:	1 31"
Elevation / Height of Top of Surface Casing:	1 4½"
I.D. of Surface Casing:	6 INCH
Type of Surface Casing:	Aluminum, non-hinge, lockable above-grade
Type of Surface Seal:	QUIKRETE CONCRETE
I.D. of Riser:	2"
Type of Riser:	PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	N/A
Type of Backfill:	Portland Cement, Type I
Elevation / Depth of Seal:	1 1'
Type of Seal:	30/65 sand
Elevation / Depth of Top of Filter Pack:	1 1.5'
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	PVC
Slot Size x Length:	.010" x 10'
I.D. of Screen:	2"
Type of Filter Pack:	20/30 sand
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	NATIVE SOIL
Elevation / Total Depth of Borehole:	1 12'

Tetra Tech NUS, Inc.

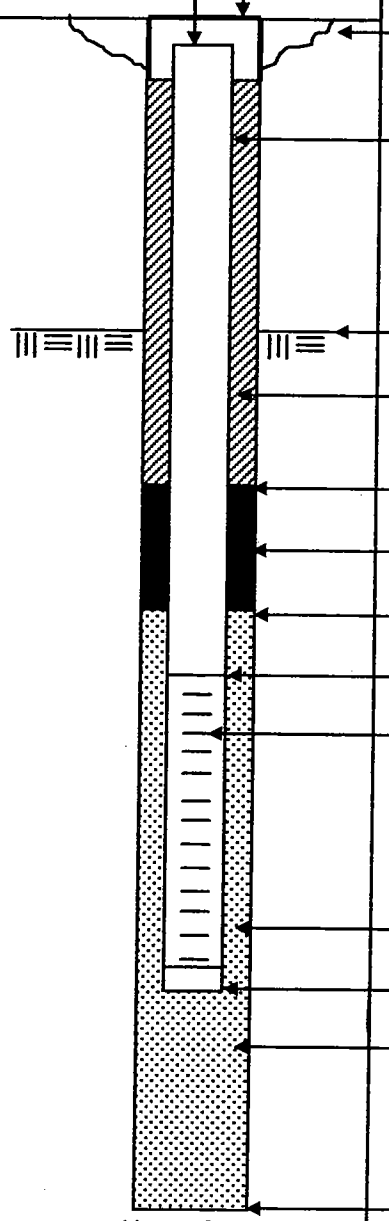
WELL No.: 105 MW-~~02~~ RFO

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-105
PROJECT No.:	~~0039~~ 7653	DRILLER:	M. Carpenter	DATE COMPLETED:	6/26/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ HT. of Top of Riser: 1 30"

Elevation / Height of Top of Surface Casing: 1 50"

I.D. of Surface Casing: 6 inch

Type of Surface Casing: Aluminum, Non-hinge, lockable, above-grade

Type of Surface Seal: QuikRete concrete

I.D. of Riser: 2"

Type of Riser: PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: N/A

Type of Backfill: Portland Cement, Type I

Elevation / Depth of Seal: 11.0'

Type of Seal: 30/65 sand

Elevation / Depth of Top of Filter Pack: 11.5'

Elevation / Depth of Top of Screen: 12'

Type of Screen: PVC

Slot Size x Length: .010" x 10'

I.D. of Screen: 2"

Type of Filter Pack: 20/30 Sand

Elevation / Depth of Bottom of Screen: 112'

Elevation / Depth of Bottom of Filter Pack: 112'

Type of Backfill Below Well: NATIVE SOIL

Elevation / Total Depth of Borehole: 112'

Tetra Tech NUS, Inc.

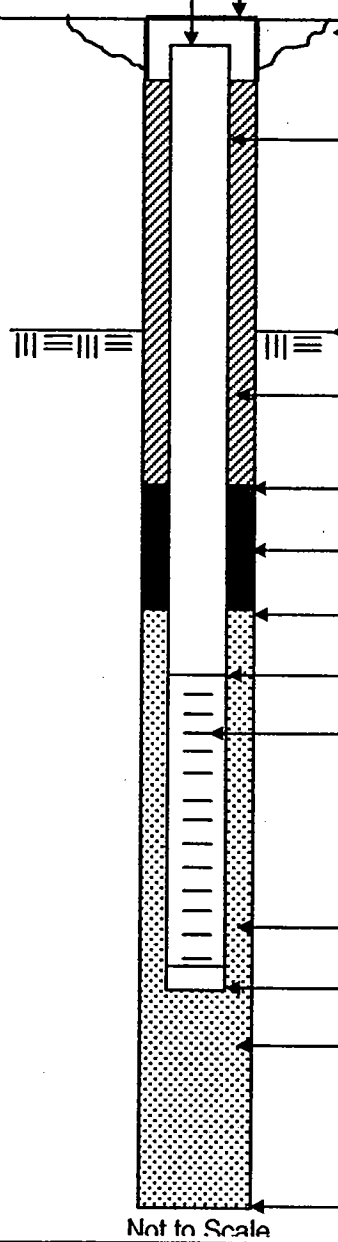
WELL No.: 115 MW-~~03~~ RFO

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-115
PROJECT No.:	~~0039~~ 7653	DRILLER:	R. Dayton	DATE COMPLETED:	6/27/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ HT. of Top of Riser:	1 31"
Elevation / Height of Top of Surface Casing:	1 40"
I.D. of Surface Casing:	6 inch
Type of Surface Casing:	Aluminum, Non-hinge, lockable, Above grade
Type of Surface Seal:	QUIKRETE Concrete
I.D. of Riser:	2"
Type of Riser:	PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	N/A
Type of Backfill:	Portland Cement, Type I
Elevation / Depth of Seal:	1 1.0'
Type of Seal:	30/65 sand
Elevation / Depth of Top of Filter Pack:	1 1.5
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	PVC
Slot Size x Length:	.010" x 10'
I.D. of Screen:	2"
Type of Filter Pack:	20/30 sand
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	~~20/30 sand~~ NATIVE SOIL MD
Elevation / Total Depth of Borehole:	1 12'

Tetra Tech NUS, Inc.

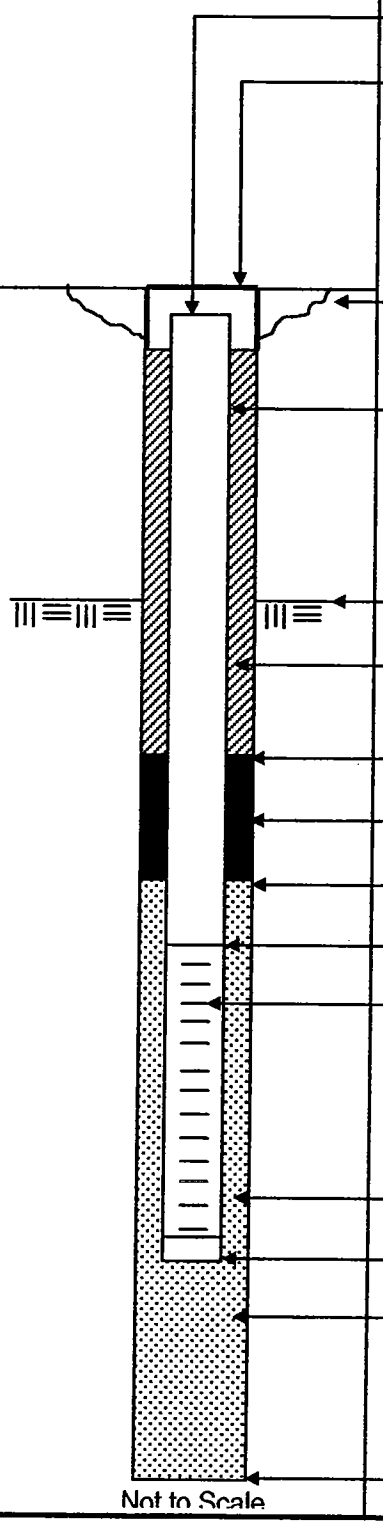
WELL No.: 125 MW-~~04~~ RFO

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-125
PROJECT No.:	~~0039~~ 7653	DRILLER:	M. Carpenter	DATE COMPLETED:	6/26/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ HT. of Top of Riser: 134"

Elevation / Height of Top of Surface Casing: 146"

I.D. of Surface Casing: 6 INCH

Type of Surface Casing: Aluminum, Non-hinge, lockable, Above-grade

Type of Surface Seal: QuikRete Concrete

I.D. of Riser: 2"

Type of Riser: PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: N/A

Type of Backfill: Portland Cement, Type I

Elevation / Depth of Seal: 16"

Type of Seal: 30/65 sand

Elevation / Depth of Top of Filter Pack: 11'

Elevation / Depth of Top of Screen: 12'

Type of Screen: PVC

Slot Size x Length: .010" x 10'

I.D. of Screen: 2"

Type of Filter Pack: 20/30 sand

Elevation / Depth of Bottom of Screen: 112'

Elevation / Depth of Bottom of Filter Pack: 112'

Type of Backfill Below Well: NATIVE SOIL

Elevation / Total Depth of Borehole: 112'

Tetra Tech NUS, Inc.

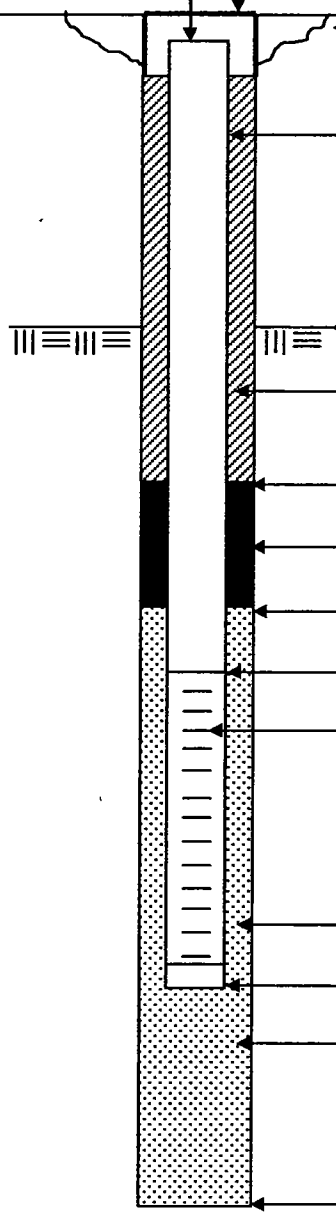
WELL No.: 135 MW-~~05~~ RFO

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-135
PROJECT No.:	~~0039~~ 7653	DRILLER:	R Dayton	DATE COMPLETED:	6/27/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ HT. of Top of Riser:	1 34"
Elevation / Height of Top of Surface Casing:	1 45"
I.D. of Surface Casing:	6 INCH
Type of Surface Casing:	Aluminum, non-hinge, lockable above-grade
Type of Surface Seal:	Quikrete Concrete
I.D. of Riser:	2"
Type of Riser:	PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	N/A
Type of Backfill:	Portland Cement, Type I
Elevation / Depth of Seal:	1 1'
Type of Seal:	30/65 sand
Elevation / Depth of Top of Filter Pack:	1 1.5
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	PVC
Slot Size x Length:	.010" x 10'
I.D. of Screen:	2"
Type of Filter Pack:	20/30 sand
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	NATIVE SOIL
Elevation / Total Depth of Borehole:	1 12'

Tetra Tech NUS, Inc.

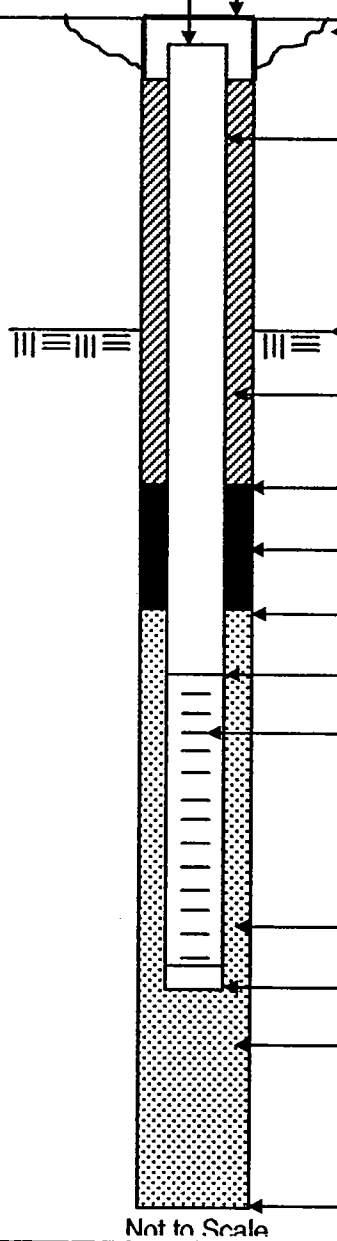
WELL No.: 145 MW-~~DC~~ RFD

MONITORING WELL SHEET

PROJECT:	NAS CECIL FIELD	DRILLING Co.:	PROSONIC	BORING No.:	CEF-015-145
PROJECT No.:	~~0039~~ 7653	DRILLER:	R. Dayton	DATE COMPLETED:	6/27/03
SITE:	SITE 15	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	S. McGuire	DEV. METHOD:	Submersible	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / ~~Depth~~ HT. of Top of Riser:	1 36"
Elevation / Height of Top of Surface Casing:	1 45"
I.D. of Surface Casing:	6 INCH
Type of Surface Casing:	Aluminum, Non-hinge, lockable, Above-grade
Type of Surface Seal:	QuikRete concrete
I.D. of Riser:	2"
Type of Riser:	PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	N/A
Type of Backfill:	Portland Cement, Type I
Elevation / Depth of Seal:	1 1.0'
Type of Seal:	30/65 sand
Elevation / Depth of Top of Filter Pack:	1 1.5'
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	PVC
Slot Size x Length:	.010" x 10'
I.D. of Screen:	2"
Type of Filter Pack:	20/30 sand
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	~~20/30 sand~~ NATIVE SOIL MD
Elevation / Total Depth of Borehole:	1 12'

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW-~~01~~ 095 RED
Site Name: Site 15 NASCF
Date Installed: 6/26/03
Project Name: PHASE 10, WELL INSTALL

Site Geologist: SCOTT McGuire
Drilling Company: ProSonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply, JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10', 10 Slot	Atlantic Drilling Supply	
End Cap	2" PVC	Atlantic Drilling Supply	
Drilling Fluid	None	—	
Drilling Fluid Additives	None	—	
Backfill Material	None	—	
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	
Bentonite Seal	Standard sand 30/65	Standard sand Co, JAX, FL	
Annular Grout	Portland Cement, Type I	TARMAC MEDLEY, FL	
Surface Cement	QUIKRETE CONCRETE	QUIKRETE ATLANTA, GA	
Protective Casing	ALUMINUM, NON-HINGE, lockable, 6"	ADS, JAX, FL	
Paint	None	—	
Rod Lubricant	None	—	
Compressor Oil	None	—	

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW-~~02~~ 10S
Site Name: Site 15, NASCF
Date Installed: 6/26/03
Project Name: PHASE 10, WELL INSTALL

Site Geologist: SCOTT McGuire
Drilling Company: Pro Sonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply, JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10', 10 Slot	Atlantic Drilling Supply, JAX, FL	
End Cap	2" PVC	Atlantic Drilling Supply, JAX, FL	
Drilling Fluid	None	—	
Drilling Fluid Additives	None	—	
Backfill Material	None	—	
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	
Bentonite Seal	Standard sand 30/65	Standard sand Co, JAX, FL	
Annular Grout	PORTLAND Cement Type I	TARMAC, MEDLEY, FL	
Surface Cement	QUIKRETE CONCRETE	QUIKRETE, ATALANTA, GA	
Protective Casing	Aluminum, Non-hinge, lockable 6"	ADS, JAX, FL	
Paint	None	—	
Rod Lubricant	None	—	
Compressor Oil	None	—	

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW ~~03~~ 115 RED
Site Name: Site 15, NASCF
Date Installed: 6/27/03
Project Name: PHASE 10, WELL INSTALL

Site Geologist: SCOTT McGUIRE
Drilling Company: Pro Sonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply, JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10', 10 Slot	Atlantic Drilling Supply	
End Cap	2" PVC	Atlantic Drilling Supply	
Drilling Fluid	None	—	
Drilling Fluid Additives	None	—	
Backfill Material	None	—	
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	
Bentonite Seal	Standard sand 30/65	Standard sand Co, JAX, FL	
Annular Grout	PORTLAND CEMENT Type I	TARMAC MEDLEY, FL	
Surface Cement	QUIKRETE CONCRETE	QUIKRETE, ATLANTA, GA	
Protective Casing	Aluminum, Non-hinge, lockable, 6"	ADS, JAX, FL	
Paint	None	—	
Rod Lubricant	None	—	
Compressor Oil	None	—	

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW-~~04~~ 125 RFD
Site Name: Site 15, NASCF
Date Installed: 6/26/03
Project Name: PHASE 1D, WELL INSTALL

Site Geologist: SCOTT McGuire
Drilling Company: Pro Sonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply, JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10', 10 Slot	Atlantic Drilling Supply	
End Cap	2" PVC	Atlantic Drilling Supply	
Drilling Fluid	None	—	
Drilling Fluid Additives		—	
Backfill Material		—	
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	
Bentonite Seal	Standard sand 30/65	Standard sand Co, JAX, FL	
Annular Grout	PORTLAND CEMENT, Type I	TARMAC MEDLEY, FL	
Surface Cement	QUIKRETE CONCRETE	QUIKRETE, ATLANTA, GA	
Protective Casing	ALUMINUM NON-HINGE, lockable 6"	ADS, JAX, FL.	
Paint	None	—	
Rod Lubricant	None	—	
Compressor Oil	None	—	

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW-~~05~~ 135 RED
Site Name: Site 15, NASCF
Date Installed: 6/27/03
Project Name: PHASE 10, WELL INSTALL

Site Geologist: SCOTT McGuire
Drilling Company: ProSonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10' 10 Slot	Atlantic Drilling supply	
End Cap	2" PVC	Atlantic Drilling supply	
Drilling Fluid	None	—	
Drilling Fluid Additives		—	
Backfill Material		—	
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	
Bentonite Seal	Standard sand 30/65	Standard sand co JAX, FL	
Annular Grout	PORTLAND CEMENT, Type I	TARMAC MEDLEY, FL	
Surface Cement	QUIKRETE CONCRETE	QUIKRETE, ATLANTA, GA	
Protective Casing	Aluminum Non-hinge, lockable 6"	ADS, JAX, FL	
Paint	None	—	
Rod Lubricant		—	
Compressor Oil		—	

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: MW-~~06~~ 14/5 RED
Site Name: Site 15, NASJF
Date Installed: 6/27/03
Project Name: PHASE 10, WELL, INSTALL

Site Geologist: SCOTT McGuire
Drilling Company: Pro Sonic
Driller: M. Carpenter / R. Dayton
Project Number: N7653

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing	Campbell Monoflex 2" x 10'	Atlantic Drilling Supply, JAX, FL	NO
Well Screen	Campbell Monoflex 2" x 10', 10 Slot	Atlantic Drilling supply	↓
End Cap	2" PVC	Atlantic Drilling supply	↓
Drilling Fluid	None	—	↓
Drilling Fluid Additives	↓	—	↓
Backfill Material	↓	—	↓
Annular Filter Pack	Standard sand 20/30	Standard sand Co, JAX, FL	↓
Bentonite Seal	Standard sand 30/65	Standard sand co, JAX, FL	↓
Annular Grout	Type I PORTLAND Cement	TARMAC, MEDLEY, FL	↓
Surface Cement	QUIKRETE CONCRETE	QUIKRETE, ATLANTA, GA	↓
Protective Casing	Aluminum, Non-hinge, lockable, 6"	ADS, JAX, FL	↓
Paint	None	—	↓
Rod Lubricant	↓	—	↓
Compressor Oil	↓	—	↓

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: Scott R. McGuire

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-~~070~~ 095 15-MW01A50
Site: ~~North Fuel Farm~~ 15
Date Installed: 6/26/03
Date Developed: 6/30/03
Dev. Method: Pump
Pump Type: Waterra

Depth to Bottom (ft.): 14.6'
Static Water Level Before (ft.): 5.48
Static Water Level After (ft.): 5.93
Screen Length (ft.): 10'
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: PC
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: ~~N3996JG050320~~

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1035		–	5.48	–	–	–	–	START DEV. / DARK BROWN
1040		~~10~~ 9	10.30	22.63	5.06	0.243	>1000	BROWN
1045		~~25~~ 19	10.75	22.20	4.88	0.120	850	BROWN
1050		27	10.80	22.46	4.86	0.118	450	BROWN
1055		37	10.83	22.31	4.62	0.114	105	LT. BROWN
1100		46	10.85	22.17	4.60	0.111	31	CLEAR
1105		55	10.86	22.09	4.54	0.108	19	CLEAR

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-~~070~~ 15-MW~~02~~ 10S RFO
Site: ~~North Fuel Farm~~ 15
Date Installed: 6/26/03
Date Developed: 6/30/03
Dev. Method: Pump
Pump Type: Waterra

Depth to Bottom (ft.): 14.8
Static Water Level Before (ft.): 5.20
Static Water Level After (ft.): 5.72
Screen Length (ft.): 10'
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: PL
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: ~~N3896JG050320~~

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
0935		—	5.20	—	—	—	—	START DEV. / DARK BROWN
0945		14	13.85	20.95	4.58	0.238	>1000	DARK BROWN
0955		27	*	20.73	4.36	0.089	190	LT. BROWN
1000		34	*	20.82	4.33	0.076	50	LT. BROWN
1005		40	*	20.48	4.28	0.067	35	CLEAR
1010		47	*	20.55	4.29	0.066	20	CLEAR
1015		55	*	20.49	4.35	0.064	10	CLEAR

* - CANNOT READ DUE TO PUMP IN WELL

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-~~070~~- 15 - MW~~03~~ 115 REO
Site: ~~North Fuel Farm~~ 15
Date Installed: 6/27/03
Date Developed: 6/30/03
Dev. Method: Pump
Pump Type: Grundfos

Depth to Bottom (ft.): 15.15'
Static Water Level Before (ft.): 5.67'
Static Water Level After (ft.): 5.73'
Screen Length (ft.): 10'
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: PL
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: N3996JG050320

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1325		—	5.67	—	—	—	—	START DEV / DARK BROWN
1330		8	12.40	21.83	5.01	0.304	71000	DARK BROWN
1335		16	*	20.93	4.32	0.087	240	BROWN
1340		27	*	20.56	4.19	0.062	60	LT BROWN
1345		35	*	20.43	4.04	0.056	10	CLEAR
1350		42	*	20.37	4.05	0.056	9.2	CLEAR
1355		48	*	20.52	4.07	0.055	8.6	CLEAR
1400		55	*	20.50	4.03	0.055	7.7	CLEAR

* CANNOT TAKE READING DUE TO PUMP IN WELL

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF ~~015~~ 015 MW04 125 RED
Site: ~~North Fuel Farm~~ 15
Date Installed: 6/26/03
Date Developed: 6/27/03
Dev. Method: Pump
Pump Type: Waterra

Depth to Bottom (ft.): 14.95' (TOC)
Static Water Level Before (ft.): 7.37'
Static Water Level After (ft.):
Screen Length (ft.): 10'
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: Pleverette
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: ~~N3996JG050320~~ N7653

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1020		—	7.37'	—	—	—	—	START DEV./DARK BROWN
1025		7	8.33	21.27	5.15	0.281	>1000	DARK BROWN
1030		13	8.40	20.71	4.89	0.134	>1000	DARK BROWN
1035		19	8.50	20.68	4.75	0.101	450	BROWN
1040		25	8.52	20.71	4.67	0.083	140	LT. BROWN
1045		31	8.52	20.85	4.60	0.077	150	LT. BROWN
1050		37	8.50	20.70	4.57	0.073	55	LT. BROWN
1055		43	8.55	20.83	4.55	0.074	80	LT. BROWN
1100		49	8.58	20.74	4.51	0.071	55	LT. BROWN
1105		55	8.60	20.80	4.51	0.069	40	LT. BROWN
								END DEV.

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-~~076~~ 15 - MW~~08~~ 135 RFD
Site: North Fuel Farm
Date Installed: 6/27/03
Date Developed: 6/30/03
Dev. Method: Pump
Pump Type: Waterra
Depth to Bottom (ft.): 15.0'
Static Water Level Before (ft.): 4.60'
Static Water Level After (ft.): 6.43'
Screen Length (ft.): 10'
Specific Capacity: N/A
Casing ID (in.): 2
Responsible Personnel: PL
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: N3996JG050320

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1530		—	4.60	—	—	—	—	START DEV./DARK BROWN
1535		4	14.95	21.44	5.39	0.126	>1000	
1540		8	*	21.57	4.99	0.104	>1000	
1545		11	*	21.21	4.97	0.093	>1000	
1550		15	*	21.27	4.77	0.076	>1000	DARK BROWN/WELL PUMPED DRY
1555		15	7.04	—	—	—	—	RESUME DEV.
1600		18	*	21.23	4.76	0.077	>1000	DARK BROWN/WELL PUMPED DRY
1605		18	7.00	-	-	—	—	RESUME DEV.
1615		22	*	21.17	4.69	0.078	>1000	
1625		25	*	21.24	4.68	0.076	>1000	
								WELL KEEP PUMPING
								DRY. MERV SAID
								SHUT IT DOWN

* CANNOT TAKE READING DUE TO FOAM IN WELL

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Well: CEF-~~076~~ 15 · MW~~06~~ 145 RPD
Site: ~~North Fuel Farm~~ 15
Date Installed: 6/27/03
Date Developed: 6/30/03
Dev. Method: Pump
Pump Type: Waterra

Depth to Bottom (ft.): 15.15
Static Water Level Before (ft.): 6.12
Static Water Level After (ft.): 6.87
Screen Length (ft.): 10
Specific Capacity: N/A
Casing ID (in.): 2

Responsible Personnel: PL
Drilling Co.: Prosonic
Project Name: NAS CECIL FIELD
Project Number: N3996JG050320

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units: mS/cm)	Turbidity (NTU)	Remarks (odor, color, etc.)
1410		—	6.12	—	—	—	—	START DEV. / DARK BROWN
1415			12.6	21.87	4.52	0.118	>1000	DARK BROWN
1420			*	21.34	4.27	0.106	>1000	DARK BROWN
1425			*	21.02	4.16	0.100	>1000	DARK BROWN
1430			*	20.84	4.15	0.097	420	BROWN
1435			*	20.93	4.14	0.096	190	LT. BROWN
1440			*	20.77	4.15	0.095	75	LT. BROWN
1445			*	21.16	4.16	0.095	45	LT. BROWN
1450		55	*	21.23	4.15	0.094	35	LT. BROWN

* CANNOT TAKE READING DUE TO PUMP IN WELL.

B.4 JULY 2003 SAMPLE LOGS

Tetra Tech NUS, Inc.

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: NAS Cecil Field
Project No.: N7653CA005A440
Location: Site 15
Personnel: Scott McGuire, Pete Leverette
Weather Conditions: PT cloudy
Measuring Device: WLI Heron # 09016
Tidally Influenced: Yes ___ No X
Remarks:

Well or Piezometer Number (CEF-)	Date	Time	Elevation of Reference Point (feet)*	~~Total Well Depth (feet)*~~ WL BGS	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	PID (ppm) BK/BH	
015-01S	8/4/03	1347		0.82	3.42			0/0	
015-02S	8/4/03	1402		1.70	4.23			0/0	
015-03S	8/4/03	1357		2.19	4.70			0/0	
015-04S	8/4/03	1424		2.27	4.89			0/0	
015-05S	8/4/03	1420		1.02	3.26			0/0	
015-06S	8/4/03	1413		0.58	3.23			0/0	
015-07S	8/4/03	1351		2.25	5.09			0/0	
015-08S	8/4/03	1333	75.9	0.64	3.18			0/0	
015-09S	8/4/03	1342		1.13	4.09			0/0	PVC cap
015-10S	8/4/03	1329		1.42	4.11			0/0	PVC cap
015-11S	8/4/03	1406		1.41	4.45			0/0	PVC
015-12S	8/4/03	1323		1.36	4.25			0/0	
015-13S	8/4/03	1339		0.55	3.68			0/0	Needs cap
015-14S	8/4/03	1409		2.44	5.34			0/0	Needs lock
								0/0	PVC cap

ppm=parts per million; BK=background; and BH=borehole of the well.

* All measurements to the nearest 0.01 foot

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-02S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-02S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

Date: 7/16/03 Time: 1220	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Method:	clear	5.87	0.174	22.61	0	0.19	-93.9	

PURGE DATA

Date: 7/16/03
Method: Peristaltic
Monitor Reading (ppm): 1.0
Well Casing Diameter:
Well Casing Material: 2" PVC
Total Well Depth (TD in feet): 15.7'
Static Water Level (WL in feet): 4.02
One Casing Volume(gal/L): 6.3
Start Purge (hrs): 1125
End Purge (hrs): 1215
Total Purge Time (min): 50
Total Vol. Purged (gal/L): 20

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	✓

OBSERVATIONS / NOTES

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327
LAB:
COC #:

Check if Collected:

☐ MS / MSD ☐ DUPLICATE / ID No.: None

Signature(s): Scott R. McG.

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-025
PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/16/02

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1125	4.02		400							
1130	4.24	2.0	400	5.87	0.175	73.3	0.85	22.84	-63.2	Suspended Solids
1135	4.24	4.0	400	5.75	0.171	55.3	0.55	22.70	-60.4	
1140	4.24	6.0	400	5.73	0.167	45.0	0.24	22.68	-75.0	
1145	4.24	8.0	400	5.75	0.168	35.4	0.18	22.55	-73.9	
1150	4.24	10.0	400	5.76	0.174	5.32	0.32	22.69	-82.0	Turbidity taken before
1155	4.24	12.0	400	5.79	0.176	1.04	0.36	22.91	-84.1	entering YSI Flow Thru
1200	4.24	14.0	400	5.82	0.174	0.16	0.30	23.39	-87.4	cell.
1205	4.24	16.0	400	5.86	0.173	0	0.22	23.16	-92.6	
1210	4.24	18.0	400	5.88	0.172	0	0.15	22.78	-95.1	
1215	4.24	20.0	400	5.87	0.174	0	0.19	22.61	-93.9	
1220	Sample collected									

SIGNATURE(S): Scott R. McGee

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-09S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-09S
[X] Monitoring Well		Sampler:	S. McGuire
[ ] Domestic Well			
[ ] Other:			

SAMPLING DATA

Date: 7/15/03	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Time: 1225								
Method:	Clear	5.56	0.101	23.24	0	0.57	131.4	

PURGE DATA

Date: 7/15/03	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Peristaltic	
Monitor Reading (ppm): 0	
Well Casing Diameter:	
Well Casing Material: 2" PVC	
Total Well Depth (TD in feet): 12.0	
Static Water Level (WL in feet): 3.59	
One Casing Volume(gal/L): 6.3	
Start Purge (hrs): ~~1030~~ 1130	
End Purge (hrs): 1220	
Total Purge Time (min): 40	
Total Vol. Purged (gal/L): 20	

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs	SW846 8310	none	2-1 liter bottles	Accutest	✓

OBSERVATIONS / NOTES

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327

LAB:

COC #:

Check if Collected:

☐ MS / MSD ☐ DUPLICATE / ID No.: None

Signature(s): Scott R. McGuire

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-095

PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/15/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1030	3.59		400							
1035	3.74	2.0	400	5.60	0.108	21	1.72	24.18	131.5	
1040	3.74	4.0	400	5.57	0.107	17	1.39	24.00	133.8	
1045	3.74	6.0	400	5.59	0.109	11	1.16	23.67	134.7	
1050	3.74	8.0	400	5.58	0.104	8.4	1.12	23.74	133.9	
~~1055~~	3.74	10.0	400	5.56	0.102	6.1	1.09	23.87	132.7	
1200	3.74	12.0	400	5.53	0.105	5.2	0.96	23.33	134.8	
1205	3.74	14.0	400	5.54	0.103	3.7	0.88	23.31	135.2	
1210	3.74	16.0	400	5.52	0.104	1.2	0.79	23.27	135.3	
1215	3.74	18.0	400	5.55	0.103	0	0.65	23.21	134.6	
1220	3.74	20.0	400	5.56	0.101	0	0.57	23.24	131.4	
1225	Sample collected									

SIGNATURE(S): Scott R. McGuire

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-10S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-10S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 7/15/03 Time: 1120 Method:	Clear	5.14	0.072	21.93	0	0.50	107.9	

PURGE DATA

Date: 7/15/03
Method: Peristaltic
Monitor Reading (ppm): 0
Well Casing Diameter:
Well Casing Material: 2" PVC
Total Well Depth (TD in feet): 12.0
Static Water Level (WL in feet): 3.74
One Casing Volume(~~gal~~/L): 6.3
Start Purge (hrs): 1010
End Purge (hrs): 1115
Total Purge Time (min): 65
Total Vol. Purged (~~gal~~/L): 19.5

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Laboratory	Collected
TOTAL LEAD SW846 6010B	HNO3	1-500 ml bottle	Accutest	✓

OBSERVATIONS / NOTES

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327
LAB:
COC #:

Check if Collected:

☐ MS / MSD ☐ DUPLICATE / ID No.: NONE

Signature(s): Scott R. McGuire

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-105
PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/15/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1010	3.74									
1015	3.97	1.5	300	5.15	0.066	60	2.30	22.45	199.7	
1020	SRW ~~3.99~~ 4.01	3.0	300	5.14	0.069	39	1.27	22.04	215.2	
1025	4.01	4.5	300	5.22	0.071	28	1.09	21.98	213.9	
1030	4.01	6.0	300	5.15	0.072	14	0.80	21.98	214.6	
1035	4.01	7.5	300	5.18	0.070	11.6	0.65	22.01	203.2	
1040	4.01	9.0	300	5.13	0.074	5.9	0.64	21.94	179.0	
1045	4.01	10.5	300	5.14	0.074	3.6	0.59	21.93	149.4	
1050	4.01	12.0	300	5.11	0.073	1.7	0.53	21.92	137.3	
1055	4.01	13.5	300	5.16	0.074	0	0.51	21.94	128.1	
1100	4.01	15.0	300	5.13	0.072	0	0.52	21.93	14.2	
1105	4.01	16.5	300	5.10	0.073	0	0.50	21.91	109.0	
1110	4.01	18.0	300	5.13	0.073	0	0.50	21.92	108.0	
1115	4.01	19.5	300	5.14	0.072	0	0.50	21.93	107.9	
1120	SRW ~~4.01~~ Sample collected									

SIGNATURE(S): Scott R. McGuire

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-11S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-11S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 7/16/03								
Time: 0840								
Method:	Clear	5.48	0.092	22.00	6.2	0.85	91.4	

PURGE DATA

Date: 7/16/03
Method: Peristaltic
Monitor Reading (ppm): 0
Well Casing Diameter:
Well Casing Material: 2" PVC
Total Well Depth (TD in feet): 12.0
Static Water Level (WL in feet): 4.19
One Casing Volume(~~gal~~/L): 6.3
Start Purge (hrs): 0745
End Purge (hrs): 0835
Total Purge Time (min): ~~40~~ 50
Total Vol. Purged (~~gal~~/L): 20.0

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
PAHs*	SW846 8310	none	2-1 liter bottles	Accutest	✓
Energetics	SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	✓

OBSERVATIONS / NOTES

* INCLUDES ANALYSES FOR CARBAZOLE.

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327
LAB:
COC #:

Check if Collected:

☐ MS / MSD ☒ DUPLICATE / ID No.: CEF-015-GW-DUP-02

Signature(s): Scott R. McG

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-115
PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/16/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0745	4.19									
0750	4.33	2.0	400	5.33	0.087	95	0.36	21.78	171.8	
0755	4.33	4.0	400	5.30	0.081	81	0.32	21.83	179.5	
0800	4.33	6.0	400	5.33	0.080	65	0.34	21.84	180.2	
0805	4.33	8.0	400	5.38	0.085	51	0.81	21.89	162.9	
0810	4.33	10.0	400	5.42	0.089	39	1.15	21.95	153.4	
0815	4.33	12.0	400	5.45	0.091	25	1.11	21.96	139.6	
0820	4.33	14.0	400	5.46	0.093	14.8	1.07	21.97	107.7	
0825	4.33	16.0	400	5.44	0.096	11.4	0.97	21.97	105.3	
0830	4.33	18.0	400	5.47	0.093	9.4	0.91	21.99	99.6	
0835	4.33	20.0	400	5.48	0.092	6.2	0.85	22.00	91.4	
0840	Sample collected									

SIGNATURE(S): Scott R. Mc[illegible]

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-12S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-12S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 7/15/03								
Time: 0945								
Method:	clear	5.49	0.080	21.64	0	0.35	61.9	

PURGE DATA

Date: 7/15/03	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Peristaltic	
Monitor Reading (ppm): 0	
Well Casing Diameter:	
Well Casing Material: 2" PVC	
Total Well Depth (TD in feet): 12.0	
Static Water Level (WL in feet): 3.84	
One Casing Volume(gal/L): 6.3	
Start Purge (hrs): 0835	
End Purge (hrs): 0940	
Total Purge Time (min): 65	
Total Vol. Purged (gal/L): 19.5	

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Laboratory	Collected
Energetics SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	✓

OBSERVATIONS / NOTES

use same name as sample I.D.

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327

LAB:
COC #:

Check if Collected:

[X] MS / MSD [ ] DUPLICATE / ID No.:

Signature(s): Scott R. McGuire

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-125

PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/15/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0835	3.84		300	7.-						
0840	3.98	1.5	300	7.23	0.095	22	3.40	21.76	78.3	
0845	3.99	3.0	300	5.78	0.081	14	0.92	21.55	62.8	
0850	3.99	4.5	300	5.53	0.086	10	0.83	21.45	60.8	
0855	3.99	6.0	300	5.65	0.087	10	0.78	21.46	52.3	
0900	3.99	7.5	300	5.59	0.085	8	1.13	21.47	46.7	
0905	3.99	9.0	300	5.55	0.084	2.3	0.89	21.46	51.4	
0910	3.99	10.5	300	5.53	0.087	2.1	0.77	21.48	54.2	
0915	3.99	12.0	300	5.51	0.086	1.4	0.72	21.48	54.1	
0920	3.99	13.5	300	5.49	0.088	0	0.62	21.52	58.5	
0925	3.99	15.0	300	5.53	0.084	0	0.53	21.53	58.6	
0930	3.99	16.5	300	5.49	0.082	0	0.49	21.55	59.9	
0935	3.99	18.0	300	5.52	0.083	0	0.46	21.59	60.4	
0940	3.99	19.5	300	5.49	0.080	0	0.35	21.64	61.9	
0945	Sample collected MS/MSD									

SIGNATURE(S): Scott R. McGuire

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-13S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-13S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Date: 7/15/03								
Time: 1455								
Method:	DK BRN	5.11	0.061	23.00	> 1000	0.14	55.2	

PURGE DATA

Date: 7/15/03
Method: Peristaltic
Monitor Reading (ppm): 0
Well Casing Diameter:
Well Casing Material: 2" PVC
Total Well Depth (TD in feet): 12.0
Static Water Level (WL in feet): 3.49
One Casing Volume(gal/L): 6.3
Start Purge (hrs): 1325
End Purge (hrs): 1450
Total Purge Time (min): 85
Total Vol. Purged (gal/L): 34.0

See Attached Low Flow Purge Data Sheet for Purge Data

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Laboratory	Collected
Total Arsenic SW846 6010B	HNO3	1-500 ml bottle	Accutest	✓

OBSERVATIONS / NOTES

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327
LAB:
COC #:

Check if Collected:

☐ MS / MSD ☐ DUPLICATE / ID No.: NONE

Signature(s): Scott R. McGuire

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-135
PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/15/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1325	3.49		400							
1330	3.71	2.0	400	5.44	0.063	Er3	0.51	22.72	55.2	Turbidity Er3 > 1000
1335	3.71	4.0	400	5.31	0.062	Er3	0.38	22.71	54.2	
1340	3.71	6.0	400	5.26	0.061	Er3	0.27	22.68	53.6	
1345		8.0	400	5.21	0.062	Er3	0.23	22.71	56.4	
1350		10.0	400	5.19	0.061	Er3	0.19	22.79	58.2	
1355		12.0	400	5.10	0.060	Er3	0.11	22.86	60.1	
1400		14.0	400	5.09	0.060	Er3	0.09	22.92	60.9	
1405		16.0	400	5.00	0.059	Er3	0.08	22.93	62.1	
1410		18.0	400	5.02	0.061	Er3	0.09	22.89	60.4	
1415		20.0	400	5.03	0.062	Er3	0.10	22.78	59.9	
1420		24.0	400	5.05	0.060	Er3	0.09	27.64	58.6	
1430		~~25.0~~ 28.0	400	5.07	0.059	Er3	0.11	22.41	57.9	
1440		30.0	400	5.08	0.060	Er3	0.12	22.19	57.1	
1450		34.0	400	5.11	0.061	Er3	0.14	23.00	55.2	
1455	Sample collected									

SIGNATURE(S): Scott R. McG

Tetra Tech NUS, Inc. **GROUNDWATER SAMPLE LOG SHEET**

Project / Site:	Cecil Field Site 15	Sample ID No.:	CEF-015-GW-14S-02
Project No.:	N7653.CA0.05A.440	Sample Location:	CEF-015-14S

[X] Monitoring Well
[ ] Domestic Well
[ ] Other:

Sampler: S. McGuire

SAMPLING DATA

Date: 7/16/03	Color	pH S.U.	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/L	ORP mV	
Time: 1005								
Method:	Clear	5.08	0.082	22.48	0	0.54	178.0	

PURGE DATA

Date: 7/16/03	See Attached Low Flow Purge Data Sheet for Purge Data
Method: Peristaltic	
Monitor Reading (ppm): 0	
Well Casing Diameter:	
Well Casing Material: 2" PVC	
Total Well Depth (TD in feet): 12.0	
Static Water Level (WL in feet): 4.67	
One Casing Volume(gal/L): 6.3	
Start Purge (hrs): 0910	
End Purge (hrs): 1000	
Total Purge Time (min): 50	
Total Vol. Purged (gal/L): 20.0	

SAMPLE COLLECTION INFORMATION

Analysis		Preservative	Container Requirements	Laboratory	Collected
Energetics	SW846 8330	none	2-1 ~~1-2~~ liter bottle	Accutest	✓

OBSERVATIONS / NOTES

LAB INFO

LAB: Accutest
4405 Vineland Rd. C-15
Orlando, FL 32811
COC #: 2327
LAB:
COC #:

Check if Collected:

☐ MS / MSD ☐ DUPLICATE / ID No.: None

Signature(s): Scott R. McG.

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NAS CECIL FIELD SITE 15 WELL ID.: CEF-015-145
PROJECT NUMBER: 7653.CA0.05A.440 DATE: 7/16/03

Time (Hrs.)	Water Level (Ft. below TOC)	Cum. Vol. (liters)	Flow (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0910	4.67		400							
0915	4.84	2.0	400	5.20	0.079	7.97	3.55	22.27	165.5	
0920	4.85	4.0	400	5.04	0.078	4.21	0.47	22.25	187.2	
0925	4.85	6.0	400	5.06	0.079	1.9	0.49	22.29	180.4	
0930	4.85	8.0	400	5.07	0.080	0.97	0.50	22.34	172.5	
0935	4.85	10.0	400	5.08	0.081	0	0.47	22.40	169.9	
0940	4.85	12.0	400	5.09	0.082	0	0.46	22.52	167.8	
0945	4.85	14.0	400	4.99	0.083	0	0.51	22.48	189.8	
0950	4.85	16.0	400	5.05	0.083	0	0.53	22.49	183.4	
0955	4.85	18.0	400	5.07	0.081	0	0.52	22.51	180.5	
1000	4.85	20.0	400	5.08	0.082	0	0.54	22.48	178.0	
1005	Sample collected									

SIGNATURE(S): Scott R. McGi

TETRA TECH NUS, INC. | **CHAIN OF CUSTODY** | **NUMBER** 2327 | **PAGE** 1 **OF** 1

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
N7653, CTL 39	SITE 15, NASCF	MARK SPERANZA	412 721 ~~408~~ 7116	ACCUTEST SUE BELL
SAMPLERS (SIGNATURE)		**FIELD OPERATIONS LEADER**	**PHONE NUMBER**	**ADDRESS**
Scott R. McGuire		MEER DARK	904 636 6125	4405 Vineland Rd. C-15
		CARRIER/WAYBILL NUMBER		**CITY, STATE**
				ORLANDO, FL 32811

STANDARD TAT ☐
RUSH TAT ☒
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G G P P

PRESERVATIVE USED: None, None, None, HNO3, HNO3

DATE YEAR 2003	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PAHS SW846 8310	PAHS with carbazole SW846 8310	NITRO AROMATICS SW846 8330	TOTAL LEAD SW846 6010B	TOTAL ARSENIC SW846 6010B				COMMENTS
7/15	0945	CEF-015-GW-125-02				GW	G	6			6						Cool to 4°C
7/15	1120	CEF-015-GW-105-02				GW	G	1				1					
7/15	1225	CEF-015-GW-095-02				GW	G	2	2								Work Release
7/15	1455	CEF-015-GW-135-02				GW	G	1					1				NOC39-WR365
7/16	0240	CEF-015-GW-115-02				GW	G	4	~~2~~	2	2						
7/16	0100	CEF-015-GW-Dup-02				GW	G	4	~~2~~	2	2						
7/16	1005	CEF-015-GW-145-02				GW	G	2			2						
7/16	1020	CEF-015-GW-025-02				GW	G	2	2								

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
Scott R. McGuire	7/16/03	1500			
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

APPENDIX C

ANALYTICAL LABORATORY RESULTS

C.1 APRIL 2000 SAMPLING ANALYTICAL LABORATORY RESULTS

C.2 MAY 2000 RE-SAMPLING ANALYTICAL LABORATORY RESULTS

C.3 JULY 2003 SAMPLING ANALYTICAL LABORATORY RESULTS

C.1 APRIL 2000 SAMPLING ANALYTICAL LABORATORY RESULTS

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-05-0-044

TO: **MARK SPERANZA** **DATE: MAY 25, 2000**

FROM: **JUSTIN ORBICH** **CC: DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – PAH/EXP**
CTO 039 – NAS CECIL FIELD
SDG F6312

SAMPLES: 7/Aqueous

CEF-15-GW-1S-01
CEF-15-GW-3S-01
CEF-15-GW-7S-01
CEF-15-GW-DUP-01
CEF-15-GW-2S-01
CEF-15-GW-6S-01
CEF-15-GW-8S-01

OVERVIEW

The sample set for CTO 039, SDG F6312 Naval Air Station (NAS) Cecil Field; Florida consists of seven (7) aqueous environmental samples. The samples were analyzed for Polynuclear Aromatic Hydrocarbon (PAH) and select explosive organic compounds. One (1) field duplicate pair (CEF-15-GW-1S-01/CEF-15-GW-DUP-01) was included within this SDG.

The sample was collected by Tetra Tech, NUS on April 18th and 19th, 2000 and analyzed by Accutest Laboratories. All analyses were performed in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria and analyzed according to SW 846 Method 8310 and 8330 analytical and reporting protocols. The data in this SDG was validated with regard to the following parameters:

- Data Completeness
- * Holding Times
- * Initial/continuing calibrations
- * Laboratory method/field quality control blank results
- * Field Duplicate Precision
- * Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified analytical results are presented in Appendix A.

PAH FRACTION

All quality control parameters were met for this fraction.

EXP FRACTION

It should be noted that the laboratory analyzed for the full explosive list of compounds, however, the Chain Of Custody (COC) requested 3-nitrotoluene, 2,4,6-trinitrotoluene, and 4-nitrotoluene.

MEMO TO: MARK SPERANZA
DATE: MAY 25, 2000 – PAGE 2

It should be noted that 3-nitrotoluene was labeled incorrectly as 3-nitroaniline on the electronic deliverables. The Validator corrected 3-nitroaniline to correctly read 3-nitrotoluene.

EXECUTIVE SUMMARY

Laboratory performance: The laboratory analyzed for the full explosive list, however only selected compounds were to be analyzed.

Other Factors Affecting Data Quality: None.

MEMO TO: MARK SPERANZA
DATE: MAY 25, 2000 – PAGE 3

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (October, 1999), and the NFESC guidelines "Navy Installation Restoration Program Laboratory Quality Assurance Guide" (February, 1996). The text of this report has been formulated to address only those problems affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Justin Orbich

Chemist/Data Validator
Tetra Tech, NUS

Joseph A. Samchuck

Data Validation Quality Assurance Officer
Tetra Tech, NUS

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

PITT-05-0-043

TO: **MARK SPERANZA** **DATE: MAY 25, 2000**

FROM: **JUSTIN ORBICH** **CC: DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – PAH/EXP**
CTO 039 – NAS CECIL FIELD
SDG F6306

SAMPLES: 2/Aqueous

CEF-15-GW-4S-01 CEF-15-GW-5S-01

OVERVIEW

The sample set for CTO 039, SDG F6306 Naval Air Station (NAS) Cecil Field; Florida consists of two (2) aqueous environmental samples. The samples were analyzed for Polynuclear Aromatic Hydrocarbon (PAH) and explosive organic compounds. No field duplicate pairs were included within this SDG.

The sample was collected by Tetra Tech, NUS on April 17th, 2000 and analyzed by Accutest Laboratories. All analyses were performed in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria and analyzed according to SW 846 Method 8310 and 8330 analytical and reporting protocols. The data in this SDG was validated with regard to the following parameters:

* • Data Completeness
* • Holding Times
* • Initial/continuing calibrations
* • Laboratory method/field quality control blank results
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified analytical results are presented in Appendix A.

PAH FRACTION

All quality control parameters were met for this fraction.

EXP FRACTION

It should be noted that the laboratory analyzed for the full explosive list of compounds, however, the Chain Of Custody (COC) requested 3-nitrotoluene, 2,4,6-trinitrotoluene, and 4-nitrotoluene.

It should be noted that 3-nitrotoluene was labeled incorrectly as 3-nitroaniline on the electronic deliverables. The Validator corrected 3-nitroaniline to correctly read 3-nitrotoluene.

MEMO TO: MARK SPERANZA
DATE: MAY 25, 2000 – PAGE 2

EXECUTIVE SUMMARY

Laboratory performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (October, 1999), and the NFESC guidelines "Navy Installation Restoration Program Laboratory Quality Assurance Guide" (February, 1996). The text of this report has been formulated to address only those problems affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Justin Orbich

Chemist/Data Validator
Tetra Tech, NUS

Joseph A. Samchuck

Data Validation Quality Assurance Officer
Tetra Tech, NUS

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

DATA QUALIFIER DEFINITIONS:

U - Value is a nondetected result as reported by the laboratory and should not be considered present.

J - Positive result is estimated as a result of a value below the CRQL or a technical noncompliance.

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-1S-01			CEF-15-GW-2S-01			CEF-15-GW-3S-01			CEF-15-GW-6S-01		
SAMPLE DATE:	04/18/00			04/18/00			04/18/00			04/18/00		
LABORATORY ID:	F6312-1			F6312-3			F6312-5			F6312-7		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
EXPLOSIVES												
2,4,6-TRINITROTOLUENE	3.9	U		5.0	U		5.0	U		5.0	U	
3-NITROTOLUENE	3.9	U		5.0	U		5.0	U		5.0	U	
4-NITROTOLUENE	3.9	U		5.0	U		5.0	U		5.0	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-7S-01			CEF-15-GW-8S-01			CEF-15-GW-DUP-01					
SAMPLE DATE:	04/18/00			04/19/00			04/19/00			/ /		
LABORATORY ID:	F6312-9			F6312-11			F6312-13					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	0.0 %			0.0 %			0.0 %			100.0 %		
UNITS:	UG/L			UG/L			UG/L					
FIELD DUPLICATE OF:							CEF-15-GW-1S-01					
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
EXPLOSIVES												
2,4,6-TRINITROTOLUENE	18	U		6.5	U		3.9	U				
3-NITROTOLUENE	18	U		6.5	U		3.9	U				
4-NITROTOLUENE	18	U		6.5	U		3.9	U				

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-1S-01			CEF-15-GW-2S-01			CEF-15-GW-3S-01			CEF-15-GW-6S-01		
SAMPLE DATE:	04/18/00			04/18/00			04/18/00			04/18/00		
LABORATORY ID:	F6312-1			F6312-3			F6312-5			F6312-7		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2	U		2.2	U		2.2	U		2.2	U	
2-METHYLNAPHTHALENE	2	U		2.2	U		2.2	U		2.2	U	
ACENAPHTHENE	2	U		2.2	U		2.2	U		2.2	U	
ACENAPHTHYLENE	2	U		2.2	U		2.2	U		2.2	U	
ANTHRACENE	2	U		2.2	U		2.2	U		2.2	U	
BENZO(A)ANTHRACENE	0.2	U		0.22	U		0.22	U		0.22	U	
BENZO(A)PYRENE	0.2	U		0.22	U		0.22	U		0.22	U	
BENZO(B)FLUORANTHENE	0.2	U		0.22	U		0.22	U		0.22	U	
BENZO(G,H,I)PERYLENE	0.2	U		0.22	U		0.22	U		0.22	U	
BENZO(K)FLUORANTHENE	0.2	U		0.22	U		0.22	U		0.22	U	
CHRYSENE	0.2	U		0.22	U		0.22	U		0.22	U	
DIBENZO(A,H)ANTHRACENE	0.2	U		0.22	U		0.22	U		0.22	U	
FLUORANTHENE	2	U		2.2	U		2.2	U		2.2	U	
FLUORENE	2	U		2.2	U		2.2	U		2.2	U	
INDENO(1,2,3-CD)PYRENE	0.2	U		0.22	U		0.22	U		0.22	U	
NAPHTHALENE	2	U		2.2	U		2.2	U		2.2	U	
PHENANTHRENE	2	U		2.2	U		2.2	U		2.2	U	
PYRENE	2	U		2.2	U		2.2	U		2.2	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-7S-01			CEF-15-GW-8S-01			CEF-15-GW-DUP-01					
SAMPLE DATE:	04/18/00			04/19/00			04/19/00			/ /		
LABORATORY ID:	F6312-9			F6312-11			F6312-13					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	0.0 %			0.0 %			0.0 %			100.0 %		
UNITS:	UG/L			UG/L			UG/L					
FIELD DUPLICATE OF:							CEF-15-GW-1S-01					
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2.2	U		2	U		2	U				
2-METHYLNAPHTHALENE	2.2	U		2	U		2	U				
ACENAPHTHENE	2.2	U		2	U		2	U				
ACENAPHTHYLENE	2.2	U		2	U		2	U				
ANTHRACENE	2.2	U		2	U		2	U				
BENZO(A)ANTHRACENE	0.22	U		0.2	U		0.2	U				
BENZO(A)PYRENE	0.22	U		0.2	U		0.2	U				
BENZO(B)FLUORANTHENE	0.22	U		0.2	U		0.2	U				
BENZO(G,H,I)PERYLENE	0.22	U		0.2	U		0.2	U				
BENZO(K)FLUORANTHENE	0.22	U		0.2	U		0.2	U				
CHRYSENE	0.22	U		0.2	U		0.2	U				
DIBENZO(A,H)ANTHRACENE	0.22	U		0.2	U		0.2	U				
FLUORANTHENE	2.2	U		2	U		2	U				
FLUORENE	2.2	U		2	U		2	U				
INDENO(1,2,3-CD)PYRENE	0.22	U		0.2	U		0.2	U				
NAPHTHALENE	2.2	U		2	U		2	U				
PHENANTHRENE	2.2	U		2	U		2	U				
PYRENE	2.2	U		2	U		2	U				

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6306

SAMPLE NUMBER:	CEF-15-GW-4S-01	CEF-15-GW-5S-01		
SAMPLE DATE:	04/17/00	04/17/00	/ /	/ /
LABORATORY ID:	F6306-1	F6306-3		
QC_TYPE:	NORMAL	NORMAL		
% SOLIDS:	0.0 %	0.0 %	100.0 %	100.0 %
UNITS:	UG/L	UG/L		
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2.2	U		2	U							
2-METHYLNAPHTHALENE	2.2	U		2	U							
ACENAPHTHENE	2.2	U		2	U							
ACENAPHTHYLENE	2.2	U		2	U							
ANTHRACENE	2.2	U		2	U							
BENZO(A)ANTHRACENE	0.22	U		0.2	U							
BENZO(A)PYRENE	0.22	U		0.2	U							
BENZO(B)FLUORANTHENE	0.22	U		0.2	U							
BENZO(G,H,I)PERYLENE	0.22	U		0.2	U							
BENZO(K)FLUORANTHENE	0.22	U		0.2	U							
CHRYSENE	0.22	U		0.2	U							
DIBENZO(A,H)ANTHRACENE	0.22	U		0.2	U							
FLUORANTHENE	2.2	U		2	U							
FLUORENE	2.2	U		2	U							
INDENO(1,2,3-CD)PYRENE	0.22	U		0.2	U							
NAPHTHALENE	2.2	U		2	U							
PHENANTHRENE	2.2	U		2	U							
PYRENE	2.2	U		2	U							

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6306

SAMPLE NUMBER:	CEF-15-GW-4S-01	CEF-15-GW-5S-01		
SAMPLE DATE:	04/17/00	04/17/00	/ /	/ /
LABORATORY ID:	F6306-1	F6306-3		
QC_TYPE:	NORMAL	NORMAL		
% SOLIDS:	0.0 %	0.0 %	100.0 %	100.0 %
UNITS:	UG/L	UG/L		
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
EXPLOSIVES												
2,4,6-TRINITROTOLUENE	5.2	U		5.2	U							
3-NITROTOLUENE	5.2	U		5.2	U							
4-NITROTOLUENE	5.2	U		5.2	U							

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**MAY 16, 2000**
FROM:	**GRETCHEN PHIPPS**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TOTAL AND FILTERED ANTIMONY, ARSENIC AND LEAD**
CTO 039 - CECIL FIELD
SDGs – F6306 AND F6312

SAMPLES: 18/Aqueous/

CEF-15-GW-4S-01	CEF-15-GW-4S-01-F
CEF-15-GW-5S-01	CEF-15-GW-5S-01-F
CEF-15-GW-1S-01	CEF-15-GW-1S-01-F
CEF-15-GW-2S-01	CEF-15-GW-2S-01-F
CEF-15-GW-3S-01	CEF-15-GW-3S-01-F
CEF-15-GW-6S-01	CEF-15-GW-6S-01-F
CEF-15-GW-7S-01	CEF-15-GW-7S-01-F
CEF-15-GW-8S-01	CEF-15-GW-8S-01-F
CEF-15-GW-DUP-01	CEF-15-GW-DUP-01-F

Overview

The sample set for CTO 039, Cecil Field, SDGs F6306 and F6312 consists of eighteen (18) aqueous environmental samples. Two (2) field duplicate pairs (CEF-15-GW-1S-01 / CEF-15-GW-DUP-01 and CEF-15-GW-1S-01-F / CEF-15-GW-DUP-01-F) were included within these SDGs.

All samples, with exception to those designated –F, were analyzed for antimony, arsenic and lead. The samples designated –F were analyzed for dissolved antimony, dissolved arsenic and dissolved lead. The samples were collected by Tetra Tech NUS on April 17 and 18, 2000 and analyzed by Accutest Laboratory under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control (QA / QC) criteria. Metals analyses were analyzed using SW 846 method 6010B.

The data was evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Verifications
• Laboratory Blank Analyses
* • Field Duplicate Results
* • Detection Limits

* - All quality control criteria were met for this parameter.

Laboratory Blank Analyses

The following contaminants were present in a laboratory method / preparation blanks at the following maximum concentrations:

Affected samples: All

Analyte	Maximum Concentration	Action Level (aqueous)
Antimony	5.0 µg/L	25.0 µg/L
Lead	1.7 µg/L	8.5 µg/L

An action level of 5X the maximum concentration has been used to evaluate the sample data for blank contamination. Sample aliquot and dilution factors were taken into consideration when determining blank contamination. Positive results less than the blank action level for antimony and lead were qualified, "U", as a result of blank contamination.

Executive Summary

Laboratory Performance: Antimony and lead were present in the laboratory method / preparation blanks.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide." (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Gretchen A. Phipps

Tetra Tech NUS
Gretchen A. Phipps

Tetra Tech NUS
Joseph A. Samchuck
Quality Control Officer

Attachments:

1. Appendix A - Qualified Analytical Data
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A
QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6306

SAMPLE NUMBER:	CEF-15-GW-4S-01			CEF-15-GW-4S-01-F			CEF-15-GW-5S-01			CEF-15-GW-5S-01-F		
SAMPLE DATE:	04/17/00			04/17/00			04/17/00			04/17/00		
LABORATORY ID:	F6306-1			F6306-2			F6306-3			F6306-4		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ANTIMONY	2.4	U		2.4	U		3.3	U	A	2.4	U	
ARSENIC	3.4	U		3.4	U		3.9			3.4	U	
LEAD	1.6	U		1.6	U		1.6	U		1.6	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-1S-01			CEF-15-GW-1S-01-F			CEF-15-GW-2S-01			CEF-15-GW-2S-01-F		
SAMPLE DATE:	04/18/00			04/18/00			04/18/00			04/18/00		
LABORATORY ID:	F6312-1			F6312-2			F6312-3			F6312-4		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ANTIMONY	2.4	U		2.4	U		2.4	U		2.9	U	A
ARSENIC	3.4	U		3.4	U		3.4	U		3.4	U	
LEAD	19.8			1.6	U		1.6	U		1.6	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-3S-01			CEF-15-GW-3S-01-F			CEF-15-GW-6S-01			CEF-15-GW-6S-01-F		
SAMPLE DATE:	04/18/00			04/18/00			04/18/00			04/18/00		
LABORATORY ID:	F6312-5			F6312-6			F6312-7			F6312-8		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ANTIMONY	2.9	U	A	2.4	U		2.4	U		2.4	U	
ARSENIC	3.4	U		3.4	U		3.4	U		3.4	U	
LEAD	2.1	U	A	1.6	U		1.6	U		1.6	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-7S-01			CEF-15-GW-7S-01-F			CEF-15-GW-8S-01			CEF-15-GW-8S-01-F		
SAMPLE DATE:	04/18/00			04/18/00			04/19/00			04/19/00		
LABORATORY ID:	F6312-9			F6312-10			F6312-11			F6312-12		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	0.0 %			0.0 %			0.0 %			0.0 %		
UNITS:	UG/L			UG/L			UG/L			UG/L		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ANTIMONY	2.4	U		2.4	U		42.9			46.2		
ARSENIC	3.4	U		3.4	U		3.4	U		3.4	U	
LEAD	1.6	U		1.6	U		2.3	U	A	1.6	U	

CTO039-NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6312

SAMPLE NUMBER:	CEF-15-GW-DUP-01	CEF-15-GW-DUP-01-F		
SAMPLE DATE:	04/19/00	04/19/00	/ /	/ /
LABORATORY ID:	F6312-13	F6312-14		
QC_TYPE:	NORMAL	NORMAL		
% SOLIDS:	0.0 %	0.0 %	100.0 %	100.0 %
UNITS:	UG/L	UG/L		
FIELD DUPLICATE OF:	CEF-15-GW-1S-01	CEF-15-GW-1S-01-F		

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
ANTIMONY	2.4	U		2.4	U							
ARSENIC	3.4	U		3.4	U							
LEAD	21.7			1.6	U							

APPENDIX B
RESULTS AS REPORTED BY THE LABORATORY

Sample Summary

Tetra Tech, NUS

Job No: F6312

NAS Cecil Field-Site 15
Project No: WORK RELEASE# 13

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
F6312-1	04/18/00	16:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-1S-01
F6312-2	04/18/00	16:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-1S-01-F
F6312-3	04/18/00	14:28	LK	04/20/00	AQ	Ground Water	CEF-15-GW-2S-01
F6312-4	04/18/00	14:28	LK	04/20/00	AQ	Ground Water	CEF-15-GW-2S-01-F
F6312-5	04/18/00	11:15	LK	04/20/00	AQ	Ground Water	CEF-15-GW-3S-01
F6312-6	04/18/00	11:15	LK	04/20/00	AQ	Ground Water	CEF-15-GW-3S-01-F
F6312-7	04/18/00	12:08	LK	04/20/00	AQ	Ground Water	CEF-15-GW-6S-01
F6312-8	04/18/00	12:08	LK	04/20/00	AQ	Ground Water	CEF-15-GW-6S-01-F
F6312-9	04/18/00	16:45	LK	04/20/00	AQ	Ground Water	CEF-15-GW-7S-01
F6312-10	04/18/00	16:45	LK	04/20/00	AQ	Ground Water	CEF-15-GW-7S-01-F
F6312-11	04/19/00	13:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-8S-01
F6312-12	04/19/00	13:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-8S-01-F
F6312-13	04/19/00	00:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-DUP-01

Sample Summary
(continued)

Tetra Tech, NUS

Job No: F6312

NAS Cecil Field-Site 15
Project No: WORK RELEASE# 13

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
F6312-14	04/19/00	00:00	LK	04/20/00	AQ	Ground Water	CEF-15-GW-DUP-01-F

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-01		
Lab Sample ID:	F6312-1	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000931.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.0	ug/l	
208-96-8	Acenaphthylene	ND	2.0	ug/l	
120-12-7	Anthracene	ND	2.0	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.20	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.20	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.20	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.20	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.20	ug/l	
218-01-9	Chrysene	ND	0.20	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.20	ug/l	
206-44-0	Fluoranthene	ND	2.0	ug/l	
86-73-7	Fluorene	ND	2.0	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.20	ug/l	
91-20-3	Naphthalene	ND	2.0	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.0	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.0	ug/l	
85-01-8	Phenanthrene	ND	2.0	ug/l	
129-00-0	Pyrene	ND	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	87%		45-130%
92-94-4	p-Terphenyl	90%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-01		
Lab Sample ID:	F6312-1	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	3.9	ug/l	
121-82-4	RDX	ND	3.9	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	3.9	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	3.9	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	3.9	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	3.9	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	3.9	ug/l	
78-11-5	PETN	ND	3.9	ug/l	
98-95-3	Nitrobenzene	ND	3.9	ug/l	
88-72-2	o-Nitrotoluene	ND	3.9	ug/l	
99-08-1	m-Nitrotoluene	ND	3.9	ug/l	
99-99-0	p-Nitrotoluene	ND	3.9	ug/l	
479-45-8	Tetryl	ND	3.9	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	3.9	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	3.9	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	59%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-01		
Lab Sample ID:	F6312-1	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	19.8	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-01-F		
Lab Sample ID:	F6312-2	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-2S-01		
Lab Sample ID:	F6312-3	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000932.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.2	ug/l	
208-96-8	Acenaphthylene	ND	2.2	ug/l	
120-12-7	Anthracene	ND	2.2	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.22	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.22	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.22	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.22	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.22	ug/l	
218-01-9	Chrysene	ND	0.22	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.22	ug/l	
206-44-0	Fluoranthene	ND	2.2	ug/l	
86-73-7	Fluorene	ND	2.2	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.22	ug/l	
91-20-3	Naphthalene	ND	2.2	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.2	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.2	ug/l	
85-01-8	Phenanthrene	ND	2.2	ug/l	
129-00-0	Pyrene	ND	2.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	92%		45-130%
92-94-4	p-Terphenyl	96%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-2S-01		
Lab Sample ID:	F6312-3	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	5.0	ug/l	
121-82-4	RDX	ND	5.0	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	5.0	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	5.0	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	5.0	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	5.0	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	5.0	ug/l	
78-11-5	PETN	ND	5.0	ug/l	
98-95-3	Nitrobenzene	ND	5.0	ug/l	
88-72-2	o-Nitrotoluene	ND	5.0	ug/l	
99-08-1	m-Nitrotoluene	ND	5.0	ug/l	
99-99-0	p-Nitrotoluene	ND	5.0	ug/l	
479-45-8	Tetryl	ND	5.0	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	5.0	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	5.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	61%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-2S-01		
Lab Sample ID:	F6312-3	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-2S-01-F		
Lab Sample ID:	F6312-4	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.9 B	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-3S-01		
Lab Sample ID:	F6312-5	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000933.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.2	ug/l	
208-96-8	Acenaphthylene	ND	2.2	ug/l	
120-12-7	Anthracene	ND	2.2	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.22	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.22	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.22	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.22	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.22	ug/l	
218-01-9	Chrysene	ND	0.22	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.22	ug/l	
206-44-0	Fluoranthene	ND	2.2	ug/l	
86-73-7	Fluorene	ND	2.2	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.22	ug/l	
91-20-3	Naphthalene	ND	2.2	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.2	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.2	ug/l	
85-01-8	Phenanthrene	ND	2.2	ug/l	
129-00-0	Pyrene	ND	2.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	87%		45-130%
92-94-4	p-Terphenyl	94%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-3S-01		
Lab Sample ID:	F6312-5	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	5.0	ug/l	
121-82-4	RDX	ND	5.0	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	5.0	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	5.0	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	5.0	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	5.0	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	5.0	ug/l	
78-11-5	PETN	ND	5.0	ug/l	
98-95-3	Nitrobenzene	ND	5.0	ug/l	
88-72-2	o-Nitrotoluene	ND	5.0	ug/l	
99-08-1	m-Nitrotoluene	ND	5.0	ug/l	
99-99-0	p-Nitrotoluene	ND	5.0	ug/l	
479-45-8	Tetryl	ND	5.0	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	5.0	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	5.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	52%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-3S-01		
Lab Sample ID:	F6312-5	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.9 B	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	2.1 B	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-3S-01-F		
Lab Sample ID:	F6312-6	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-6S-01		
Lab Sample ID:	F6312-7	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000934.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.2	ug/l	
208-96-8	Acenaphthylene	ND	2.2	ug/l	
120-12-7	Anthracene	ND	2.2	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.22	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.22	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.22	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.22	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.22	ug/l	
218-01-9	Chrysene	ND	0.22	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.22	ug/l	
206-44-0	Fluoranthene	ND	2.2	ug/l	
86-73-7	Fluorene	ND	2.2	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.22	ug/l	
91-20-3	Naphthalene	ND	2.2	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.2	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.2	ug/l	
85-01-8	Phenanthrene	ND	2.2	ug/l	
129-00-0	Pyrene	ND	2.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	92%		45-130%
92-94-4	p-Terphenyl	98%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-6S-01		
Lab Sample ID:	F6312-7	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	5.0	ug/l	
121-82-4	RDX	ND	5.0	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	5.0	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	5.0	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	5.0	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	5.0	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	5.0	ug/l	
78-11-5	PETN	ND	5.0	ug/l	
98-95-3	Nitrobenzene	ND	5.0	ug/l	
88-72-2	o-Nitrotoluene	ND	5.0	ug/l	
99-08-1	m-Nitrotoluene	ND	5.0	ug/l	
99-99-0	p-Nitrotoluene	ND	5.0	ug/l	
479-45-8	Tetryl	ND	5.0	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	5.0	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	5.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	69%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-6S-01		
Lab Sample ID:	F6312-7	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-6S-01-F		
Lab Sample ID:	F6312-8	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-7S-01		
Lab Sample ID:	F6312-9	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000936.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.2	ug/l	
208-96-8	Acenaphthylene	ND	2.2	ug/l	
120-12-7	Anthracene	ND	2.2	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.22	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.22	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.22	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.22	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.22	ug/l	
218-01-9	Chrysene	ND	0.22	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.22	ug/l	
206-44-0	Fluoranthene	ND	2.2	ug/l	
86-73-7	Fluorene	ND	2.2	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.22	ug/l	
91-20-3	Naphthalene	ND	2.2	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.2	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.2	ug/l	
85-01-8	Phenanthrene	ND	2.2	ug/l	
129-00-0	Pyrene	ND	2.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	90%		45-130%
92-94-4	p-Terphenyl	92%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-7S-01		
Lab Sample ID:	F6312-9	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	18	ug/l	
121-82-4	RDX	ND	18	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	18	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	18	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	18	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	18	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	18	ug/l	
78-11-5	PETN	ND	18	ug/l	
98-95-3	Nitrobenzene	ND	18	ug/l	
88-72-2	o-Nitrotoluene	ND	18	ug/l	
99-08-1	m-Nitrotoluene	ND	18	ug/l	
99-99-0	p-Nitrotoluene	ND	18	ug/l	
479-45-8	Tetryl	ND	18	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	18	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	18	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	76%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-7S-01		
Lab Sample ID:	F6312-9	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-7S-01-F		
Lab Sample ID:	F6312-10	Date Sampled:	04/18/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-8S-01		
Lab Sample ID:	F6312-11	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000937.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.0	ug/l	
208-96-8	Acenaphthylene	ND	2.0	ug/l	
120-12-7	Anthracene	ND	2.0	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.20	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.20	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.20	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.20	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.20	ug/l	
218-01-9	Chrysene	ND	0.20	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.20	ug/l	
206-44-0	Fluoranthene	ND	2.0	ug/l	
86-73-7	Fluorene	ND	2.0	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.20	ug/l	
91-20-3	Naphthalene	ND	2.0	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.0	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.0	ug/l	
85-01-8	Phenanthrene	ND	2.0	ug/l	
129-00-0	Pyrene	ND	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	90%		45-130%
92-94-4	p-Terphenyl	96%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-8S-01		
Lab Sample ID:	F6312-11	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	6.5	ug/l	
121-82-4	RDX	ND	6.5	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	6.5	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	6.5	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	6.5	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	6.5	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	6.5	ug/l	
78-11-5	PETN	ND	6.5	ug/l	
98-95-3	Nitrobenzene	ND	6.5	ug/l	
88-72-2	o-Nitrotoluene	ND	6.5	ug/l	
99-08-1	m-Nitrotoluene	ND	6.5	ug/l	
99-99-0	p-Nitrotoluene	ND	6.5	ug/l	
479-45-8	Tetryl	ND	6.5	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	6.5	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	6.5	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	44%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-8S-01		
Lab Sample ID:	F6312-11	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	42.9	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	2.3 B	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-8S-01-F		
Lab Sample ID:	F6312-12	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	46.2	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-DUP-01		
Lab Sample ID:	F6312-13	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000938.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.0	ug/l	
208-96-8	Acenaphthylene	ND	2.0	ug/l	
120-12-7	Anthracene	ND	2.0	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.20	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.20	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.20	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.20	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.20	ug/l	
218-01-9	Chrysene	ND	0.20	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.20	ug/l	
206-44-0	Fluoranthene	ND	2.0	ug/l	
86-73-7	Fluorene	ND	2.0	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.20	ug/l	
91-20-3	Naphthalene	ND	2.0	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.0	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.0	ug/l	
85-01-8	Phenanthrene	ND	2.0	ug/l	
129-00-0	Pyrene	ND	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	81%		45-130%
92-94-4	p-Terphenyl	87%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-DUP-01		
Lab Sample ID:	F6312-13	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	3.9	ug/l	
121-82-4	RDX	ND	3.9	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	3.9	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	3.9	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	3.9	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	3.9	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	3.9	ug/l	
78-11-5	PETN	ND	3.9	ug/l	
98-95-3	Nitrobenzene	ND	3.9	ug/l	
88-72-2	o-Nitrotoluene	ND	3.9	ug/l	
99-08-1	m-Nitrotoluene	ND	3.9	ug/l	
99-99-0	p-Nitrotoluene	ND	3.9	ug/l	
479-45-8	Tetryl	ND	3.9	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	3.9	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	3.9	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	30%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-DUP-01		
Lab Sample ID:	F6312-13	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	21.7	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-DUP-01-F		
Lab Sample ID:	F6312-14	Date Sampled:	04/19/00
Matrix:	AQ - Ground Water	Date Received:	04/20/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/24/00	04/25/00	JK	SW846 6010A

RL = Reporting Limit

Sample Summary

Tetra Tech, NUS

Job No: F6306

NAS Cecil Field-Site 15
Project No: WORK RELEASE# CF-13

Sample Number	Collected Date	Time By	Received	Matrix Code	Matrix Type	Client Sample ID
F6306-1	04/17/00	17:30 MD	04/19/00	AQ	Ground Water	CEF-15-GW-4S-01
F6306-2	04/17/00	17:30 MD	04/19/00	AQ	Ground Water	CEF-15-GW-4S-01-F
F6306-3	04/17/00	15:50 MD	04/19/00	AQ	Ground Water	CEF-15-GW-5S-01
F6306-4	04/17/00	15:50 MD	04/19/00	AQ	Ground Water	CEF-15-GW-5S-01-F

Report of Analysis

Client Sample ID:	CEF-15-GW-4S-01		
Lab Sample ID:	F6306-1	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000939.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.2	ug/l	
208-96-8	Acenaphthylene	ND	2.2	ug/l	
120-12-7	Anthracene	ND	2.2	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.22	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.22	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.22	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.22	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.22	ug/l	
218-01-9	Chrysene	ND	0.22	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.22	ug/l	
206-44-0	Fluoranthene	ND	2.2	ug/l	
86-73-7	Fluorene	ND	2.2	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.22	ug/l	
91-20-3	Naphthalene	ND	2.2	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.2	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.2	ug/l	
85-01-8	Phenanthrene	ND	2.2	ug/l	
129-00-0	Pyrene	ND	2.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	94%		45-130%
92-94-4	p-Terphenyl	106%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-4S-01		
Lab Sample ID:	F6306-1	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	5.2	ug/l	
121-82-4	RDX	ND	5.2	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	5.2	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	5.2	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	5.2	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	5.2	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	5.2	ug/l	
78-11-5	PETN	ND	5.2	ug/l	
98-95-3	Nitrobenzene	ND	5.2	ug/l	
88-72-2	o-Nitrotoluene	ND	5.2	ug/l	
99-08-1	m-Nitrotoluene	ND	5.2	ug/l	
99-99-0	p-Nitrotoluene	ND	5.2	ug/l	
479-45-8	Tetryl	ND	5.2	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	5.2	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	5.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	56%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-4S-01		
Lab Sample ID:	F6306-1	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-4S-01-F		
Lab Sample ID:	F6306-2	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-5S-01		
Lab Sample ID:	F6306-3	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
Method:	EPA 8310	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA000940.D	1	04/27/00	CCJ	04/21/00	OP1471	GAA45
Run #2							

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	2.0	ug/l	
208-96-8	Acenaphthylene	ND	2.0	ug/l	
120-12-7	Anthracene	ND	2.0	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.20	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.20	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.20	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.20	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.20	ug/l	
218-01-9	Chrysene	ND	0.20	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.20	ug/l	
206-44-0	Fluoranthene	ND	2.0	ug/l	
86-73-7	Fluorene	ND	2.0	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.20	ug/l	
91-20-3	Naphthalene	ND	2.0	ug/l	
90-12-0	1-Methylnaphthalene	ND	2.0	ug/l	
91-57-6	2-Methylnaphthalene	ND	2.0	ug/l	
85-01-8	Phenanthrene	ND	2.0	ug/l	
129-00-0	Pyrene	ND	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	95%		45-130%
92-94-4	p-Terphenyl	90%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-5S-01		
Lab Sample ID:	F6306-3	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
Method:	SW846 8330	Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1		1	04/25/00	AMA	04/24/00	M:OP1897	M:GC1749
Run #2							

CAS No.	Compound	Result	RL	Units	Q
2691-41-0	HMX	ND	5.2	ug/l	
121-82-4	RDX	ND	5.2	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	5.2	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	5.2	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	5.2	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	5.2	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	5.2	ug/l	
78-11-5	PETN	ND	5.2	ug/l	
98-95-3	Nitrobenzene	ND	5.2	ug/l	
88-72-2	o-Nitrotoluene	ND	5.2	ug/l	
99-08-1	m-Nitrotoluene	ND	5.2	ug/l	
99-99-0	p-Nitrotoluene	ND	5.2	ug/l	
479-45-8	Tetryl	ND	5.2	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	5.2	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	5.2	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
528-29-0	o-Dinitrobenzene	54%		50-150%

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	CEF-15-GW-5S-01		
Lab Sample ID:	F6306-3	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	3.3 B	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.9 B	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-5S-01-F		
Lab Sample ID:	F6306-4	Date Sampled:	04/17/00
Matrix:	AQ - Ground Water	Date Received:	04/19/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Antimony	2.4 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Arsenic	3.4 U	10.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A
Lead	1.6 U	5.0	ug/l	1	04/21/00	04/24/00	JK	SW846 6010A

RL = Reporting Limit

C.2 MAY 2000 RE-SAMPLING ANALYTICAL LABORATORY RESULTS

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**JUNE 9, 2000**
FROM:	**JENNIFER M. MALLE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION –FILTERED AND UNFILTERED LEAD**
CTO-039 NAS CECIL FIELD
SDG- F6607

SAMPLES: 1/Aqueous/

CEF-15-GW-1S-02

Overview

The sample set for CTO 039, NAS Cecil Field SDG F6607 includes one (1) aqueous environmental sample. There were no field duplicate pairs included within this SDG.

Sample CEF-15-GW-1S-02 was anlayzed for filtered and unfiltered lead. The sample was collected by Tetra Tech NUS on May 22, 2000 and analyzed by Accutest Laboratories in accordance with Naval Facilities Engineering Service Center (NFESC) Navy Installation Restoration Laboratory Quality Assurance Guide, (February 1996). Lead analysis was conducted under SW846 method 6010B.

The data was evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Initial and Continuing Calibration Verifications
• Laboratory Blank Analyses
* • Detection Limits

* - All quality control criteria were met for this parameter.

Laboratory Blank Analyses

The following contaminant was detected in the laboratory method/preparation blanks at the following maximum concentration:

Affected samples : All

Analyte	Maximum Concentration	Action Level (aqueous)
Lead	2.0 ug/L	10.0 ug/L

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot and dilution factors were taken into consideration in evaluation for blank contamination. The positive result less than the action level for lead was qualified as nondetected, "U", for laboratory blank contamination.

Notes

The Contract Required Detection Limit (CRDL) Percent Recovery (%R) for lead was greater than the 120% quality control limit. However, validation action was not required as per regional guidelines.

Executive Summary

Laboratory Performance: Lead was present in the laboratory method/preparation blanks.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS
Jennifer M. Malle
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

Qualified Analytical Results

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCB D% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = % Solid content is less than 30%

CTO(NAS CECIL FIELD
WATER DATA
Accutest, NJ
SDG: F6607

SAMPLE NUMBER:	CEF-15-GW-1S-02			CEF-15-GW-1S-02-F								
SAMPLE DATE:	05/22/00			05/22/00			/ /			/ /		
LABORATORY ID:	F6607-1			F6607-2								
QC_TYPE:	NORMAL			NORMAL								
% SOLIDS:	0.0 %			0.0 %			100.0 %			100.0 %		
UNITS:	UG/L			UG/L								
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	9.0	U	A	1.6	U							

APPENDIX B

Results as Reported by the Laboratory

Sample Summary

Tetra Tech, NUS

Job No: F6607

NAS Cecil Field-Site 15
Project No: WORK RELEASE# 13

Sample Number	Collected Date	Time By	Received	Matrix Code	Type	Client Sample ID
F6607-1	05/22/00	18:16 LK	05/24/00	AQ	Ground Water	CEF-15-GW-1S-02
F6607-2	05/22/00	18:16 LK	05/24/00	AQ	Groundwater Filtered	CEF-15-GW-1S-02F

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-02		
Lab Sample ID:	F6607-1	Date Sampled:	05/22/00
Matrix:	AQ - Ground Water	Date Received:	05/24/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Lead	9.0	5.0	ug/l	1	05/25/00	05/31/00	JK	SW846 6010A

RL = Reporting Limit

Report of Analysis

Client Sample ID:	CEF-15-GW-1S-02F		
Lab Sample ID:	F6607-2	Date Sampled:	05/22/00
Matrix:	AQ - Groundwater Filtered	Date Received:	05/24/00
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	Units	DF	Prep	Analyzed	By	Method
Lead	1.6 U	5.0	ug/l	1	05/25/00	05/31/00	JK	SW846 6010A

RL = Reporting Limit

C.3 JULY 2003 SAMPLING ANALYTICAL LABORATORY RESULTS

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**SEPTEMBER 5, 2003**
FROM:	**BERNARD F SPADA III**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION- SVOC/PAH/EXP**
CTO 039, NAS CECIL FIELD
SDG F18605/F18801

SAMPLES: 6/Aqueous

CEF-015-GW-02S-02*	CEF-015-GW-09S-02*	CEF-015-GW-11S-02*#
CEF-015-GW-12S-02#	CEF-015-GW-14S-02#	CEF-015-GW-DUP-02*#

2/Soil

CEF-015-SS-DU22	CEF-015-SU-904-03

OVERVIEW

The sample set for CTO 039, NAS Cecil Field, SDG F18605/F18801 consists of five (5) environmental aqueous samples, one (1) environmental soil sample, and two (2) field duplicates. The soil samples were analyzed for total petroleum hydrocarbons (TPH). The samples denoted with an asterisk (*) were analyzed for polynuclear aromatic hydrocarbons (PAH). The samples denoted with a pound sign (#) were analyzed for explosives (EXP). Samples CEF-015-GW-11S-02 and CEF-015-GW-DUP-02 were also analyzed for carbazole. The field duplicate pairs included in this SDG are (CEF-015-GW-DUP-02 / CEF-015-GW-11S-02) and (CEF-015-SS-DU22 / CEF-015-SU-904-03).

The samples were collected by TetraTech NUS on July 15, 16, and 29, 2003 and analyzed by Accutest Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Methods 8270C, 8270 SIM, and 8330 and Florida-PRO analytical and reporting protocols. The data contained in this SDG were validated with regard to the following parameters:

* • Data completeness
* • Holding times
* • Initial and continuing calibration
* • Laboratory method and field quality control blank results
* • Field Duplicate Precision
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A.

SVOC

No qualifications were assigned to this fraction.

PAH

No qualifications were assigned to this fraction.

EXP

No qualifications were assigned to this fraction.

TPH

The percent solids were <30% in the EDD for both samples. The percent solids listed on the Form I's were entered into the database and used for validadion.

EXECUTIVE SUMMARY

Laboratory Performance Issues: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (10/99) and the NFESC guidelines (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Bernard F Spada III

Tetra Tech NUS
Bernard F Spada III
Chemist/Data Validator

TetraTech NUS
Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = % Difference between columns/detectors >25% for positive results determined via GC/HPLC
V = Non-linear calibrations; correlation coefficient $r < 0.995$
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: OS

nsample	CEF-015-GW-11S-02	nsample	CEF-015-GW-DUP-02
samp_date	7/16/2003	samp_date	7/16/2003
lab_id	F18605-5	lab_id	F18605-6
qc_type	NM	qc_type	NM
units	UG/L	units	UG/L
Pct_Solids	0	Pct_Solids	0
DUP_OF:		DUP_OF:	CEF-015-GW-11S-02

Parameter	Result	Val Qual	Qual Code
CARBAZOLE	1.1	U	

Parameter	Result	Val Qual	Qual Code
CARBAZOLE	1.1	U	

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: PAH

nsample	CEF-015-GW-02S-02	nsample	CEF-015-GW-09S-02	nsample	CEF-015-GW-11S-02
samp_date	7/16/2003	samp_date	7/15/2003	samp_date	7/16/2003
lab_id	F18605-8	lab_id	F18605-3	lab_id	F18605-5
qc_type	NM	qc_type	NM	qc_type	NM
units	UG/L	units	UG/L	units	UG/L
Pct_Solids	0	Pct_Solids	0	Pct_Solids	0
DUP_OF:		DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.27	U	
2-METHYLNAPHTHALENE	0.27	U	
ACENAPHTHENE	0.53	U	
ACENAPHTHYLENE	0.53	U	
ANTHRACENE	0.27	U	
BENZO(A)ANTHRACENE	0.11	U	
BENZO(A)PYRENE	0.11	U	
BENZO(B)FLUORANTHENE	0.11	U	
BENZO(G,H,I)PERYLENE	0.11	U	
BENZO(K)FLUORANTHENE	0.11	U	
CHRYSENE	0.11	U	
DIBENZO(A,H)ANTHRACENE	0.11	U	
FLUORANTHENE	0.27	U	
FLUORENE	0.27	U	
INDENO(1,2,3-CD)PYRENE	0.11	U	
NAPHTHALENE	0.27	U	
PHENANTHRENE	0.27	U	
PYRENE	0.27	U	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.26	U	
2-METHYLNAPHTHALENE	0.26	U	
ACENAPHTHENE	0.52	U	
ACENAPHTHYLENE	0.52	U	
ANTHRACENE	0.26	U	
BENZO(A)ANTHRACENE	0.1	U	
BENZO(A)PYRENE	0.1	U	
BENZO(B)FLUORANTHENE	0.1	U	
BENZO(G,H,I)PERYLENE	0.1	U	
BENZO(K)FLUORANTHENE	0.1	U	
CHRYSENE	0.1	U	
DIBENZO(A,H)ANTHRACENE	0.1	U	
FLUORANTHENE	0.26	U	
FLUORENE	0.26	U	
INDENO(1,2,3-CD)PYRENE	0.1	U	
NAPHTHALENE	0.26	U	
PHENANTHRENE	0.26	U	
PYRENE	0.26	U	

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.26	U	
2-METHYLNAPHTHALENE	0.26	U	
ACENAPHTHENE	0.53	U	
ACENAPHTHYLENE	0.53	U	
ANTHRACENE	0.26	U	
BENZO(A)ANTHRACENE	0.11	U	
BENZO(A)PYRENE	0.11	U	
BENZO(B)FLUORANTHENE	0.11	U	
BENZO(G,H,I)PERYLENE	0.11	U	
BENZO(K)FLUORANTHENE	0.11	U	
CHRYSENE	0.11	U	
DIBENZO(A,H)ANTHRACENE	0.11	U	
FLUORANTHENE	0.26	U	
FLUORENE	0.26	U	
INDENO(1,2,3-CD)PYRENE	0.11	U	
NAPHTHALENE	0.26	U	
PHENANTHRENE	0.26	U	
PYRENE	0.26	U	

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: PAH

nsample	CEF-015-GW-DUP-02
samp_date	7/16/2003
lab_id	F18605-6
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	CEF-015-GW-11S-02

Parameter	Result	Val Qual	Qual Code
1-METHYLNAPHTHALENE	0.27	U	
2-METHYLNAPHTHALENE	0.27	U	
ACENAPHTHENE	0.53	U	
ACENAPHTHYLENE	0.53	U	
ANTHRACENE	0.27	U	
BENZO(A)ANTHRACENE	0.11	U	
BENZO(A)PYRENE	0.11	U	
BENZO(B)FLUORANTHENE	0.11	U	
BENZO(G,H,I)PERYLENE	0.11	U	
BENZO(K)FLUORANTHENE	0.11	U	
CHRYSENE	0.11	U	
DIBENZO(A,H)ANTHRACENE	0.11	U	
FLUORANTHENE	0.27	U	
FLUORENE	0.27	U	
INDENO(1,2,3-CD)PYRENE	0.11	U	
NAPHTHALENE	0.27	U	
PHENANTHRENE	0.27	U	
PYRENE	0.27	U	

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: EXP

nsample	CEF-015-GW-11S-02	nsample	CEF-015-GW-12S-02	nsample	CEF-015-GW-14S-02
samp_date	7/16/2003	samp_date	7/15/2003	samp_date	7/16/2003
lab_id	F18605-5	lab_id	F18605-1	lab_id	F18605-7
qc_type	NM	qc_type	NM	qc_type	NM
units	UG/L	units	UG/L	units	UG/L
Pct_Solids	0	Pct_Solids	0	Pct_Solids	0
DUP_OF:		DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
1,3,5-TRINITROBENZENE	0.054	U	
1,3-DINITROBENZENE	0.054	U	
2,4,6-TRINITROTOLUENE	0.054	U	
2,4-DINITROTOLUENE	0.054	U	
2,6-DINITROTOLUENE	0.054	U	
2-AMINO-4,6-DINITROTOLUENE	0.054	U	
2-NITROTOLUENE	0.054	U	
3-NITROTOLUENE	0.054	U	
4-AMINO-2,6-DINITROTOLUENE	0.054	U	
4-NITROTOLUENE	0.081	U	
HMX	0.081	U	
NITROBENZENE	0.054	U	
RDX	0.081	U	
TETRYL	0.081	U	

Parameter	Result	Val Qual	Qual Code
1,3,5-TRINITROBENZENE	0.054	U	
1,3-DINITROBENZENE	0.054	U	
2,4,6-TRINITROTOLUENE	0.054	U	
2,4-DINITROTOLUENE	0.054	U	
2,6-DINITROTOLUENE	0.054	U	
2-AMINO-4,6-DINITROTOLUENE	0.054	U	
2-NITROTOLUENE	0.054	U	
3-NITROTOLUENE	0.054	U	
4-AMINO-2,6-DINITROTOLUENE	0.054	U	
4-NITROTOLUENE	0.081	U	
HMX	0.081	U	
NITROBENZENE	0.054	U	
RDX	0.081	U	
TETRYL	0.081	U	

Parameter	Result	Val Qual	Qual Code
1,3,5-TRINITROBENZENE	0.054	U	
1,3-DINITROBENZENE	0.054	U	
2,4,6-TRINITROTOLUENE	0.054	U	
2,4-DINITROTOLUENE	0.054	U	
2,6-DINITROTOLUENE	0.054	U	
2-AMINO-4,6-DINITROTOLUENE	0.054	U	
2-NITROTOLUENE	0.054	U	
3-NITROTOLUENE	0.054	U	
4-AMINO-2,6-DINITROTOLUENE	0.054	U	
4-NITROTOLUENE	0.081	U	
HMX	0.081	U	
NITROBENZENE	0.054	U	
RDX	0.081	U	
TETRYL	0.081	U	

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: EXP

nsample	CEF-015-GW-DUP-02
samp_date	7/16/2003
lab_id	F18605-6
qc_type	NM
units	UG/L
Pct_Solids	0
DUP_OF:	CEF-015-GW-11S-02

Parameter	Result	Val Qual	Qual Code
1,3,5-TRINITROBENZENE	0.053	U	
1,3-DINITROBENZENE	0.053	U	
2,4,6-TRINITROTOLUENE	0.053	U	
2,4-DINITROTOLUENE	0.053	U	
2,6-DINITROTOLUENE	0.053	U	
2-AMINO-4,6-DINITROTOLUENE	0.053	U	
2-NITROTOLUENE	0.053	U	
3-NITROTOLUENE	0.053	U	
4-AMINO-2,6-DINITROTOLUENE	0.053	U	
4-NITROTOLUENE	0.08	U	
HMX	0.08	U	
NITROBENZENE	0.053	U	
RDX	0.08	U	
TETRYL	0.08	U	

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-11S-02		
Lab Sample ID:	F18605-5	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	L018120.D	1	07/29/03	ME	07/23/03	OP8049	SL980
Run #2							

	Initial Volume	Final Volume
Run #1	940 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
86-74-8	Carbazole	ND	5.3	1.1	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	65%		49-119%
321-60-8	2-Fluorobiphenyl	67%		45-118%
1718-51-0	Terphenyl-d14	71%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-DUP-02		
Lab Sample ID:	F18605-6	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	L018121.D	1	07/29/03	ME	07/23/03	OP8049	SL980
Run #2							

	Initial Volume	Final Volume
Run #1	920 ml	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
86-74-8	Carbazole	ND	5.4	1.1	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	77%		49-119%
321-60-8	2-Fluorobiphenyl	81%		45-118%
1718-51-0	Terphenyl-d14	76%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-02S-02		
Lab Sample ID:	F18605-8	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C BY SIM SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	W016250.D	1	07/18/03	SKW	07/18/03	OP8006	SW850
Run #2							

	Initial Volume	Final Volume
Run #1	940 ml	1.0 ml
Run #2		

BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	1.1	0.53	ug/l	
208-96-8	Acenaphthylene	ND	1.1	0.53	ug/l	
120-12-7	Anthracene	ND	1.1	0.27	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.21	0.11	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.21	0.11	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.21	0.11	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.21	0.11	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.21	0.11	ug/l	
218-01-9	Chrysene	ND	0.21	0.11	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.21	0.11	ug/l	
206-44-0	Fluoranthene	ND	1.1	0.27	ug/l	
86-73-7	Fluorene	ND	1.1	0.27	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.21	0.11	ug/l	
90-12-0	1-Methylnaphthalene	ND	1.1	0.27	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.1	0.27	ug/l	
91-20-3	Naphthalene	ND	1.1	0.27	ug/l	
85-01-8	Phenanthrene	ND	1.1	0.27	ug/l	
129-00-0	Pyrene	ND	1.1	0.27	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	62%		49-119%
321-60-8	2-Fluorobiphenyl	68%		45-118%
1718-51-0	Terphenyl-d14	85%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-09S-02		
Lab Sample ID:	F18605-3	**Date Sampled:**	07/15/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C BY SIM SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	W016245.D	1	07/18/03	SKW	07/18/03	OP8006	SW850
Run #2							

	Initial Volume	Final Volume
Run #1	970 ml	1.0 ml
Run #2		

BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	1.0	0.52	ug/l	
208-96-8	Acenaphthylene	ND	1.0	0.52	ug/l	
120-12-7	Anthracene	ND	1.0	0.26	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.21	0.10	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.21	0.10	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.21	0.10	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.21	0.10	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.21	0.10	ug/l	
218-01-9	Chrysene	ND	0.21	0.10	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.21	0.10	ug/l	
206-44-0	Fluoranthene	ND	1.0	0.26	ug/l	
86-73-7	Fluorene	ND	1.0	0.26	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.21	0.10	ug/l	
90-12-0	1-Methylnaphthalene	ND	1.0	0.26	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.0	0.26	ug/l	
91-20-3	Naphthalene	ND	1.0	0.26	ug/l	
85-01-8	Phenanthrene	ND	1.0	0.26	ug/l	
129-00-0	Pyrene	ND	1.0	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	75%		49-119%
321-60-8	2-Fluorobiphenyl	81%		45-118%
1718-51-0	Terphenyl-d14	86%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-11S-02		
Lab Sample ID:	F18605-5	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C BY SIM SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	W016248.D	1	07/18/03	SKW	07/18/03	OP8006	SW850
Run #2							

	Initial Volume	Final Volume
Run #1	950 ml	1.0 ml
Run #2		

BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	1.1	0.53	ug/l	
208-96-8	Acenaphthylene	ND	1.1	0.53	ug/l	
120-12-7	Anthracene	ND	1.1	0.26	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.21	0.11	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.21	0.11	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.21	0.11	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.21	0.11	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.21	0.11	ug/l	
218-01-9	Chrysene	ND	0.21	0.11	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.21	0.11	ug/l	
206-44-0	Fluoranthene	ND	1.1	0.26	ug/l	
86-73-7	Fluorene	ND	1.1	0.26	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.21	0.11	ug/l	
90-12-0	1-Methylnaphthalene	ND	1.1	0.26	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.1	0.26	ug/l	
91-20-3	Naphthalene	ND	1.1	0.26	ug/l	
85-01-8	Phenanthrene	ND	1.1	0.26	ug/l	
129-00-0	Pyrene	ND	1.1	0.26	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	94%		49-119%
321-60-8	2-Fluorobiphenyl	84%		45-118%
1718-51-0	Terphenyl-d14	95%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-DUP-02		
Lab Sample ID:	F18605-6	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8270C BY SIM SW846 3510C	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	W016249.D	1	07/18/03	SKW	07/18/03	OP8006	SW850
Run #2							

	Initial Volume	Final Volume
Run #1	940 ml	1.0 ml
Run #2		

BN PAH List

CAS No.	Compound	Result	RL	MDL	Units	Q
83-32-9	Acenaphthene	ND	1.1	0.53	ug/l	
208-96-8	Acenaphthylene	ND	1.1	0.53	ug/l	
120-12-7	Anthracene	ND	1.1	0.27	ug/l	
56-55-3	Benzo(a)anthracene	ND	0.21	0.11	ug/l	
50-32-8	Benzo(a)pyrene	ND	0.21	0.11	ug/l	
205-99-2	Benzo(b)fluoranthene	ND	0.21	0.11	ug/l	
191-24-2	Benzo(g,h,i)perylene	ND	0.21	0.11	ug/l	
207-08-9	Benzo(k)fluoranthene	ND	0.21	0.11	ug/l	
218-01-9	Chrysene	ND	0.21	0.11	ug/l	
53-70-3	Dibenzo(a,h)anthracene	ND	0.21	0.11	ug/l	
206-44-0	Fluoranthene	ND	1.1	0.27	ug/l	
86-73-7	Fluorene	ND	1.1	0.27	ug/l	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	0.21	0.11	ug/l	
90-12-0	1-Methylnaphthalene	ND	1.1	0.27	ug/l	
91-57-6	2-Methylnaphthalene	ND	1.1	0.27	ug/l	
91-20-3	Naphthalene	ND	1.1	0.27	ug/l	
85-01-8	Phenanthrene	ND	1.1	0.27	ug/l	
129-00-0	Pyrene	ND	1.1	0.27	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
4165-60-0	Nitrobenzene-d5	100%		49-119%
321-60-8	2-Fluorobiphenyl	91%		45-118%
1718-51-0	Terphenyl-d14	99%		46-135%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-11S-02		
Lab Sample ID:	F18605-5	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8330A SW846 3535A	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GG007070.D	1	07/24/03	NJ	07/22/03	OP8038	GGG349
Run #2							

	Initial Volume	Final Volume
Run #1	930 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
2691-41-0	HMX	ND	0.22	0.081	ug/l	
121-82-4	RDX	ND	0.22	0.081	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	0.22	0.054	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	0.22	0.054	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
98-95-3	Nitrobenzene	ND	0.22	0.054	ug/l	
88-72-2	o-Nitrotoluene	ND	0.22	0.054	ug/l	
99-08-1	m-Nitrotoluene	ND	0.22	0.054	ug/l	
99-99-0	p-Nitrotoluene	ND	0.22	0.081	ug/l	
479-45-8	Tetryl	ND	0.22	0.081	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	0.22	0.054	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	0.22	0.054	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
610-39-9	3,4-Dinitrotoluene	94%		51-137%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-12S-02		
Lab Sample ID:	F18605-1	**Date Sampled:**	07/15/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8330A SW846 3535A	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GG007069.D	1	07/24/03	NJ	07/22/03	OP8038	GGG349
Run #2							

	Initial Volume	Final Volume
Run #1	930 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
2691-41-0	HMX	ND	0.22	0.081	ug/l	
121-82-4	RDX	ND	0.22	0.081	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	0.22	0.054	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	0.22	0.054	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
98-95-3	Nitrobenzene	ND	0.22	0.054	ug/l	
88-72-2	o-Nitrotoluene	ND	0.22	0.054	ug/l	
99-08-1	m-Nitrotoluene	ND	0.22	0.054	ug/l	
99-99-0	p-Nitrotoluene	ND	0.22	0.081	ug/l	
479-45-8	Tetryl	ND	0.22	0.081	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	0.22	0.054	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	0.22	0.054	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
610-39-9	3,4-Dinitrotoluene	96%		51-137%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-14S-02		
Lab Sample ID:	F18605-7	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8330A SW846 3535A	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GG007072.D	1	07/24/03	NJ	07/22/03	OP8038	GGG349
Run #2							

	Initial Volume	Final Volume
Run #1	930 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
2691-41-0	HMX	ND	0.22	0.081	ug/l	
121-82-4	RDX	ND	0.22	0.081	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	0.22	0.054	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	0.22	0.054	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	0.22	0.054	ug/l	
98-95-3	Nitrobenzene	ND	0.22	0.054	ug/l	
88-72-2	o-Nitrotoluene	ND	0.22	0.054	ug/l	
99-08-1	m-Nitrotoluene	ND	0.22	0.054	ug/l	
99-99-0	p-Nitrotoluene	ND	0.22	0.081	ug/l	
479-45-8	Tetryl	ND	0.22	0.081	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	0.22	0.054	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	0.22	0.054	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
610-39-9	3,4-Dinitrotoluene	96%		51-137%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-DUP-02		
Lab Sample ID:	F18605-6	**Date Sampled:**	07/16/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
Method:	SW846 8330A SW846 3535A	**Percent Solids:**	n/a
Project:	NAS Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	GG007071.D	1	07/24/03	NJ	07/22/03	OP8038	GGG349
Run #2							

	Initial Volume	Final Volume
Run #1	940 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
2691-41-0	HMX	ND	0.21	0.080	ug/l	
121-82-4	RDX	ND	0.21	0.080	ug/l	
99-65-0	1,3-Dinitrobenzene	ND	0.21	0.053	ug/l	
606-20-2	2,6-Dinitrotoluene	ND	0.21	0.053	ug/l	
121-14-2	2,4-Dinitrotoluene	ND	0.21	0.053	ug/l	
35572-78-2	2-amino-4,6-Dinitrotoluene	ND	0.21	0.053	ug/l	
19406-51-0	4-amino-2,6-Dinitrotoluene	ND	0.21	0.053	ug/l	
98-95-3	Nitrobenzene	ND	0.21	0.053	ug/l	
88-72-2	o-Nitrotoluene	ND	0.21	0.053	ug/l	
99-08-1	m-Nitrotoluene	ND	0.21	0.053	ug/l	
99-99-0	p-Nitrotoluene	ND	0.21	0.080	ug/l	
479-45-8	Tetryl	ND	0.21	0.080	ug/l	
99-35-4	1,3,5-Trinitrobenzene	ND	0.21	0.053	ug/l	
118-96-7	2,4,6-Trinitrotoluene	ND	0.21	0.053	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
610-39-9	3,4-Dinitrotoluene	94%		51-137%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**SEPTEMBER 5, 2003**
FROM:	**BERNARD F SPADA III**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – METALS PARAMETERS**
CTO-039 NAS CECIL FIELD
SAMPLE DELIVERY GROUP (SDG) – F18605

SAMPLES: 2/Aqueous

CEF-015-GW-10S-02 CEF-015-GW-13S-02

Overview

The sample set for CTO 039, NAS Cecil Field, SDG F18605, consists of two (2) environmental aqueous samples.

Sample CEF-015-GW-10S-02 was analyzed for lead and sample CEF-015-GW-13S-02 was analyzed for arsenic. The samples were collected by TetraTech NUS on July 15, 2003 and analyzed Katahdin Analytical Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Metals analyses were conducted using SW 846 method 6010B.

These data were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Recoveries
• Laboratory Blank Analyses
* • Detection Limits

* - All quality control criteria were met for this parameter.

Holding Times

All holding times were met.

Laboratory Blank Analyses

The following contaminant was detected in the laboratory method blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Lead	4.5 µg/L	22.5 µg/L

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. The positive result less than the action level for lead was qualified "U" as a result of blank contamination.

Executive Summary

Laboratory Performance: Qualification was made based on method blank contamination.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", July 2002 and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Bernard F Spada III

Tetra Tech NUS
Bernard F. Spada III
Environmental Scientist

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration Noncompliance (i.e., % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
C01 = GC/MS Tuning Noncompliance
D = MS/MSD Recovery Noncompliance
E = LCS/LCSD Recovery Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - includes ICS % R Noncompliance
L = Instrument Calibration Range Exceedance
M = Sample Preservation Noncompliance
N = Internal Standard Noncompliance
N01 = Internal Standard Recovery Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues; i.e.chromatography,interferences, etc.)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = % Difference between columns/detectors >25% for positive results determined via GC/HPLC
V = Non-linear calibrations; correlation coefficient $r < 0.995$
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

PROJ_NO: 7653

SDG: F18605 MEDIA: WATER DATA FRACTION: M

nsample	CEF-015-GW-10S-02	nsample	CEF-015-GW-13S-02
samp_date	7/15/2003	samp_date	7/15/2003
lab_id	F18605-2	lab_id	F18605-4
qc_type	NM	qc_type	NM
units	UG/L	units	UG/L
Pct_Solids	0	Pct_Solids	0
DUP_OF:		DUP_OF:	

Parameter	Result	Val Qual	Qual Code
LEAD	3.4	U	A

Parameter	Result	Val Qual	Qual Code
ARSENIC	13.7		

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-10S-02		
Lab Sample ID:	F18605-2	**Date Sampled:**	07/15/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method	Prep Method
Lead	3.4 B	5.0	1.2	ug/l	1	07/21/03	07/22/03 DM	SW846 6010B	SW846 3010A

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but <RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-GW-13S-02		
Lab Sample ID:	F18605-4	**Date Sampled:**	07/15/03
Matrix:	AQ - Ground Water	**Date Received:**	07/16/03
		Percent Solids:	n/a
Project:	NAS Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method	Prep Method
Arsenic	13.7	10	2.8	ug/l	1	07/21/03	07/22/03	DM	SW846 6010B	SW846 3010A

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 2327 | PAGE 1 OF 1

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
N7653, CTO 39	SITE 15, NASCF	MARK SPERANZA	412 921 ~~4089~~ 8116	ACCUTEST SUE BELL
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
Scott R. McGuire		MERV DALE	904 636 6125	4405 Vineland Rd. Q85
		CARRIER/WAYBILL NUMBER		CITY, STATE
				ORLANDO, FL 32811

STANDARD TAT ☐
RUSH TAT ☒
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☒ 14 day

F18605

	DATE YEAR	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS	PAHS SW846 8310	PAHS with carbazole SW846 8310	NITRO AROMATICS SW846 8330	TOTAL LEAD SW846 6010B	TOTAL ARSENIC SW846 6010B				COMMENTS
CONTAINER TYPE PLASTIC (P) or GLASS (G)										G	G	G	P	P				
PRESERVATIVE USED										None	None	None	HNO_3	HNO_3				
1	7/16	0945	CEF-015-GW-12S-02				GW	G	6			6						Cool to 4°C
2	7/15	1120	CEF-015-GW-10S-02				GW	G	1				1					
3	7/15	1225	CEF-015-GW-09S-02				GW	G	2	2								Work Release
4	7/15	1455	CEF-015-GW-13S-02				GW	G	1				~~SPM~~	1				N0039-WR365
5	7/16	0840	CEF-015-GW-11S-02				GW	G	4	~~2~~ SPM	2	2						
6	7/16	0000	CEF-015-GW-Dup-02				GW	G	4	~~2~~ SPM	2	2						
7	7/16	1005	CEF-015-GW-14S-02				GW	G	2			2						
8	7/16	1220	CEF-015-GW-02S-02				GW	G	2	2								
			SPM								SPM							

1. RELINQUISHED BY Scott R. McGuire	DATE 7/16/03	TIME 1500	1. RECEIVED BY Accutest Courier	DATE	TIME
2. RELINQUISHED BY Accutest Courier	DATE	TIME	2. RECEIVED BY [illegible]	DATE 7/16/03	TIME 1920.
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY) 4/02R

A.2 SUPPLEMENT TO GROUNDWATER TECHNICAL MEMORANDUM FOR NO FURTHER ACTION

TECHNICAL MEMORANDUM

SUPPLEMENT TO
TECHNICAL MEMORANDUM FOR NO FURTHER GROUNDWATER MONITORING
SITE 15 FEASIBILITY STUDY REPORT
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

APRIL 2007

1.0 Status

The groundwater at Site 15 was identified as requiring No Further Action (NFA) as described in the Technical Memorandum for No Further Groundwater Monitoring provided as Appendix A.1 of the Site 15 Feasibility Study (FS) (TtNUS, 2001). However, prior to the final submission of the FS, the United States Environmental Protection Agency (U.S. EPA) Maximum Contaminant Level (MCL) and the Florida Department of Environmental Protection (FDEP) Groundwater Cleanup Target Level (GCTL) for arsenic were revised. In response to the revised groundwater criteria, a complete review of the database was conducted. The re-evaluation of the database identified the following:

- The 1995 groundwater monitoring results at two locations exceeded the FDEP RDX GCTL of 0.3 µg/L, with detected concentrations of 0.451 µg/L at monitoring well CEF-015-01S and 0.404 µg/L at monitoring well CEF-015-05S. In addition, the same 1995 monitoring data indicated that 4,4'-DDE exceeded its GCTL of 0.1 µg/L with a detected concentration of 0.26 µg/L at well CEF-015-05S.

- The MCL and GCTL for arsenic were revised from 50 to 10 µg/L. Monitoring well CEF-015-13S sampled in July 2003 had an unfiltered arsenic result of 13.7 µg/L, in excess of the newly established criteria.

Actions conducted to address these identified exceedances are described below.

1.1 RDX and 4,4'-DDE

To evaluate the 1995 exceedances of RDX and 4,4-DDE, monitoring wells MW01S and MW05S, which had since been abandoned, were reinstalled and resampled in August 2006 (TtNUS, 2006). Results of that resampling showed that RDX and 4,4-DDE were no longer detected at these two locations in excess of their respective analytical detection limits of 0.07 µg/L and 0.02 µg/L. Therefore, the GCTL exceedances of RDX and 4.4'-DDE were not confirmed, and no further action regarding RDX and 4-4-DDE is required.

1.2 Arsenic

The arsenic U.S. EPA MCL and FDEP GCTL during the Remedial Investigation (RI) phase and during the initial preparation of the FS were both 50 µg/L. Subsequently, the arsenic MCL and GCTL were revised to 10 µg/L. At that time, the maximum filtered arsenic concentration was 13.7 µg/L detected at well CEF-015-13S in July 2003. The following is a summary of events conducted to investigate this potential exceedance:

- **July 15, 2003**. The groundwater sample collected at CEF-015-13S had a turbidity reading greater than 1,000 nephelometric turbidity units (NTUs) and was identified as dark brown. The other six samples collected at Site 15 on this date were identified as clear with turbidity readings of 0 NTUs (except CEF-015-11S, which was 6.2 NTUs). The unfiltered arsenic result at CEF-015-13S was 13.7

µg/L. Because all groundwater results were less than applicable criteria at that time [and in accordance with the Technical Memorandum for Groundwater No Further Action (TtNUS, 2001)], CEF-015-13S was abandoned along with all other monitoring wells at Site 15.

- **November 18, 2005**. Based on the new MCL and GCTL for arsenic, monitoring well CEF-015-15S was installed at the same location as abandoned monitoring well CEF-015-13S. CEF-015-15S was reported as a 2-inch-diameter well screened from 2 to 12 feet below ground surface (bgs). Filtered and unfiltered groundwater samples were collected on November 22, 2005 for arsenic analysis. The turbidity was greater than 999 NTUs (exceeding the limits of the turbidity meter) at the beginning of purging and 500 NTUs just prior to collection of the unfiltered sample. Arsenic was detected in the filtered or unfiltered sample, but detection limits were elevated due to interferences. The detection limit for the unfiltered sample was 16.5 µg/L, and the detection limit for the filtered sample was 8 µg/L.

- **March 2006**. Due to the elevated detection limit, which was greater than the arsenic MCL and FDEP GCTL in the unfiltered sample, and the inability to obtain a quality (non-turbid) groundwater sample, monitoring well CEF-015-15S was redeveloped in an attempt to reduce the turbidity of the groundwater. Note that the well was identified as CEF-015-13S in field log book and on the chain of custody form. Field personnel were unable to obtain clear development water. Filtered and unfiltered groundwater samples were collected on March 15, 2006. The turbidity was too high to obtain an accurate reading (greater than 999 NTUs), and the sample described as dark brown. The unfiltered arsenic result was 14.7 µg/L, and the filtered result was 3.5 µg/L.

- Based on the inability to develop the monitoring well to obtain a clear sample, a microwell with a pre-packed screen and a fine sand pack was installed using direct push technology (DPT) on March 17, 2006 to a depth of 12 feet bgs and identified as CEF-015-13S(R). During development, clear groundwater could not be obtained. Filtered and unfiltered groundwater samples were collected on March 21, 2006. The arsenic result was 22.4 µg/L for the unfiltered sample, and arsenic was detected in the filtered sample at a detection limit of 2.9 µg/L.

- **April 2006 to February 2007.** The NAS Cecil Field Base Realignment and Closure (BRAC) Cleanup Team (BCT) had several discussions regarding the high turbidity observed in the area being discussed and how to collect a groundwater sample that was representative of typical conditions observed across the rest of Site 15 (i.e., low turbidity samples). The BCT made a decision to install a 2-inch well with a larger diameter fine sand pack (30/45) and smaller screen slot size (0.006-inch), and additional efforts would be taken to assure proper installation and development. The well, identified as CEF-015-16S, was installed on February 14, 2007.

- Monitoring well CEF-015-16S was developed 48 hours after installation. The development water was described as muddy. Over a 5-day period, approximately 370 gallons of water with turbidity readings that exceeded the limits of the meter (greater than 999 NTUs) were removed. An additional 420 gallons of water with turbidity readings between 908 NTUs and 104.2 NTUs were removed prior to sampling on February 28, 2007. Filtered and unfiltered groundwater samples were collected. The turbidity at time of sample collection was 112 NTUs, and the water was described as yellow. The arsenic results for both the filtered and unfiltered samples were less than detection limits (2.8 µg/L for both).

It was identified that the earlier samples with elevated turbidity readings collected through March 2006 should not have been submitted for analysis based on the elevated turbidity readings, and if the turbidity could not have been reduced, the well should have been identified as not producing an acceptable groundwater sample. Based on the filtered sample results, it is evident that the unfiltered samples would have been less than the criteria if the turbidity was not significantly elevated.

The unfiltered groundwater result from monitoring well CEF-015-16S, installed in the area of the maximum arsenic soil contamination, was non-detect at a detection limit of 2.8 µg/L. This result is less than the U.S. EPA MCL and FDEP GCTL for arsenic. Based on this result, the NFA determination for groundwater at Site 15 remains appropriate.

2.0 Conclusion

Because neither the GCTL exceedances of RDX and 4.4'-DDE nor the potential MCL and GCTL exceedance of arsenic could be verified, the NFA status of the Site 15 groundwater was confirmed. Accordingly, groundwater was not retained as a medium of concern in the FS and no groundwater remedial alternatives were developed and evaluated.

References

FDEP (Florida Department of Environmental Protection), 2005. Contaminant Cleanup Target Levels. Chapter 62-777, Florida Administrative Code (F.A.C.). April.

TtNUS (Tetra Tech NUS, Inc.), 2001. Technical Memorandum for No Further Groundwater Monitoring at OU 5, Site 15, Blue 10 Ordnance Disposal Area, Naval Air Station Cecil Field. Prepared for NAVFAC EFD SOUTH, North Charleston, South Carolina. August.

TtNUS, 2006. Sampling and Analysis Work Plan, Round VI for Groundwater, Site 15, Blue 10 Disposal Area, Naval Air Station Cecil Field, Jacksonville, Florida. August 22.

United States Environmental Protection Agency (U.S. EPA), 2002. National Primary Drinking Water Standards, List of Contaminants and Their MCLs, EPA 816-F-02-013, Washington, D.C., July. Accessed online at www.epa.gov/safewater/mcl.html.

APPENDIX B

ECOLOGICALLY-BASED REMEDIATION GOALS FOR LEAD AND PAHs IN SOIL

Ecologically-Based Remediation Goals for Lead and PAHs in Soil

Site 15, Blue 10 Ordnance Disposal Area

Naval Air Station Cecil Field

Jacksonville, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0039

November 2003

100113/P

ECOLOGICALLY-BASED REMEDIATION GOALS FOR LEAD ANAD PAHs IN SOIL

SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA

NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0039

NOVEMBER 2003

PREPARED UNDER THE SUPERVISION OF:

MARK SPERANZA, P.E.
TASK ORDER MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

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

TABLE OF CONTENTS

SECTION **PAGE NO.**

CERTIFICATION OF TECHNICAL DATA CONFORMITY ii

ACRONYMS vi

1.0 INTRODUCTION 1

2.0 SITE INVESTIGATION 2
- 2.1 SAMPLE COLLECTION 2
- 2.2 SAMPLE ANALYSES 3

3.0 RESULTS 4
- 3.1 SOIL CHEMISTRY AND PHYSICAL CHARACTERISTICS 4
- 3.2 INVERTEBRATE TISSUE CONCENTRATIONS OF LEAD 5
- 3.3 SOIL TOXICITY TESTS 5
- 3.4 INVERTEBRATE DIVERSITY AND ABUNDANCE 5

4.0 DATA ANALYSIS AND RISK CHARACTERIZATION 6
- 4.1 LEAD 6
- 4.1.1 Risk to Soil Invertebrates 6
- 4.1.2 Risk to Avian and Mammalian Receptors 11
- 4.2 PAHS 15
- 4.2.1 Survival of Soil Invertebrates 15
- 4.2.2 Diversity and Abundance of Soil Invertebrates 16

5.0 SUMMARY AND CONCLUSIONS 16
- 5.1 SOIL INVERTEBRATES 16
- 5.2 INSECTIVOROUS BIRDS 17
- 5.3 INSECTIVOROUS MAMMALS 17

REFERENCES 18

APPENDIX

- **A WORK PLAN AND SAMPLING AND ANALYSIS PLAN**
- **B LABORATORY ANALYTICAL DATA**
- **C TOXICITY TEST REPORT**
- **D INVERTEBRATE REPORT**
- **E HABITAT NOTES**
- **F SCATTER PLOTS AND CORRELATION RESULTS**
- **G PRG CALCULATION SPREADSHEETS**

TABLES

NUMBER		PAGE NO.
3-1	Data Summary	20
3-2	Soil Grain Size Distribution	21
3-3	Soil-To-Invertebrate BAFs for Lead	22
3-4	Summary of Invertebrate Abundance by Functional Role	23
3-5	Invertebrate Abundance by Taxon	24
4-1	Preliminary Remediation Goals for Lead – Mammalian Receptors	26

FIGURES

NUMBER		PAGE NO.
2-1	Sample Locations	27
3-1	Lead and Total PAH Concentrations in Soil Samples	28
3-2	Invertebrate Lead Concentration as A Function of Soil Lead Concentration	29
3-3	Total Number of Invertebrates by Sampling Plot	30

ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
AF	Absorption fraction
ASTM	American Society of Testing and Materials
CEC	Cation exchange capacity
CLEAN	Comprehensive Long-Term Environmental Action Navy
FDEP	Florida Department of Environmental Protection
HLA	Harding Lawson Associates
IBDS	Inorganic Background Data Set
ID	Inside diameter
LOAEC	Lowest-observed-effects concentration
NAS	Naval Air Station
NOAEC	No-observed-adverse-effects concentration
PRG	Preliminary remediation goal
TOC	Total organic carbon
TtNUS	Tetra Tech NUS, Inc.
U.S. EPA	United States Environmental Protection Agency
XRF	X-ray fluorescence

ECOLOGICALLY-BASED REMEDIATION GOALS FOR LEAD AND PAHS IN SOIL SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA

1.0 INTRODUCTION

The results of a screening-level ecological risk assessment indicated that lead and polynuclear aromatic hydrocarbons (PAHs) in surface soil in some portions of Site 15 may pose a risk to ecological receptors (ABB-ES, 1997). Additional sampling and risk assessment activities have further characterized locations of elevated lead and PAHs at the site. Site-specific preliminary remediation goals (PRGs) for soil at Site 15 are needed so that risk managers can evaluate remedial options. This document describes how ecologically-based PRGs have been developed for lead and PAHs at Site 15.

The remainder of this section summarizes the history of activities at Site 15 relative to the U.S. Environmental Protection Agency's (U.S. EPA's) 8-step process for designing and conducting ecological risk assessments (U.S. EPA, 1997). Section 2 of this report describes the site investigation conducted in June 2001, and Section 3 presents the data from the site investigation. Data analysis, risk characterization, and PRGs are provided in Section 4. Section 5 presents the summary and conclusions.

The history of activities at Site 15 relative to U.S. EPA's 8-step process for designing and conducting ecological risk assessments is as follows. The initial ecological risk assessment (ABB-ES, 1997) represents Step 1 (Screening Level Problem Formulation and Ecological Effects Evaluation) and Step 2 (Screening Level Exposure Estimate and Risk Calculation). Subsequent to the screening-level ecological risk assessment, several additional sampling events were conducted to further characterize locations of elevated lead and PAHs in soil at the site. The results of this additional sampling were used to develop a draft work plan and sampling and analysis plan, which were completed in March 2001. The draft work plan and sampling and analysis plan represent Step 3 (Baseline Risk Assessment Problem Formulation) and Step 4 (Study Design and Data Quality Objective Process). Step 5 (Field Verification of Sampling Design) was conducted on May 3, 2001. The final work plan and the sampling and analysis plan were completed June 12, 2001 (TTNUS, 2001). The field sampling component of Step 6 (Site Investigation and Data Analysis) was conducted from June 18 to 28, 2001. This document represents the remainder of Step 6 (Data Analysis) and Step 7 (Risk Characterization).

The final work plan (TtNUS, 2001) details the Site 15 conceptual model and addresses the physical characteristics and ecological receptors at the site, complete exposure pathways to be evaluated, assessment endpoints, risk questions, measurement endpoints, and data evaluation procedures. The final work plan was approved by representatives of the Navy, U.S. EPA Region IV, and the Florida Department of Environmental Protection. This document does not provide a detailed description of the conceptual model and data evaluation procedures used to estimate risk and generate PRGs at Site 15. Instead, the reader is advised to consult the final work plan, which is included herein as Appendix A, for details on these topics.

2.0 SITE INVESTIGATION

2.1 Sample Collection

In June 2001, soil samples were collected from 24 locations at Site 15 (Figure 2-1). These samples consisted of 12 samples expected to provide a gradient of lead concentrations with minimal PAH concentrations (SS-701 through SS-719A), and 12 samples expected to provide a gradient of PAH concentrations with minimal lead concentrations (SS-721 through SS-737). The expected gradients were based on data from previous sampling efforts and results from field-portable x-ray fluorescence (XRF) equipment used during sampling activities. Soil samples were also collected from three offsite reference locations (SS-739 through SS-741) expected to contain minimal concentrations of lead and PAHs (Figure 2-1).

Soil samples consisted of the first 3 inches of mineral soil plus the overlying duff layer atop the mineral horizon. Each soil sample was a composite of five sub-samples collected from 10-foot by 15-foot plots and was homogenized in the field. After homogenization, aliquots were taken for chemical and physical analyses and toxicity tests.

The work plan proposed using 15-foot by 15-foot plots for sample collection; however, midway through sampling at the initial plot, it became clear that smaller plots would provide an adequate amount of invertebrates to meet the study objectives. Thus, the field team leader modified the plot size to 10 feet by 15 feet. This decision was supported by Dr. Ted Simon of U.S. EPA Region IV, who was present at the site during sampling, and had been pre-approved by Dr. Bethany Grohs of U.S. EPA's Environmental Response Team.

At each of the 12 lead gradient sampling locations, one additional soil sample was collected and archived for possible future analyses. These additional samples consisted of mineral soil only (no overlying duff) and consisted of composited material of 0 to 12 inches below the surface.

Soil invertebrates were collected from the same 10-foot by 15-foot plots as the soil samples. At each sampling location, tree limbs and debris were removed from the surface, and the duff layer (consisting of decomposing organic matter) atop the mineral horizon was removed and meticulously searched by hand for visible invertebrates. Invertebrates were placed in zip-lock bags and stored on ice in the field. At the end of each day, samples were placed in jars and either frozen (for tissue lead analysis) or preserved in 70 percent alcohol.

Sample location SS-703 consisted of a 10-foot by 13-foot plot instead of a 10-foot by 15-foot plot. The slightly smaller plot was necessitated by inclement weather (thunderstorms) in the area during sampling.

2.2 Sample Analyses

Soil samples were analyzed for lead, PAHs, total organic carbon (TOC), cation exchange capacity (CEC), acidity (pH), moisture content, and grain size. Analyses for lead, PAHs, moisture content, CEC and TOC in soil were conducted by Accutest Laboratories of Orlando, Florida. Grain size analyses were conducted by Civil Services Inc. of Jacksonville, Florida.

Soil invertebrates collected from the 12 lead gradient plots and those from the reference locations were analyzed for lead. Each of the invertebrate samples was a composite of all invertebrates collected within a sampling plot. Invertebrate tissue analyses were performed by Severn Trent Laboratories, Inc. of Canton, Ohio.

Soil samples were also subjected to 14-day toxicity tests in which the survival of laboratory-reared earthworms (*Eisenia fetida*) was evaluated following standardized methods (ASTM, 1998). Four replicates per sample, with 10 earthworms per replicate, were used in the toxicity tests conducted by Springborne Laboratories Inc. of Wareham, Massachusetts.

Soil invertebrates from each of the 27 sampling locations were identified and enumerated by Wade Davidson, Department of Entomology and Nematology, University of Florida, Gainesville, Florida. Invertebrates were identified to the most detailed taxon practicable. Insects, snails, and earthworms were identified to family. Identification of insects beyond the family level was not conducted, as this requires the attention of specialists for each family. For example, a coleopteran specialist would be required to classify beetles and a dipteran expert would be needed to classify flies. Non-insect arthropods were identified to order. Identification of non-insect arthropods beyond the order taxon often requires dissection of mouthparts and/or specialists who work exclusively with a specific order or family of arthropod (i.e. spiders). The level of invertebrate identification was detailed enough to categorize the specimens, as described by White (1963), Borror and White (1970), and Dindal (1990), into the following

functional roles within the food web: generalist predators, specialist predators, omnivores, herbivores, and detritivores.

3.0 RESULTS

3.1 Soil Chemistry and Physical Characteristics

Lead and total PAH concentrations in soil are shown in Table 3-1 and Figure 3-1. Complete laboratory data for lead and PAHs are provided in Appendix B.

Lead was detected in 23 of 24 samples from Site 15, at concentrations ranging from 23.4 to 5,470 mg/kg. Lead concentrations in reference samples ranged from 7.8 to 11.4 mg/kg, well below the Naval Air Station (NAS) Cecil Field site-specific Inorganic Background Data Set (IBDS) lead value of 197 mg/kg (HLA, 1998).

PAHs were detected in 17 of 24 samples from Site 15, and PAHs were not detected in reference samples. Concentrations of total PAHs ranged from 906 to 1,121,520 µg/kg. PAH concentrations presented and discussed herein represent total detected PAHs, and were calculated as the sum of detected individual PAHs within a sample. The impact of this method of calculating total PAHs relative to the risk characterization of PAHs is discussed in Section 4.2.1. For samples in which no PAHs were detected, the values in Table 3-1 and Figure 3-1 represent the lowest detection limit for an individual PAH in that sample.

Soil moisture content, CEC, and TOC data are provided in Table 3-1 and Appendix B. The soil pH values shown in Table 3-1 are those measured by the toxicity test laboratory at test initiation; pH values for each sample at the beginning and end of the 14-day toxicity tests can be found in Appendix C. The soil moisture data in Table 3-1 are values measured by the lab conducting the chemical analyses (Accutest Laboratories); these data averaged 24.1 percent and ranged from 14.0 to 40.4 percent. Soil moisture was also measured by the toxicity test lab (Springborne Laboratories) prior to conducting toxicity tests. Those values (provided in Appendix C) were very similar to the Accutest values. CEC averaged 27.4 milliequivalents per 100 grams of oven dry soil (meq/100g) and ranged from 15.6 to 44.8 meq/100g. Soil TOC averaged 6.1 percent and ranged from 2.5 to 13.7 percent. (Note: The laboratory reported TOC in units of mg/kg and the TOC values in Table 3-1 are in these units. Further reference to TOC values will be in percent. Soil pH averaged 3.5, and ranged from 3.0 to 4.9.

Soil grain size data are provided in Table 3-2. Soils were predominantly fine sand and very fine sand, with small proportions of medium-grained sand and very small proportions of silt and clay.

3.2 Invertebrate Tissue Concentrations of Lead

Lead was detected in all 12 invertebrate samples from Site 15 at concentrations ranging from 0.7 to 333 mg/kg (Table 3-1). The maximum tissue-lead concentration (333 mg/kg) was in invertebrates collected from the plot with the maximum lead concentration (SS-706; 5,470 mg/kg). Lead was not detected in invertebrates collected from the reference locations at a detection limit of 0.16 mg/kg.

The invertebrate tissue data was used to develop soil-to-invertebrate bioaccumulation factors (BAFs). The invertebrate tissue concentrations of lead reported by the laboratory are wet weight concentrations. Because dry weight BAFs are needed to calculate soil remedial goals protective of avian and mammalian receptors, the invertebrate lead concentrations were converted to dry weight concentrations assuming a moisture content of 71 percent, which is the average moisture content of earthworms (84 percent), adult beetles (61 percent), and crickets and grasshoppers (69 percent) (U.S. EPA, 1993). The BAFs, expressed as the ratios between dry weight concentrations of lead in tissue and dry weight concentrations of lead in soil, are presented in Table 3-3 for each of the 12 soil and corresponding invertebrate samples. BAFs ranged from 0.004 to 0.246.

Linear regression was used to derive a site-wide BAF as per the work plan. The critical value for the correlation coefficient at 10 (n-2) degrees of freedom, one independent variable, and alpha = 0.05, was 0.576 (Rohlf and Sokal, 1969). Thus, a correlation coefficient (r) greater than 0.576 is considered significant. Invertebrate lead concentrations were correlated with soil lead concentrations (r = 0.772) and the BAF based on the regression equation was 0.14 (Figure 3-2). The median of the 12 BAFs was 050.

3.3 Soil Toxicity Tests

The 14-day survival of earthworms in all reference samples, in laboratory control samples, and in 22 of 24 samples from Site 15 was 100 percent. The 14-day survival of earthworms in the remaining two samples (SS-703 and SS-706) was 0 percent; all earthworms in these samples were dead at test termination. All earthworms appeared to be healthy and were noted to be burrowing into the soil at test initiation. At test termination, surviving earthworms appeared lethargic in many samples (Table 3-1). Sample SS-703 was noted by laboratory personnel as being "moldy on surface" at test termination. Full details regarding the toxicity tests are contained in the laboratory report (Appendix C).

3.4 Invertebrate Diversity and Abundance

The abundance of invertebrates within sampling plots ranged from 14 individuals at SS-706 to 80 individuals at SS-707 (Tables 3-4 and 3-5). Most invertebrates were classified as generalist predators, and centipedes (*Lithobiomorpha* and *Scolopendromorpha*) were the most commonly encountered

invertebrates. Herbivores and detritivores were present in most sampling plots, but were much less abundant than generalist predators. Omnivores were encountered in small numbers and in very few sampling plots. Only one specialist predator was encountered and in only one plot (Table 3-4); this category is combined with the generalist predator category in Table 3-5. Some invertebrates could not be identified and are included in the "unknown" category (Tables 3-4 and 3-5). The "unknown" invertebrates were almost always larvae. Figure 3-3 presents the total number of invertebrates (excluding ants) in each sampling plot. The complete invertebrate report is included as Appendix D.

The understory tended to cover approximately 20 to 30 percent of most sampling plots, and the most common understory species were gall berry (*Ilex glabra*), greenbrier (*Smilax* sp.), and yellow jessamine (*Gelsemium sempervirens*). A midstory was generally absent, or nearly so, within the plots. The overstory tended to cover approximately 30 to 50 percent of most sampling plots, and slash pine (*Pinus elliottii*) was the most common overstory species. The duff layer of decomposing organic matter ranged in thickness from ½ to 5 inches, but tended to be approximately 1½-2 inches. Habitat descriptions at sampling plots are included as Appendix E.

4.0 DATA ANALYSIS AND RISK CHARACTERIZATION

This section discusses the data analysis and risk characterization, and is divided into separate discussions of lead and PAHs. Uncertainties associated with the data analyses and risk characterizations are also presented.

4.1 Lead

4.1.1 Risk to Soil Invertebrates

Soil invertebrates serve as prey for rodents, shrews, moles, and birds, which are preyed upon by carnivores such as hawks, owls, foxes, weasels, and bobcats. Thus, soil invertebrates are vital components of the ecosystem at Site 15. With this in mind, the assessment endpoint associated with invertebrates at Site 15 is as follows:

- Survival of soil invertebrate populations typical in pine flatwoods habitat.

Based on the conceptual model and the above assessment endpoint, the associated risk questions involving lead contamination at Site 15 are as follows (TtNUS, 2001):

- At what soil concentration does lead at Site 15 cause (or potentially cause) reduced survival of soil invertebrates?

- At what soil concentration does lead at Site 15 cause (or potentially cause) reduced diversity and abundance of soil invertebrates?

The measurement endpoints for these risk questions are discussed in the following subsections.

4.1.1.1 Survival of Soil Invertebrates

The measurement endpoint for the first risk question above was the survival of earthworms in 14-day laboratory toxicity tests using soil samples collected from Site 15 and reference locations. The purpose of the toxicity tests was to determine if lead concentrations in site soil samples are correlated with mortality of the organisms associated with this assessment endpoint (i.e., soil invertebrates). Earthworms were used to represent other soil invertebrates that occur on the site because toxicity test methodologies using earthworms have been standardized, whereas toxicity tests using other invertebrates have not. Earthworms are generally considered to be representative of soil invertebrates in ecological risk assessments (Sample *et al*, 1997).

As mentioned in Section 3.3, all earthworms survived in 22 of 24 samples from Site 15, and in the three reference samples. No earthworms survived (100 percent mortality) in samples SS-703 and SS-706.

The laboratory noted that earthworms were lethargic (sluggish, slow moving) in 18 of 25 samples at test termination (Table 3-1). Discussions with the laboratory director indicated that such a high degree of lethargy is abnormal, even when food has been withheld from test organisms for 14 days, as in the toxicity tests conducted for this investigation. The laboratory director stated that the lethargy might have been due to the high acidity of the samples (pH range = 3.0 to 4.9). Although the reason for the lethargy is unknown, the condition does not appear to be due to lead toxicity because lethargy was also noted in all worms within two of three reference samples (SS-740 and SS-741; Table 3-1).

4.1.1.1.1 Mortality in Sample SS-706

All earthworms in this sample were dead at test termination. Because this sample had the greatest lead concentration (5,470 mg/kg) in this investigation, it is assumed that the observed mortality was due to lead toxicity. This sample also had one of the highest soil-to-invertebrate BAFs (0.210).

4.1.1.1.2 Mortality in Sample SS-703

The lead concentration in sample SS-703 was 1,400 mg/kg (Table 3-1). Lead concentrations were greater in samples SS-708 (2,200 mg/kg), SS-707 (3,080 mg/kg) and SS-704 (3,380 mg/kg), and yet, earthworm survival was 100 percent in these samples.

It is unclear why no earthworms survived in sample SS-703 while all earthworms survived in three samples with greater lead concentrations, but factors other than lead or PAHs might have been responsible for the mortality. PAHs were not detected in SS-703, but chemical analyses of soil samples were limited to lead and PAHs.

Other numerous factors can influence soil toxicity tests. The sample was collected, mixed, preserved, transported, and shipped to the laboratory in the same way as the other samples. It was noted during sample collection that the duff layer in this plot was thicker (3-5 inches) and more thickly intertwined with small roots than at other plots (Appendix E), but this would not appear to be a contributing factor regarding the observed mortality. Based on discussions with the testing laboratory and on the toxicity test report (Appendix C), conditions during the 14-day test appear to have been the same for SS-703 as for the other samples.

The toxicity test laboratory noted that sample SS-703 was moldy at test termination. It is uncertain whether this mold was a normal by-product of the decaying process or was due to fungi present in the sample. ASTM (1998) guidelines note that fungi can influence toxicity test results.

Physicochemical properties such as soil moisture, pH, CEC, TOC, and grain size can interfere with toxicity tests. Soil moisture was not a contributing factor because each soil sample was hydrated to 75 percent of its water holding capacity prior to test initiation. Soil grain size in SS-703 (Table 3-2) was similar to that in other samples.

Soil CEC does not appear to have been a factor in the observed mortality. CEC is a measure of a soil's ability to hold positively charged ions (cations) such as lead. If lead is electrostatically retained onto soil particles instead of leaching downward in the soil, then the lead would be more available for exposure to biota. According to the testing laboratory, a low CEC (<5 meq/100g) indicates a soil is sandy and low in organic matter, and cannot hold many cations, while a high CEC (>25 meq/100g) indicates a soil has a high clay content and/or high organic matter content, and can hold many cations. Addition of organic material will increase a soil's CEC. The relatively high CEC values from Site 15 (Table 3-1) are probably due to the samples being a mixture of sandy soil and the overlying organic duff layer as per the work plan; the CEC values would undoubtedly be much lower if the samples had consisted of mineral soil only.

In summary, the CEC value for SS-703 is not low, and is not believed to be a factor in the observed mortality of earthworms.

Sandy soils in Florida pine flatwoods habitats are typically acidic (Abrahamson and Hartnett, 1990). All soil samples in this investigation were acidic with pH values ranging from 3.0 to 4.9. The pH in sample SS-703 was 3.0, and the TOC in this sample (4.07 percent) was also one of the lower values measured in Site 15 samples. The low pH combined with the somewhat low organic carbon content might have resulted in lead or other chemicals being more bioavailable than in other samples. This speculation is partially supported by TOC data. Below is a summary of the soil samples with lead concentrations greater than 1,000 mg/kg.

Sample	Soil Lead (mg/kg)	Soil pH	Soil TOC	BAF
SS-703	1,400	3.0	4.07%	0.115
SS-704	3,380	3.0	5.37%	0.037
SS-706	5,470	3.5	2.53%	0.210
SS-707	3,080	3.0	12.1%	0.004
SS-708	2,200	3.4	9.3%	0.246

Earthworm mortality in toxicity tests occurred only in samples SS-703 and SS-706, the two samples with relatively low TOC and elevated soil lead concentrations. The maximum soil-to-invertebrate BAF is in SS-708, but earthworm survival in this sample was 100%.

In summary, it is unclear whether the 100 percent mortality in SS-703 was due to lead toxicity, other chemicals, fungi, a combination of these factors, or unknown factors.

4.1.1.1.3 Conclusions

The work plan stated that toxicity test data would be statistically analyzed to determine the no-observed-adverse-effect concentration (NOAEC) and the lowest-observed-adverse-effect concentration (LOAEC). Furthermore, backward elimination stepwise regression analysis was to have been used to determine which parameters accounted for the variability in survival between samples. Independent variables in the regression analysis were to have been lead concentrations, PAH concentrations, soil pH, soil CEC, soil TOC, and soil grain size. However, there were no "partial responses" (i.e., no samples in which survival was between 0 and 100 percent); therefore, the nature of the data precludes statistical analyses of the toxicity test results.

One hundred percent of test organisms died in SS-706 (5,470 mg/kg). Because this sample had the greatest lead concentration in the investigation, it is assumed that the mortality was due to lead toxicity.

The occurrence of 100 percent mortality in SS-703 (1,400 mg/kg lead), while 100 percent of test organisms survived in three samples with greater lead concentrations (2,200 to 3,380 mg/kg), cannot be totally explained. The lethargy noted in surviving organisms from most samples is not believed to be related to lead toxicity because lethargy was also noted in all worms in two of three reference samples. For these reasons, the toxicity test NOAEC and LOAEC cannot be determined.

Conservatively assuming that the toxicity test mortality at 1,400 mg/kg was due to lead toxicity, then the LOAEC would be 1,400 mg/kg and the NOAEC would be 894 mg/kg, which is the lead concentration in SS-708A. The geometric mean of the NOAEC and LOAEC is often used as a "toxicity threshold" when evaluating toxicity test results. The geometric mean of these two values is 1,119 mg/kg.

Because it is unclear whether the earthworm mortality at 1,400 was due to lead toxicity, an alternate approach is to assume that the LOAEC was 5,470 mg/kg (lead concentration in SS-706), and the NOAEC was 3,380 mg/kg (lead concentration in SS-704). The toxicity threshold based on the geometric mean of these two values is 4,300 mg/kg.

4.1.1.2 Diversity and Abundance of Soil Invertebrates

As stated in the introduction to Section 4.1.1, the assessment endpoint associated with invertebrates at Site 15 is the survival of soil invertebrate populations typical in pine flatwoods habitat. The use of earthworms to represent other soil invertebrates introduces some uncertainty into a risk assessment; therefore, a risk question pertinent to this assessment is as follows (TtNUS, 2001):

- At what soil concentration does lead at Site 15 cause (or potentially cause) reduced diversity and abundance of soil invertebrates?

The measurement endpoint for this risk question is the diversity and abundance of soil invertebrates collected from a gradient of lead concentrations at Site 15 and from three reference locations. The invertebrate diversity and abundance data were collected to evaluate the likelihood that site-related lead concentrations are adversely impacting the soil invertebrate community.

Centipedes were present in all plots. Spiders (*Araneida*), scarab beetles (*Scarabidae*), roaches (*Blatellidae*), and click beetles (*Elateridae*) were present in most plots. Other invertebrate taxa were sporadically present (Table 3-5). The abundance of invertebrates, especially those classified as generalist predators and detritivores, was highly variable among sampling plots (Table 3-4 and Figure 3-3). Because habitat characteristics can affect the diversity and abundance of soil invertebrates, the sampling locations were selected such that habitat characteristics were similar among locations to the

maximum practical extent. Nevertheless, no two plots were *exactly* alike, and the diversity and abundance data could be due to a variety of habitat conditions.

As discussed in the work plan, the data collection methods for invertebrate diversity and abundance were not designed for definitive statistical analyses. Instead, the diversity and abundance data were intended to be visually analyzed and used in a "lines of evidence" approach to assess the likelihood that site-related lead toxicity is occurring. Nevertheless, scatter plots comparing the invertebrate data to soil lead concentrations and to various physical soil factors have been generated (Appendix F). Abundance was not correlated with any of these factors. The total biomass (grams) of soil invertebrates tended to increase with increasing TOC (Appendix F).

The total number of invertebrates was lowest in SS-706 (n=14), but was also low (n=16 to 18) in four samples with low soil lead concentrations. Predatory invertebrates might be exposed, through feeding, to lower lead concentrations than herbivores or detritivores. SS-703 was the only sample with no detritivores. The sum of herbivores plus detritivores was lowest in SS-706 (n=1), and was also low in SS-703 (n=3) and SS-704 (n=4). However, one reference sample (SS-739) also had a low number of herbivores and detritivores (n=5). Caution should be taken in the interpretation of the diversity data because the sampling was somewhat biased toward predators and against herbivores and detritivores. Most predators were centipedes and were relatively large and easily seen as they attempted to flee. Most herbivores and detritivores, however, tend to be camouflaged and "freeze" when alarmed.

4.1.2 Risk to Avian and Mammalian Receptors

As discussed in the work plan (TtNUS, 2001), the assessment endpoints for birds and mammals at Site 15 are as follows:

- Growth and reproduction of residential and migratory avian populations typical in pine flatwoods habitat.
- Growth and reproduction of mammalian populations typical in pine flatwoods habitat.

An important distinction pertaining to these two assessment endpoints above is that lead in soil could potentially cause adverse impacts to birds and mammals *directly* through ingestion of contaminated prey and *indirectly* through a reduced food supply (which could result from a toxicity-related decline in prey populations). This discussion focuses on potential direct impacts. Potential indirect impacts are discussed in Section 4.1.1.

Based on the conceptual model and the above assessment endpoints, the associated risk question involving lead contamination at Site 15 is as follows (TtNUS, 2001):

- At what soil concentration does the ingestion of lead at Site 15 cause (or potentially cause) adverse effects to avian and mammalian receptors?

The measurement endpoint for determining the soil concentration at which the ingestion of lead causes adverse effects to avian and mammalian receptors is concentrations of lead in soil and in soil invertebrates collected from the site. The purpose of the invertebrate tissue analyses was to measure lead concentrations in prey items consumed by the species associated with the assessment endpoints. This allows the development of soil-to-invertebrate BAFs for Site 15 with which soil remedial goals protective of avian and mammalian receptors can be calculated. Following the work plan, the mockingbird (*Mimus polyglottus*) was used to represent insectivorous and vermivorous avian receptors at Site 15, and the least shrew (*Cryptotis parva*) was used to represent insectivorous and vermivorous mammalian receptors at Site 15. The term "vermivorous" refers to worm-eating organisms, while "insectivorous" refers to insect-eating organisms. However, most animals that consume worms also consume adult and larval insects and other arthropods, and no animals at Site 15 are strictly vermivorous. Therefore, in this document, the term "insectivorous" will be used for brevity to denote animals whose primary prey is a combination of worms, insects, and other arthropods.

The work plan describes in detail how soil concentrations (i.e., soil PRGs) will be developed that pose acceptable risks to birds and mammals that prey upon soil invertebrates at Site 15. As discussed in the work plan, there are uncertainties associated with each of the following four factors:

- Bioavailability (absorption fraction) of lead
- Incidental ingestion of soil
- Avian food Items
- Soil-to-invertebrate BAF

The following subsections briefly discuss these factors and present values that were used to develop PRGs. The values were based on available literature, conditions at Site 15, and extensive discussions with representatives of the Navy, U.S. EPA Region IV, and the Florida Department of Environmental Protection. A brief description of how dry weight food ingestion values were derived is also included. The final subsection presents the resulting soil PRGs.

4.1.2.1 Bioavailability of Lead

The bioavailability of lead after ingestion depends upon a variety of factors, including the chemical form of lead, the species of organism, and the age, sex, and nutritional status of the individual (Eisler, 1988).

Because relevant bioavailability data do not exist for birds and mammals at Site 15, lead was conservatively assumed to be 100 percent bioavailable.

4.1.2.2 Incidental Ingestion of Soil

Terrestrial animals can ingest lead in soil while grooming fur, preening feathers, digging, grazing close to the soil, or feeding on items to which soil has adhered or contain soil (such as earthworms). Soil ingestion rates are not available for the mockingbird or for closely related avian species. The soil ingestion rate of the wild turkey (*Meleagris gallopavo*) has been estimated to be 9.3 percent of the diet (Beyer et al, 1994). Wild turkeys, however, spend much more time on the ground surface, and forage on nuts and seeds on the ground to a larger extent than the mockingbird or most other perching (Order Passeriformes) birds. Thus, the wild turkey would probably consume more soil than perching birds represented by the mockingbird.

The estimated fractions of soil in wildlife diets are derived from measuring the acid-insoluble ash content of scats or digestive tract contents. Soil in scats and digestive tracts is the result of all the sources mentioned above (grooming, digging, earthworm gut contents, etc). However, the lead data from whole-body invertebrates analyzed in this investigation represents not only lead that was biologically incorporated into invertebrate tissues, but also includes lead in soil adhering to, and within the gut of, the invertebrates. Thus, lead in soil adhering to invertebrates and within the gut of invertebrates is included in the invertebrate analytical data, and in effect would be counted twice if standard literature-derived soil ingestion data are utilized. In addition, invertebrates in the soil/duff layer at Site 15 are primarily arthropods, while earthworms were not commonly observed (Appendix D). Arthropods presumably contain less soil in their digestive tracts than do earthworms. Thus, birds at Site 15 would consume less soil than birds at locations where earthworms are more prevalent. Soil ingestion rates at Site 15 for insectivorous birds represented by the mockingbird cannot be quantified with existing data, but it was assumed that 5.0 percent of the mockingbird diet consists of soil; this value appears to be a reasonable approximation based on the factors discussed above.

An accurate soil ingestion rate is difficult to determine for the least shrew. U.S. EPA (2003) estimates that 3.0 percent of a shrew's diet is soil. This value is the 90th percentile of data from analyses of gastrointestinal (GI) tracts of short-tailed shrews (Blarina spp.) (U.S. EPA, 2003). However, the diet of the nine-banded armadillo (*Dasypus novemcinctus*), which also consumes a variety of soil invertebrates, has been reported to consist of approximately 17 percent soil (Beyer et al, 1994). Soil ingestion rates for shrews at Site 15 cannot be quantified with existing data, but it was assumed that 5.0 percent of the shrew diet consists of soil.

4.1.2.3 Avian Food Items

The average non-soil portion of the mockingbird's diet is approximately 50 percent invertebrates and 50 percent fruit (Derrickson and Breitwisch, 1992). During the breeding season, however, the mockingbird's diet is almost completely insectivorous. The avian PRG was calculated by assuming that the non-soil portion of the mockingbird's diet consists of 75 percent invertebrates and 25 percent fruit. As discussed in the work plan, lead concentrations in fruit (e.g., berries) is probably insignificant, and thus, lead was assumed to be absent in the fruit portion of the diet.

4.1.2.4 Soil-To-Invertebrate BAFs

The BAF based on the regression equation was 0.14 (Figure 3 2). This value is very near the upper end of the range of BAFs from the 12-sample data set, and exceeds 10 of 12 BAFs (Table 3-3). Because the BAF data approximated an exponential relationship rather than a linear one, the median of the 12-sample data set (0.050) is also a legitimate value to represent site-wide conditions.

For this evaluation, it was conservatively assumed that insectivorous birds represented by the mockingbird would forage throughout Site 15. The median BAF, which was assumed to represent site-wide conditions, was used to derive a soil PRG protective of insectivorous birds.

Small insectivorous mammals represented by the least shrew forage over much smaller areas than birds. The home range of the least shrew is approximately 2 acres (Choate and Fleharty, 1973). The median BAF and the regression-derived BAF were used to derive soil PRGs for insectivorous mammals, resulting in two PRGs for consideration by risk managers.

4.1.2.5 Food ingestion

Food ingestion values for insectivorous birds and mammals were converted to dry weight values assuming a moisture content of 71 percent in food items, which is the average moisture content of earthworms (84 percent), adult beetles (61 percent), and crickets and grasshoppers (69 percent) (U.S. EPA, 1993). For the least shrew, the 3.3 gram/day food ingestion value presented in the work plan was converted to 0.957 g/day as follows: 3.3 g/day (fresh weight) x 0.29 (dry matter in food) = 0.957 g/day (dry weight). The mockingbird dry weight total food ingestion was 6.72 g/day. This value was obtained by dividing the mockingbird field metabolic rate by the metabolizable energy available in food of avian insectivores (121 kJ/day ÷ 18 kJ/g = 6.72 g/day) (Nagy et al 1999). Since 75 percent of the mockingbird's diet is assumed to consist of invertebrates (see Section 4.1.2.3), and lead concentrations were assumed to be negligible in other food items, then a mockingbird would consume 5.04 g/day invertebrates (6.72 g/day x 0.75 = 5.04 g/day).

4.1.2.6 Soil PRGs for Insectivorous Birds and Mammals

Based on the values discussed above, the soil PRG for insectivorous birds is 1127 mg/kg. The soil PRG for insectivorous mammals is 2512 mg/kg using a BAF of 0.14, and 4716 mg/kg using a BAF of 0.05 (Table 4-1). Appendix G presents the spreadsheets used to calculate the values in Table 4-1.

4.2 PAHs

As discussed in the work plan, the potential toxicity of PAHs via the terrestrial food web is negligible at the concentrations present at Site 15. Thus, toxicity to upper level receptors such as mammals and birds is not expected and is not evaluated in this investigation. However, some PAHs are toxic to soil invertebrates at concentrations that will remain after the human health remediation at Site 15 is completed. Soil invertebrates are primary prey items for a variety of birds and mammals, and thus, reduced populations of soil invertebrates could impact populations of upper level receptors by decreasing their food supply. Because soil invertebrates are the primary receptors at risk from PAHs at Site 15, the risk questions, assessment endpoints, and measurement endpoints are similar to those described for lead in Section 4.1.1.

4.2.1 Survival of Soil Invertebrates

The only two soil samples in which mortality occurred in toxicity tests were SS-703 and SS-706. PAHs were not detected in SS-703. The concentration of total PAHs in SS-706 was 959 µg/kg (Table 3-1). This concentration is less than the U.S. EPA Region IV ecological screening value for total PAHs (1,000 µg/kg). PAHs were elevated in several samples and were especially high in SS-701 (620,730 µg/kg), SS-721 (395,700 µg/kg), SS-734 (629,150 µg/kg) and SS-726A (1,121,520 µg/kg) (Table 3-1). The absence of mortality in the toxicity test at total PAH concentrations as high as 1,121,520 µg/kg indicates that the mortality in SS-706 was not due to PAHs. As discussed in Section 4.1.1.1.2, the mortality in SS-706 is believed to be due to lead toxicity. Furthermore, the absence of mortality in the toxicity test at elevated PAH concentrations indicates that the soils were not acutely toxic to earthworms under the conditions of the toxicity tests. Based on the results of the toxicity tests, the NOAEC for total PAHs was 1,121,520 µg/kg, the highest total PAH concentration tested.

The NOAEC for total PAHs would be greater than 1,121,520 µg/kg if values representing non-detected PAHs had been used to calculate total PAH concentrations. Total PAH concentrations are often calculated using a pre-determined value to represent non-detected individual PAHs; one-half the detection limit is typically used. Total PAH concentrations in this investigation were calculated as the sum of *detected* PAHs only and thus would be higher than those shown in Table 3-1 if total PAH values had

been calculated using one-half (or any other fraction) of the detection limit for non-detected PAHs. For example, the maximum concentration of total PAHs was measured in SS-726A, but six PAHs were not detected in this sample (Appendix A). The 1,121,520 µg/kg value, therefore, is a conservative estimate of the NOAEC.

4.2.2 Diversity and Abundance of Soil Invertebrates

Invertebrate diversity and abundance were not correlated with PAH concentrations. The greatest PAH concentrations were in samples SS-701, SS-721, SS-726A, and SS-734; diversity in these samples was similar to that in other samples. The total abundance of invertebrates in SS-701, SS-721, and SS-734 exceeded the site-wide average and equaled the site-wide average in SS-726A. The invertebrate population data do not appear to be correlated with PAH concentrations (See scatter plot, Appendix F).

5.0 SUMMARY AND CONCLUSIONS

This document evaluates data and characterizes ecological risk at Site 15, Naval Air Station Cecil Field, Jacksonville, Florida, and is based on sampling conducted in June 2001. The outcome of the risk characterization process is a range of ecologically-based PRGs for lead and PAHs at the site. The site investigation, data evaluation, and risk characterization procedures were based on U.S. EPA's 8-step process for designing and conducting ecological risk assessments (U.S. EPA, 1997). The site-specific methods for this process are contained in the final work plan (TtNUS, 2001) that has been approved by representatives of the Navy, U.S. EPA Region IV, and the Florida Department of Environmental Protection. Potential risk to soil invertebrates and to insectivorous mammals and birds from exposure to lead and potential risk to soil invertebrates from exposure to PAHs were evaluated.

5.1 Soil Invertebrates

For lead and PAHs, the assessment endpoint associated with invertebrates at Site 15 was the survival of soil invertebrate populations typical in pine flatwoods habitat. Invertebrate survival was examined through soil toxicity tests and measurement of the diversity and abundance of invertebrate populations.

Toxicity tests using laboratory-reared earthworms were conducted using 24 soil samples from Site 15 representing a range of lead and PAH gradients and from three reference locations. No earthworms died at the maximum total PAH concentration of 1,121,520 µg/kg. All earthworms died in the samples with soil lead concentrations of 5,470 and 1,400 mg/kg, while all earthworms survived in other samples (including three samples with soil lead concentrations of 2,200 to 3,380 mg/kg).

The diversity and abundance of soil invertebrates were evaluated by collecting, identifying, and enumerating invertebrates from 10-foot by 15-foot plots at each soil sampling location. The toxicity test results combined with the invertebrate population data indicate that risk posed by PAHs in soil is negligible at concentrations of up to 1,121,520 µg/kg.

Risk to invertebrates from lead in soil is evident at the highest concentration in this investigation (5,470 mg/kg). There is no indication of lead-related impacts at concentrations less than 1,120 mg/kg. There is uncertainty regarding lead-toxicity at soil concentrations between these two values. It appears, however, that concentrations in this range might pose risk to invertebrates when the soil TOC is less than approximately 4 percent.

5.2 Insectivorous Birds

The soil PRG for lead protective of insectivorous birds is 1127 mg/kg (site-wide average lead concentration). Because insectivorous birds forage over large areas, this value is intended as a site-wide remediation goal.

5.3 Insectivorous Mammals

The characterization of lead-related risk to insectivorous mammals is complicated by uncertainty regarding the most appropriate soil-to-invertebrate BAF. The work plan for this investigation (Appendix A) stated that the BAF would be derived using regression analysis from the 12 corresponding soil and tissue samples, if the correlation was significant. The regression analysis indicated that the correlation was significant, but a more detailed evaluation of the data indicated that the data approximated an exponential relationship rather than a linear one. Moreover, the soil data, tissue data, and the BAFs are all lognormally distributed. Thus, the median value is also a legitimate BAF for use in deriving an ecological PRG. The two BAFs result in two PRGs for consideration by risk managers: 2,512 mg/kg (based on the regression-derived BAF) and 4,716 mg/kg (based on the median BAF). Because the home range of insectivorous mammals represented by the least shrew is approximately 2 acres, both of these PRGs are intended to apply to 2-acre average lead concentrations.

REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1997. Remedial Investigation, Operable Unit 5, Sites 14 and 15, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, October.

Abrahamson, W.G. and D.C. Hartnett, 1990. *Pine Flatwoods and Dry Prairies*, in Myers, R. L. and J. J. Ewel (eds.), 1990, *Ecosystems of Florida*, University of Central Florida Press, Orlando, Florida.

ASTM (American Society for Testing and Materials), 1998. Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm *Eisenia Fetida*). E 1676-97, West Conshohocken, Pennsylvania.

Choate, J. R. and E. D. Fleharty, 1973. Habitat preference and spatial relations of shrews in a mixed grassland in Kansas. Southwestern Naturalist 18:110-112.

Choate, J.R., J.K. Jones, Jr., and C. Jones, 1994. Handbook of Mammals of the South-Central States, Louisiana State University Press, Baton Rouge, Louisiana, pp 304.

Derrickson, K. C. and Breitwisch, 1992. Northern mockingbird. In: *The Birds of North America,* No. 7 (A. Poole, P. Stettenheim, and F. Gill, eds.). Philadelphia, the Academy of Natural Sciences, Washington, D.C.: The American Ornithologists' Union.

Dasmann, R.F., 1981. Wildlife Biology. John Wiley & Sons, Inc., New York, New York, pp 212.

Eisler, R., 1988. Lead Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. USFWS Biological Report 85(1.14).

Rohlf, F.J. and R.R. Sokal, 1969. Statistical Tables. W.H. Freeman and Company, San Francisco, California.

Sample, B.E., M.S. Alpin, R.A. Efroymson, G. W. Suter II, and C.J.E. Welsh, 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Stone, C.L., M.R.S. Fox, and K.S. Hogye, 1981. Bioavailability of lead in oysters fed to young Japanese quail. Environmental Research, 26: 409-421.

TtNUS (Tetra Tech NUS, Inc.), 2001. Development of Ecologically-Based Remediation Goals for Lead and PAHs in Soil, Site 15, Blue 10 Ordinance Area, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for SOUTHNAVFACENGCOM, June.

U.S. EPA (U.S. Environmental Protection Agency). 2003. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 92857-55. Office of Solid Waste and Emergency Response, Washington, D.C. August.

U.S. EPA (U.S. Environmental Protection Agency), 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, June 5, Edison, New Jersey.

U.S. EPA (U.S. Environmental Protection Agency). 1993. Wildlife Exposure Factors Handbook: Volumes I and II. EPA/600/R-93/187. U.S. EPA Office of Research and Development, Washington, D.C.

U.S. EPA, 1986. *Air Quality Criteria for Lead. Vol. I of IV,* Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA-600/8-83/028aF, Cited in Risk Assessment Information System website, Toxicity Profiles, Lead; http://risk.lsd.ornl.gov/tox/profiles/lead.htm

Wixson, B. G. and B. E. Davies, 1993. *Bioavailability of Lead for Animals*, Lead in Soil Task Force Recommended Guidelines, Society for Environmental Geochemistry and Health. Science Reviews, 132 pp.

TABLE 3-1

DATA SUMMARY
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Sample	Soil Lead Conc. (mg/kg)	Soil PAH Conc. (µg/kg)	Invertebrate Lead Conc. (mg/kg)	Total Number of Invertebrates	Soil Moisture (percent)	Soil pH	Soil CEC (meq/100g)	Soil TOC (mg/kg)	Toxicity tests: Lethargic worms at day 14?
SS-701	419	620730	5.2	48	25.8	3.6	23.3	63300	Yes (all)
SS-703	1400	340 U	46.5	32	20.6	3.0	21.8	40700	all dead
SS-704	3380	1305	36.7	21	18.8	3.0	25.4	53700	Yes (all)
SS-706	5470	959	333	14	18.3	3.5	20.6	25300	all dead
SS-707	3080	500 U	3.8	80	32.9	3.0	34	121000	Yes (all)
SS-707A	672	490 U	1.7	52	31.6	3.0	41.8	119000	Yes (all)
SS-708	2200	15099	157	49	40.4	3.4	38.9	93000	No
SS-708A	894	370 U	3.5	20	28.1	3.6	34	98600	Yes (all)
SS-709	709	906	11.6	41	16.6	3.0	23.3	30400	Yes (all)
SS-717	120	320 U	3.7	37	15.9	3.0	23.1	32900	Yes (all)
SS-719	66.3	9425	0.7	36	23.0	3.1	18.2	37100	No
SS-719A	97.8	1144	1.7	16	26.7	4.4	42.8	80500	No
SS-721	102	395700	NA	45	23.7	3.7	23.8	58600	No
SS-722	23.4	370 U	NA	20	28.7	3.5	29.2	68600	Yes (all)
SS-724	31	2191	NA	18	18.7	3.0	21.6	49200	Yes (all)
SS-726A	532	1121520	NA	38	15.2	4.9	24.1	28000	Yes (some)
SS-727A	283	16396	NA	17	14.0	3.6	15.6	31300	No
SS-728A	84.8	50337	NA	54	22.5	4.0	24.1	54100	Yes (some)
SS-732	214	5403	NA	18	22.5	3.7	20	53600	No
SS-733	336	89717	NA	37	18.5	4.1	31	43000	Yes (some)
SS-734	73	629150	NA	66	19.7	3.4	26.7	48500	Yes (all)
SS-735A	40.6	1308	NA	54	14.8	3.3	23.8	53900	Yes (all)
SS-736A	0.73 U	420 U	NA	43	36.5	3.5	44.8	137000	Yes (all)
SS-737	45.8	4958	NA	53	29.2	3.4	28.6	42100	Yes (all)
SS-739[a]	11.4	400 U	0.16 U	45	33.8	3.5	23.7	59700	No
SS-740[a]	9.3	430 U	0.16 U	26	22.4	3.0	25.3	55000	Yes (all)
SS-741[a]	7.8	190 U	0.16 U	53	30.8	3.4	29.2	71500	Yes (all)

Conc: Concentration.
CEC: Cation exchange capacity.
TOC: Total organic carbon.
NA: Not applicable; invertebrate tissue analysis not conducted in this sample.
U = Not detected at or above detection limit (associated value).
a Reference sample.

TABLE 3-2

SOIL GRAIN SIZE DISTRIBUTION
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Sample	% Medium Sand[a]	% Fine Sand[b]	% Very Fine Sand[c]	% Silt and Clay[d]
CEF-015-SS-701	11.0	55.0	33.0	1.0
CEF-015-SS-703	6.0	55.0	35.0	4.0
CEF-015-SS-704	6.0	56.0	36.0	2.0
CEF-015-SS-706	4.0	50.0	39.0	7.0
CEF-015-SS-707	12.0	55.5	31.0	1.5
CEF-015-SS-707A	13.0	55.0	29.0	3.0
CEF-015-SS-708A	25.0	40.0	25.0	10.0
CEF-015-SS-708	10.0	53.0	34.0	3.0
CEF-015-SS-709	18.0	36.0	38.0	8.0
CEF-015-SS-717	5.0	53.0	39.0	3.0
CEF-015-SS-719	6.0	55.0	37.0	2.0
CEF-015-SS-719A	11.0	54.0	31.0	4.0
CEF-015-SS-721	7.0	55.0	35.0	3.0
CEF-015-SS-722	6.0	57.0	35.0	2.0
CEF-015-SS-724	9.0	56.0	33.0	2.0
CEF-015-SS-726A	7.5	56.3	33.1	3.1
CEF-015-SS-727A	4.7	55.8	36.7	2.8
CEF-015-SS-728A	6.0	53.0	38.0	3.0
CEF-015-SS-732	15.0	49.0	30.0	6.0
CEF-015-SS-733	5.5	57.0	35.0	2.5
CEF-015-SS-734	14.0[e]	49.0	35.0	2.0
CEF-015-SS-735A	5.0	54.5	37.5	3.0
CEF-015-SS-736A	23.0	58.0	18.0	1.0
CEF-015-SS-737	10.0	55.9	32.6	1.5
CEF-015-SS-739	12.0	53.2	33.1	1.7
CEF-015-SS-740	9.0	50.0	39.0	2.0
CEF-015-SS-741	16.0	48.0	34.0	2.0

a Percentage of sample passing through 2.0 mm sieve and retained on 0.25 mm sieve.
b Percentage of sample passing through 0.25 mm sieve and retained on 0.15 mm sieve.
c Percentage of sample passing through 0.15 mm sieve and retained on 0.075 mm sieve.
d Percentage of sample passing through 0.075 mm sieve.
e 14.0 % value for this sample actually consisted of 6% coarse sand (passed through 4.75 mm sieve and retained on 2.0 mm sieve) and 8% medium sand; course sand was absent from all other samples.

TABLE 3-3

SOIL-TO-INVERTEBRATE BAIOACCUMULATION FACTORS (BAFs) FOR LEAD
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Sample[a]	Invertebrate Lead Concentration (mg/kg wet weight)	Invertebrate Lead Concentration (mg/kg dry weight)[b]	Soil Lead Concentration (mg/kg dry weight)	BAF[c]
SS-707	3.8	13.1	3080	0.004
SS-707A	1.7	5.9	672	0.009
SS-708A	3.5	12.1	894	0.013
SS-719	0.7	2.4	66.3	0.036
SS-704	36.7	126.6	3380	0.037
SS-701	5.2	17.9	419	0.043
SS-709	11.6	40.0	709	0.056
SS-719A	1.7	5.9	97.8	0.060
SS-717	3.7	12.8	120	0.106
SS-703	46.5	160.3	1400	0.115
SS-706	333	1148.3	5470	0.210
SS-708	157	541.4	2200	0.246

a Samples are arranged so that BAFs are in ascending numerical order.
b Dry weight concentrations were derived assuming 71 percent moisture content in invertebrates.
c BAF = invertebrate lead concentration (dry weight) ÷ soil lead concentration

TABLE 3-4

SUMMARY OF INVERTEBRATE ABUNDANCE BY FUNCTIONAL ROLE
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Sample	Generalist Predators	Specialist Predators	Omnivores	Herbivores	Detritivores	Unknown	Total Abundance	Total Mass (g)
SS-701	38	0	0	4	6	0	48	3.7
SS-703	27	0	0	3	0	2	32	2.3
SS-704	16	0	0	1	3	1	21	2.6
SS-706	13	0	0	0	1	0	14	0.9
SS-707	60	0	0	1	14	5	80	6.6
SS-707A	35	0	0	7	6	4	52	3.9
SS-708	33	0	1	3	12	0	49	1.4
SS-708A	13	0	0	3	4	0	20	2.3
SS-709	26	0	0	4	8	3	41	2.6
SS-717	26	0	0	4	6	1	37	2.2
SS-719	26	0	0	3	6	1	36	2.7
SS-719A	9	0	0	4	1	2	16	5.2
SS-721	20	0	1	5	16	3	45	NA
SS-722	14	0	0	2	4	0	20	NA
SS-724	9	0	0	2	4	3	18	NA
SS-726A	21	0	0	1	10	6	38	NA
SS-727A	10	0	0	3	4	0	17	NA
SS-728A	37	0	2	5	9	1	54	NA
SS-732	8	0	0	0	9	1	18	NA
SS-733	23	0	0	1	10	3	37	NA
SS-734	49	0	0	1	14	2	66	NA
SS-735A	35	0	1	5	13	0	54	NA
SS-736A	27	1	0	1	11	3	43	NA
SS-737	38	0	0	0	14	1	53	NA
SS-739	40	0	0	1	4	0	45	2.3
SS-740	16	0	1	1	8	0	26	1.8
SS-741	30	0	0	0	21	2	53	2.7
Average	25.9	0.04	0.2	2.4	8.1	1.6	38.3	2.9
SD	13.1	0.2	0.5	1.9	5.1	1.7	17.0	1.5

Ants were not enumerated and are not included above (as per work plan).
NA: Mass of invertebrates was not determined from PAH-gradient sample plots.
SD: Standard deviation

TABLE 3-5

INVERTEBRATE ABUNDANCE BY TAXON
SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 1 OF 2

TAXON	SS-701	SS-703	SS-704	SS-706	SS-707	SS-707A	SS-708	SS-708A	SS-709	SS-717	SS-719	SS-719A	SS-721	SS-722
Predators														
Anthocoridae	-	1	-	-	4	-	-	-	1	1	-	1	-	-
Araneida	-	4	3	4	5	4	4	-	2	6	2	1	12	4
Carabidae	-	-	-	1	3	1	2	-	-	-	-	-	-	-
Cicindelidae	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Cleridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithobiomorpha	4	10	3	5	3	10	21	4	5	11	1	-	-	1
Mantidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Opiolones	1	-	-	-	1	-	-	-	-	-	-	-	1	
Reduviidae	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Scolopendromorpha	33	12	10	2	43	20	6	9	18	6	23	7	7	9
Scorpiones	-	-	-	1	1	-	-	-	-	-	-	-	-	-
Omnivores														
Formicidae[b]	A	P	P	P	P	P	P	A	P	P	P	P	A	P
Melandryidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Staphylinidae	-	-	-	-	-	-	1	-	-	-	-	-	1	-
Herbivores														
Cicadidae	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Lygaeidae	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Miridae	-	-	-	-	-	-	2	-	-	-	-	-	-	-
Scarabidae	4	2	1		1	7	1	3	4	3	3	3	5	2
Tettigonidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vitrinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Detritivores														
Blatellidae	2	-	2	-	5	4	9	3	3	3	-	-	11	-
Diplipoda	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elateridae	4	-	1	-	6	1	-	1	2	2	5	1	3	2
Gryllidae	-	-	-	1	2	-	3	-	3	-	1	-	-	2
Helodidae	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Hydrophilidae	-	-	-	-	-	1	-	-	-		-	-	-	-
Isopoda	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lumbricidae	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Silphidae	-	-	-	-	1	-	-	-	-	-	-	-	1	-
Tabanidae[c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	2	1	-	5	4	-	-	3	1	1	2	3	-
Total Abundance	48	32	21	14	80	52	49	20	41	36	36	16	45	20

TABLE 3-5

INVERTEBRATE ABUNDANCE BY TAXON
SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 2 OF 2

TAXON	SS-724	SS-726A	SS-727A	SS-728A	SS-732	SS-733	SS-734	SS-735A	SS-736A	SS-737	SS-739[a]	SS-740[a]	SS-741[a]
Predators													
Anthocoridae	-	-	-	2	-	-	6	9	-	1	-	-	-
Araneida	2	8	2	2	2	4	5	6	3	3	-	1	3
Carabidae	-	1		2		3	5	2	-	2	-	-	2
Cicindelidae	-	-	-	-	-	-	-	-	1	-	-	-	-
Cleridae	-	-	-	-	-	-	-	-	1	-	-	-	-
Lithobiomorpha	2	1	4	2	-	5	11	3	1	7	21	2	-
Mantidae	-	-	-	-	-	-	-	-	-	-	1	-	-
Opiolones	-	-	-	3	-	-	3	3	-	4	-	-	2
Reduviidae	-	-			1		-	-	-	-	-	-	-
Scolopendromorpha	5	11	4	26	5	10	19	12	22	21	18	13	23
Scorpiones	-	-	-	-	-	1	-	-	-	-	-	-	-
Omnivores													
Formicidae[b]	P	P	P	A	P	A	P	A	P	P	P	P	P
Melandryidae	-	-	-	-	-	-	-	-	-	-	-	1	-
Staphylinidae	-	-	-	2	-	-	-	1	-	-	-	-	-
Herbivores													
Cicadidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Lygaeidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Miridae	-	-	-	-	-	-	-	-	-	-	-	-	-
Scarabidae	2	1	2	5	-	1	1	4	1	-	1	1	-
Tettigonidae	-	-	1	-	-	-	-	-	-	-	-	-	-
Vitrinidae	-	-	-	-	-	-	-	1	-	-	-	-	-
Detritivores													
Blatellidae	1	7	-	6	5	6	12	11	9	3	1	3	4
Diplipoda	-	-	-	-	-	2	-	-	-	-	-	-	-
Elateridae	3	2	1	-	-	2	2	2	1	10	2	5	17
Gryllidae	-	-	1	-	1	-	-	-	1	1	1		-
Helodidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrophilidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopoda	-	-	-	-	2	-	-	-	-	-	-	-	-
Lumbricidae	-	-	1	3	1	-	-	-	-	-	-	-	-
Silphidae	-	-	1	-	-	-	-	-	-	-	-	-	-
Tabanidae[c]	-	1	-	-	-	-	-	-	-	-	-	-	-
Unknown	3	6	-	1	1	3	2	-	3	1	-	-	2
Total Abundance	18	38	17	54	18	37	66	54	43	53	45	26	53

a Reference location.
b Formicidae (ants) noted as present (P) or absent (A) but not enumerated as per work plan.
c Tabanidae (horse fly) is a detritovore only in larval stage.
d Egg sacks were not included in enumeration of individual taxa or total number;egg sacks were observed in the following plots:
SS-706: Blatellidae (n=2); Araneida (n=1)
SS-707: Blatellidae (n=1)
SS-707A: Blatellidae (n=2)
SS-717: Blatellidae (n=1)
SS-722: Araneida (n=1)

TABLE 4-1

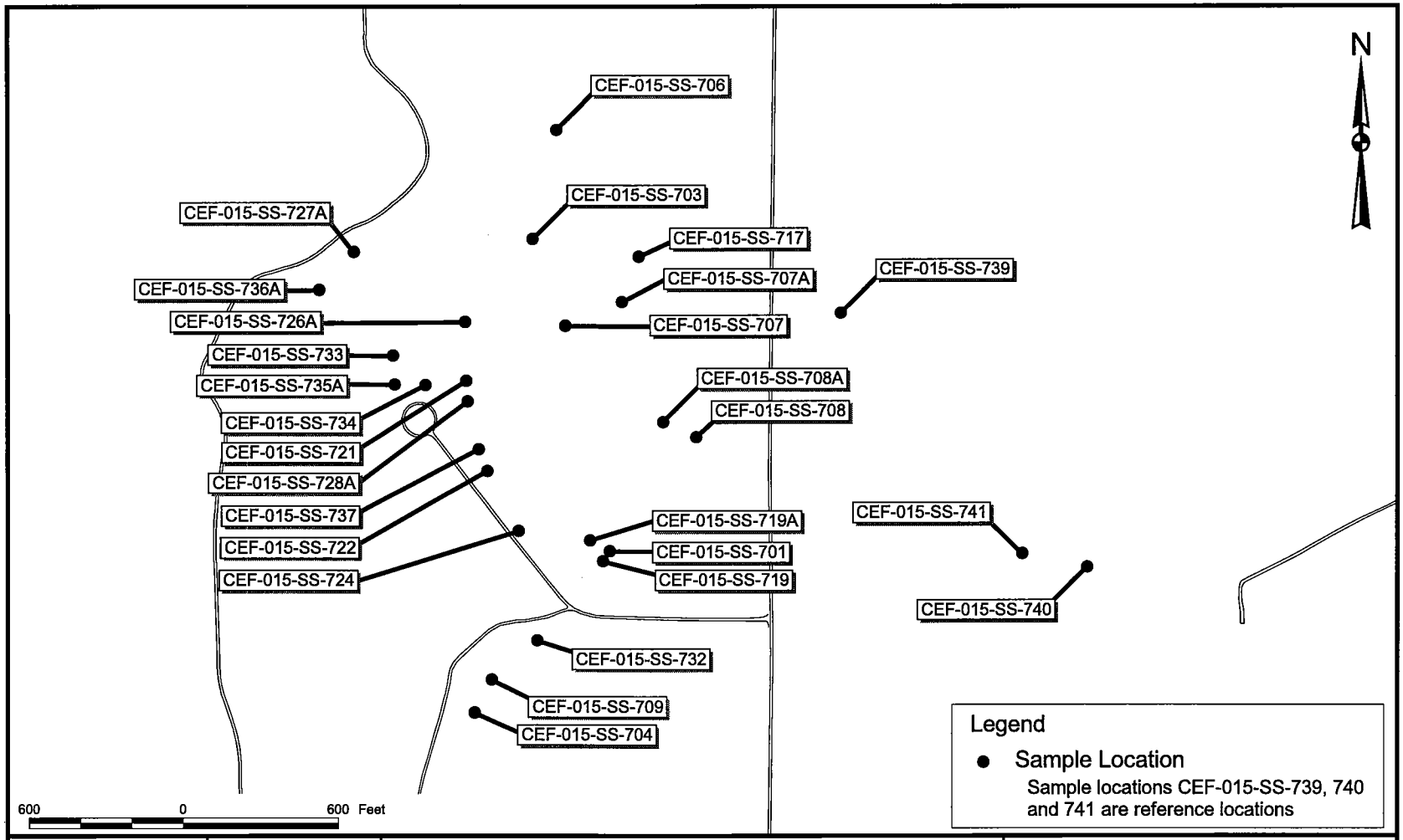
PRELIMINARY REMEDIATION GOALS FOR LEAD
MAMMALIAN AND AVIAN RECEPTORS
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Representative Receptor	BAF	PRG (mg/kg)
Mammal (shrew)	0.14	2512
	0.05	4716
Bird (mockingbird)	0.05	1127

BAF: Soil-to-invertebrate bioaccumulation factor

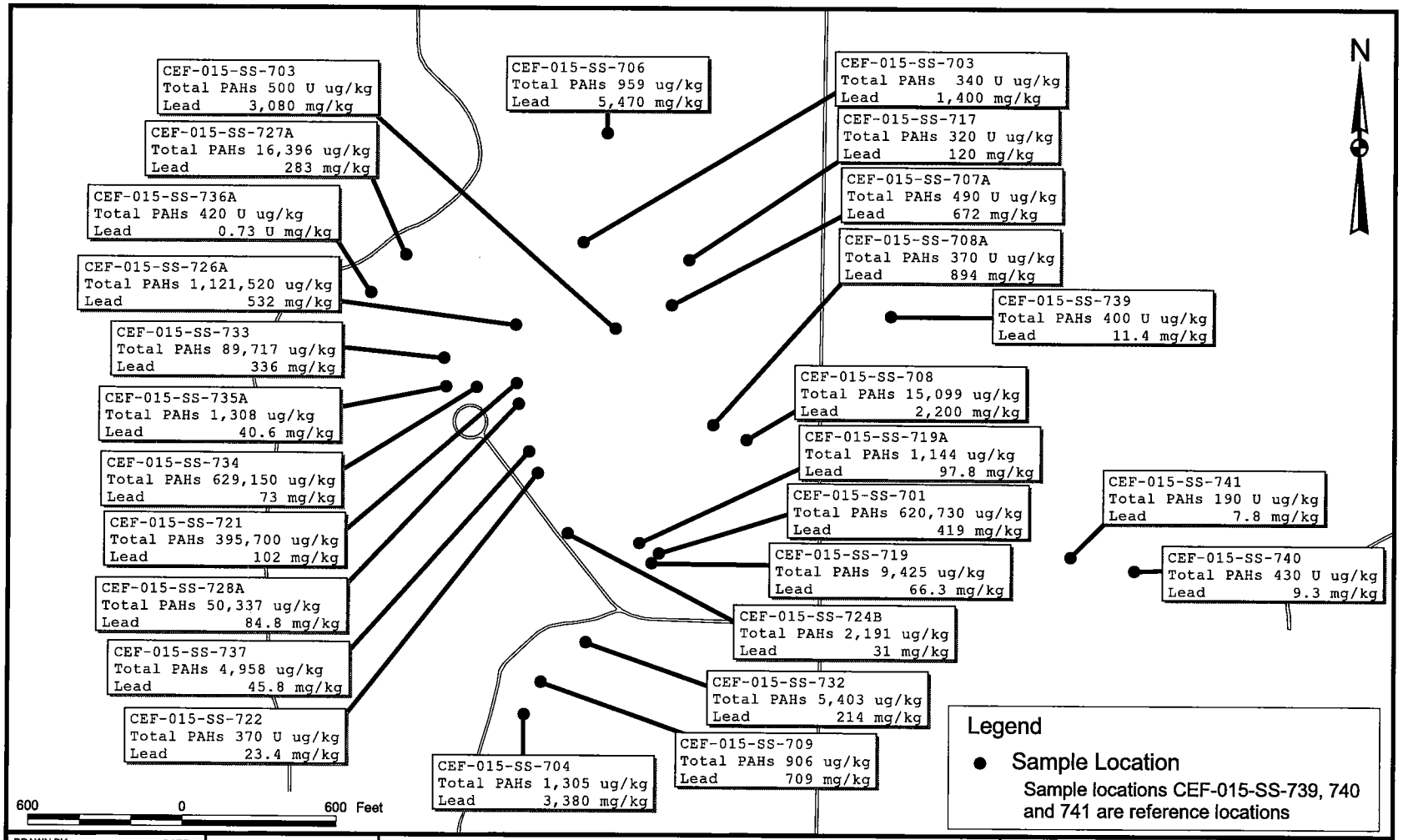
PRG: Preliminary remediation goal

See text for explanation of values used and associated assumptions.



DRAWN BY	DATE			CONTRACT NUMBER 7653	
MJJ	19Dec00		SAMPLE LOCATIONS	APPROVED BY —	DATE —
CHECKED BY —	DATE —		SITE 15	APPROVED BY —	DATE —
COST/SCHEDULE-AREA			NAS CECIL FIELD	DRAWING NO. FIGURE 2-1	REV 0
SCALE AS NOTED			JACKSONVILLE, FLORIDA		

P:\GIS\NAS_CecilField\Site-15_eco.apr 18Sep01 MJJ Layout3



DRAWN BY	DATE
MJJ	25Aug01
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE	AS NOTED

LEAD AND TOTAL PAH CONCENTRATIONS IN SOIL SAMPLES

SITE 15

NAS CECIL FIELD

JACKSONVILLE, FLORIDA

CONTRACT NUMBER	
7653	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 3-1	REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 18Sep01 MJJ Layout2

FIGURE 3-2

INVERTEGRATE LEAD CONCENTRATION AS A FUNCTION OF SOIL LEAD CONCENTRATON
SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

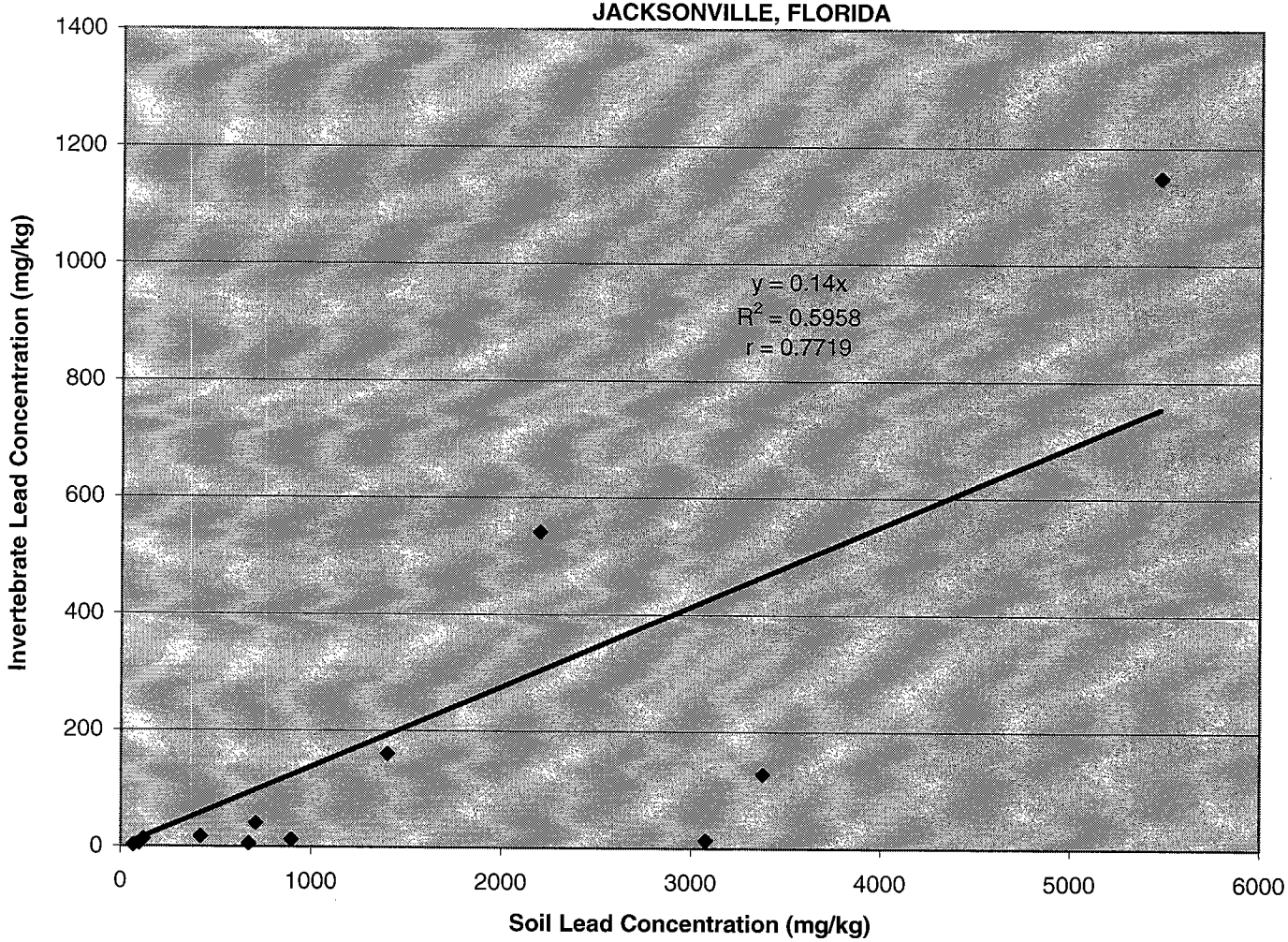
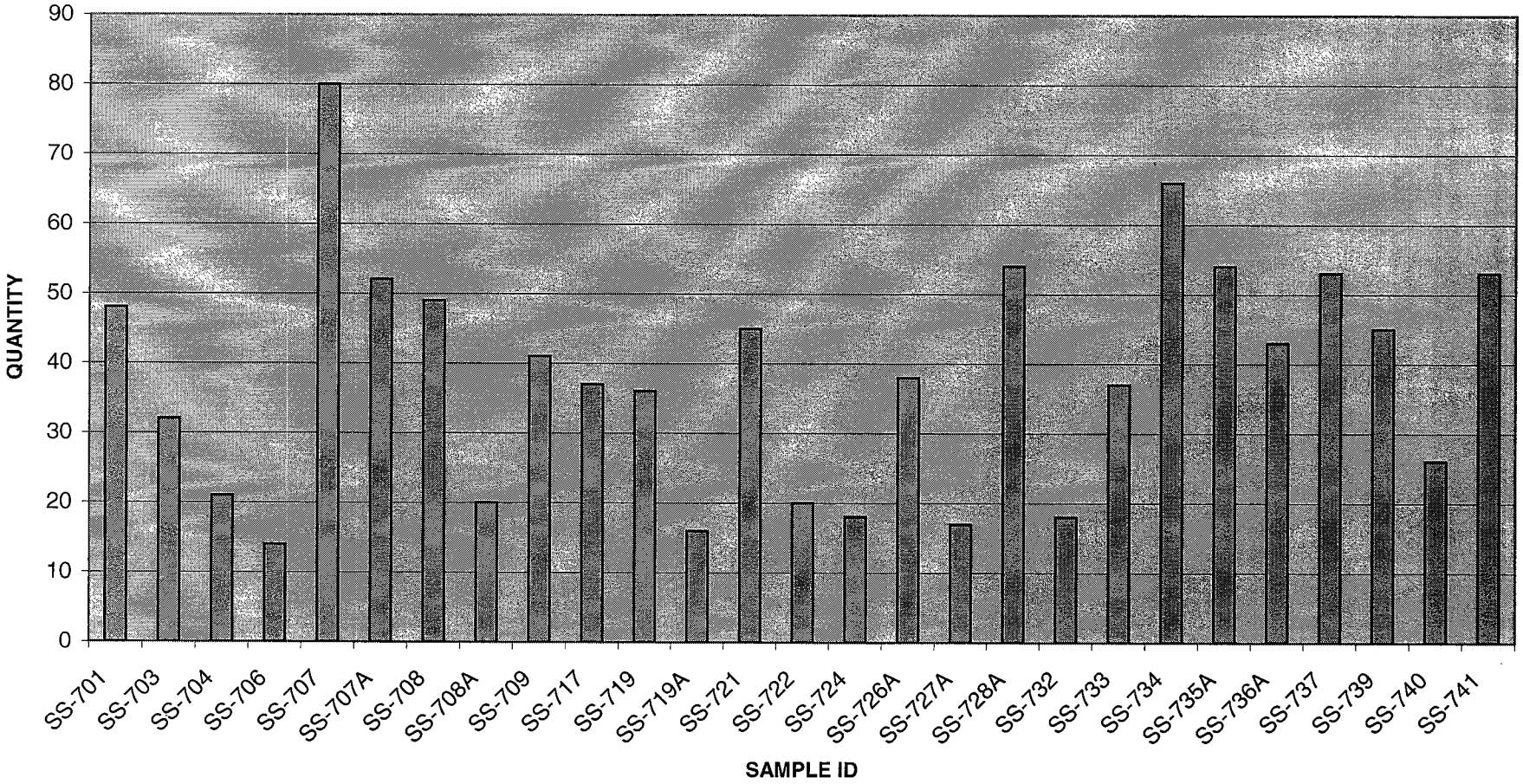


FIGURE 3-3

TOTAL NUMBER OF INVERTEBRATES BY SAMPLING PLOT
SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA



APPENDIX A

WORK PLAN AND SAMPLING AND ANALYSIS PLAN

Development of Ecologically-Based Remediation Goals for Lead and PAHs in Soil

Site 15, Blue 10 Ordnance Disposal Area

Naval Air Station Cecil Field

Jacksonville, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888
Contract Task Order 0078

June 2001

DEVELOPMENT OF ECOLOGICALLY-BASED REMEDIATION GOALS FOR LEAD AND PAHs IN SOILS

FOR

SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0078

JUNE 2001

PREPARED UNDER THE SUPERVISION OF:

MARK SPERANZA, P.E.
TASK ORDER MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

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

TABLE OF CONTENTS

SECTION **PAGE NO.**

1.0 INTRODUCTION **1**

2.0 THE CONCEPTUAL SITE MODEL **1**
- 2.1 HABITAT TYPES AND ECOLOGICAL RECEPTORS 1
- 2.2 CONTAMINANT SOURCES 3
- 2.3 MIGRATION PATHWAYS 3
- 2.4 EXPOSURE PATHWAYS 3
- 2.4.1 Lead 3
- 2.4.2 PAHs 6

3.0 ASSESSMENT AND MEASUREMENT ENDPOINTS **6**
- 3.1 LEAD 6
- 3.1.1 Assessment Endpoints 6
- 3.1.2 Risk Questions 7
- 3.1.3 Measurement Endpoints 7
  - 3.1.3.1 Survival of Soil Invertebrates 7
  - 3.1.3.2 Diversity and Abundance of Soil Invertebrates 9
  - 3.1.3.3 Impacts to Birds and Small Mammals 10
- 3.1 PAHS 11
- 3.2.1 Assessment Endpoints 11
- 3.2.2 Risk Questions 11
- 3.2.3 Measurement Endpoints 11
  - 3.2.3.1 Survival of Soil Invertebrates 11
  - 3.2.3.2 Diversity and Abundance of Soil Invertebrates 12

DEVELOPMENT OF PRGs **12**
- 4.1 LEAD PRG DEVELOPMENT FOR SOIL INVERTEBRATES 12
- 4.1.1 Toxicity Tests 12
- 4.1.2 Diversity and Abundance of Soil Invertebrates 13
- 4.2 LEAD PRG DEVELOPMENT FOR BIRDS AND SMALL MAMMALS 13
- 4.3 PRG DEVELOPMENT FOR PAHs 17

5.0 SUMMARY **17**

REFERENCES **R-1**

APPENDIX
- A **PHASE VIII SAMPLING AND ANALYSIS WORK PLAN**

TABLES

NUMBER		PAGE NO.
1	Food Ingestion Rates in Herbivorous and Omnivorous Mammals	19
2	Exposure Parameters for Representative Ecological Receptors	20

FIGURES

NUMBER		PAGE NO.
1	Site 15 Habitat Map	21
2	Contaminant Pathways at Site 15	22
3	Isoconcentration Contours for Lead in Soil	23
4	Site 15 and Reference Site Location	24
5	Isoconcentration Contours for PAHs in Soil	25

DEVELOPMENT OF ECOLOGICALLY-BASED REMEDIATION GOALS FOR LEAD AND PAHs IN SOIL SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA

1.0 INTRODUCTION

Previous sampling of media at Site 15 conducted in support of an ecological risk assessment has shown that lead and polycyclic aromatic hydrocarbons (PAHs) in surface soil in some portions of the site may pose risk to ecological receptors (ABB, 1997). Additional sampling at Site 15 has further characterized locations of elevated lead and PAHs in soil at the site. Site-specific preliminary remediation goals (PRGs) for soil at Site 15 are needed so that risk managers can evaluate remedial options.

This report describes how ecologically-based PRGs will be developed for lead and PAHs at Site 15. The methodologies described herein have been approved by representatives of the Navy, the U.S. Environmental Protection Agency (EPA) Region IV, and the Florida Department of Environmental Protection in a teleconference on May 11, 2001.

The development of PRGs requires the creation of a conceptual site model that addresses the physical characteristics and ecological receptors at the site, complete exposure pathways that will be evaluated, assessment endpoints, risk questions, and measurement endpoints. Each of these topics is discussed herein.

2.0 THE CONCEPTUAL SITE MODEL

This section describes the conceptual site model for Site 15 and begins with a description of the habitats and ecological receptors at the site.

2.1 Habitat Types and Ecological Receptors

Site 15 covers approximately 85 acres in the northern portion of NAS Cecil Field. The majority of the site consists of pine flatwoods (Figure 1). This habitat type is characterized by flat topography, acidic, sandy soil, an overstory of pines, an extensive low shrub stratum, and a variable but often sparse herbaceous layer (Abrahamson and Hartnett, 1990). Planted slash pine (*Pinus elliottii*) is the dominant tree species at the site. The understory in some portions of this habitat is a thick layer of shrubs dominated by saw palmetto (*Serenoa repens*) and gallberry (*Ilex glabra*), while in other areas the understory is sparsely vegetated. A 1 to 5 inch layer of decaying organic matter (i.e., detritus, duff) covers the surface throughout most of the pine flatwoods habitat. Trees were harvested from an area at the eastern portion of the site in 1997. A large portion of the pine flatwoods south and west of the paved entrance road was

burned by a forest fire in 1999; this area was subsequently clear-cut, is now largely devoid of trees and shrubs, and consists mostly of logging debris.

Other habitats at the site include mesic pine/hardwoods, a narrow strip of floodplain forest, and a depressional area that was formerly a cypress dome swamp (Figure 1). The floodplain forest is located along a wet-weather stream that drains the southern portion of the site, and is dominated by oaks (*Quercus spp.*), red bay (*Persea borbonia*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and blackgum (*Nyssa sylvatica*). Major understory species here include saw palmetto, gallberry, *Vaccinium spp.*, and wild grape (*Vitis rotundifolia*). The mesic pine/hardwoods habitat occurs where the floodplain forest merges with the pine flatwoods, and is composed of plants typically found in the latter two habitats. A shallow circular depression covering approximately ¾ acre is located in the eastern portion of the site. This area appears to have been a cypress dome swamp in the past, but now consists of bare ground except for a few scattered bald cypress (*Taxodium distichum*) trees. Yellow jessamine (*Gelsemium sempervirens*), myrtle-leaf holly (*Ilex myrtifolia*), and saw palmetto are scattered around the edge of the depression. The depression has been dry during site visits by Tetra Tech NUS biologists. Drainage ditches north and northwest of the site have apparently altered the hydrology, so that appreciable surface water runoff into this area no longer occurs, and the depression presumably rarely (if ever) contains surface water.

Based on several site visits by Tetra Tech NUS biologists, Site 15 appears to be typical of other pine flatwoods habitats in northern peninsular Florida. As such, the site provides habitat for several species of vertebrate receptors. Numerous bird species such as the brown-headed nuthatch (*Sitta pusilla*), prairie warbler (*Dendroica discolor*), pine warbler (*Dendroica pinus*), rufous-sided towhee (*Pipilo erythrophthalmus*), mockingbird (*Mimus polyglottus*), and red-bellied woodpecker (*Melanerpes carolinus*) have been observed on the site. Mammals such as the white-tailed deer (*Odocoileus virginianus*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), gray squirrel (Sciurus carolinensis), nine-banded armadillo *(Dasypus novemcinctus*), Eastern cottontail (Sylvilagus floridanus), and Eastern mole (*Scalopus aquaticus*) are known to utilize the site. Based on current habitat and known geographic range, mammals such as the cotton mouse (*Peromyscus gossypinus*), cotton rat (*Sigmodon hispidus*), Southern short-tailed shrew (*Blarina carolinensis*), Southeastern shrew (*Sorex longirostris*), and least shrew (*Cryptotis parva*) are expected to be present. Amphibians and reptiles such as the oak toad (*Bufo quercicus*), box turtle (*Terrapene carolina*), and black racer (*Coluber constrictor*) probably occur on the site.

Previous observations at Site 15 and at nearby reference locations indicate that invertebrates are scarce in soils deeper than one to three inches below the top of the mineral horizon, presumably due to the typically low organic mater content of the sandy soils in pine flatwoods (Abrahamson and Hartnett, 1990).

However, a variety of invertebrates (e.g. beetles, spiders, centipedes, millipedes, and termites) have been observed at Site 15 in the organic duff layer and at the interface between the duff layer and mineral soil. (Note: The remaining text uses the term "soil invertebrates" to include invertebrates in the mineral soil as well as those in the organic duff layer).

2.2 Contaminant Sources

Site 15 was used as a trap and skeet range during the 1940s and 1950s. A second shooting area possibly existed south of the access road (ABB, 1997). Lead shot from the trap and skeet range is the primary source of lead contamination in soils at the site. Soil concentrations of lead are elevated in some portions of the site, with a maximum concentration of approximately 65,000 mg/kg.

A metal chamber near the center of Site 15 was used to incinerate ordnance from the mid 1960s through 1977. Ash resulting from the burned ordnance was presumably deposited in various areas in the vicinity of the burn chamber (ABB, 1997). Soil concentrations of PAHs are elevated in some portions of the site, with a maximum concentration of approximately 12,000 mg/kg. The source of elevated PAHs at the site is assumed to be the disposal of ash from the burn chamber and/or fragments of "clay pigeons" used as targets on the former trap and skeet range. A study at one trap and skeet range showed that clay pigeons were comprised of 32 percent petroleum pitch, which consisted of several PAHs (Baer et al, 1995).

2.3 Migration Pathways

Surface soil is considered to be the only significant exposure medium for ecological receptors at Site 15. Previous sampling and analyses have shown that infiltration of contaminants into groundwater and subsequent discharge of groundwater contaminants into surface water is negligible at the site (ABB, 1997). Overland flow and surface runoff are minor due to the overall flat character of the site. Furthermore, the forest cover and duff layer throughout most of the site minimizes erosion as a migration pathway. In addition, aquatic habitat at the site is negligible. A wet-weather stream is located in the southern portion of the site, and a second wet-weather stream is in the extreme western portion of the site. However, these two streams are dry except after recent rain events, and permanent aquatic habitats have not become established therein. For the above reasons, site-related contaminants are relatively stationary in soil, and soil is the only significant exposure medium.

2.4 Exposure Pathways

2.4.1 Lead

Soil invertebrates are directly exposed to lead in soil at Site 15. Terrestrial animals can be exposed to site-related lead contamination through ingestion of contaminated food items. Animals can also incidentally ingest lead in soil while grooming fur, preening feathers, digging, grazing close to the soil, or

feeding on items to which soil has adhered. Absorption of lead from the gastrointestinal tract is the primary pathway of intake for terrestrial receptors, and chronic exposure to lead can produce adverse neurological, gastrointestinal, respiratory, immunological, and reproductive (fetal and maternal) effects (Eisler, 1988).

Ingestion of lead shot can be acutely toxic to birds, but previous studies at Site 15 indicate that relatively few lead pellets remain in the soil. Specifically, 36 soil samples were collected and sieved through a No. 20 sieve to remove pelletized lead shot (ABB, 1997). Each of the samples was analyzed for lead before and after sieving. Lead concentrations in the sieved samples were within 16 percent (average difference) of the lead concentrations in the unsieved samples. The authors concluded that most of the lead shot had oxidized (ABB, 1997). Based on the ABB study, and since no pelletized lead shot has been observed by Tetra Tech NUS biologists during previous site visits, lead shot is assumed to be largely absent from surficial soils. Therefore, exposure to lead in soil at Site 15 is considered to be primarily chronic, rather than acute.

Soil invertebrates at the site undoubtedly serve as food items for vermivorous, insectivorous, and omnivorous mammals and birds that are known or expected to occur at Site 15. These mammals include the Eastern mole, nine-banded armadillo, Southern short-tailed shrew, Southeastern shrew, least shrew, cotton mouse, and others. (Note: "vermivorous" refers to worm-eating organisms. However, most animals that consume worms also consume adult and larval insects and other arthropods, and no animals at Site 15 are strictly vermivorous. Thus, the term "vermivorous/insectivorous" will be used herein to denote animals whose primary prey is a combination of worms, insects, and other arthropods). Numerous species of birds prey upon soil invertebrates at the site; examples include the bobwhite quail (*Colinus virginianus)*, mockingbird, American robin (*Turdus migratorius*), and rufous-sided towhee. Invertebrates in lead-contaminated soils are known to accumulate lead (Eisler, 1988), and the exposure pathway of soil to invertebrates to animals that prey on invertebrates is assumed to be the primary pathway of exposure to lead at Site 15 (Figure 2). This pathway includes toxicity to soil invertebrates and toxicity to birds and mammals that prey upon soil invertebrates.

The contaminant pathway at Site 15 is admittedly more complex than the simplified pathway shown in Figure 2. For example, lead in soil can reduce plant growth and photosynthesis. Lead in soil can also be taken up via plant roots, transported through the vascular system, and deposited in foliage; the foliage can then provide lead exposure to herbivorous mammals as well as to insects and subsequently to insectivorous birds and mammals. Senescent foliage on the ground is colonized by fungi, which are foraged upon by mites and other tiny arthropods; these are preyed upon by larger arthropods such as nematodes and spiders, which are consumed by birds and mammals. Reptiles and amphibians can be exposed to lead through activities such as consuming lead-contaminated insects and other organisms.

Upper level carnivores such as hawks, owls, foxes, and weasels can ingest lead through the consumption of lead-contaminated prey items (e.g., reptiles, amphibians, vermivorous/insectivorous birds and mammals). As EPA (1997) points out, however, it is frequently possible to reduce the number of exposure pathways that need to be evaluated to one or a few critical exposure pathways. Furthermore, it is not practical or necessary to directly evaluate risks to all of the individual components of the ecosystem (EPA, 1997). The exposure pathway of soil to invertebrates to animals that prey on invertebrates represents a sensitive and ecologically important pathway. It is sensitive because soil invertebrates are in constant contact with the contaminated medium (*i.e.*, soil), and invertebrates are known to be vulnerable to lead toxicity. This pathway is ecologically important because site-related lead toxicity can adversely impact not only the invertebrate community, but can also adversely impact populations of vermivorous/insectivorous birds and mammals. Reduced populations of vermivorous/insectivorous birds and mammals would result in fewer prey items for carnivorous animals that consume the vermivorous/insectivorous animals, and thus, populations of carnivorous animals might be reduced as an indirect result of impacts to the invertebrate community.

The pathway of soil to vegetation to herbivorous animals is likely complete, but lead ingestion for invertebrate-eating mammals and birds will be higher than lead ingestion for herbivorous and omnivorous mammals. At least two factors are responsible for this. First, lead accumulation in plants is usually less than accumulation in invertebrates (Sample et al, 1998a; ORNL, 1998). Second, food ingestion rates of insectivorous/vermivorous mammals such as shrews and moles are greater than food ingestion rates of herbivorous and omnivorous mammals (Table 1). Moles and shrews have high metabolic rates (Brown, 1997), so their food ingestion rates are greater than food ingestion rates of herbivorous and omnivorous rodents. Therefore, the soil-to-herbivore pathway will not be investigated because the remediation goals will be developed using the more highly exposed receptors.

Lead usually does not biomagnify in food chains (Eisler, 1988), and lead concentrations in prey items of vermivorous/insectivorous mammals and birds will be greater than in prey items of large carnivores. For example, mean and median soil-to-earthworm uptake factors for lead were 3.342 and 0.266, respectively, in a review of several published literature studies (Sample et al, 1998a), while mean and median soil-to-small mammal uptake factors for lead were 0.1615 and 0.1054, respectively, in a review of several published literature studies (Sample et al, 1998b). Ingestion of food containing biologically incorporated lead is unlikely to cause clinical signs of toxicity in birds of prey (Eisler, 1988; Custer *et al*, 1984; Henny *et al*, 1994). Lead tends to be deposited in bones, but bones are not digested by owls, and are only partially digested by hawks and falcons before being regurgitated in pellets (Henny *et al*, 1994). In summary, the soil-to-carnivore pathway will not be investigated because the remediation goals will be developed using more highly exposed and sensitive receptors.

2.4.2 PAHs

PAHs show little tendency to biomagnify in the food web (Eisler, 1987). U.S. EPA Region IV considers the potential toxicity of PAHs via the terrestrial food web to be generally negligible unless PAHs are present at extremely high concentrations (i.e., percent levels: 10,000 mg/kg) in soil. Risks to human health from carcinogenic PAHs at Site 15 have been evaluated, and preliminary human-health remediation goals have been generated; the maximum concentration of total PAHs expected at Site 15 after human health-based remediation of carcinogenic PAHs is 746 mg/kg. Because this value is well below percent levels, toxicity to upper level receptors is not expected and will not be further evaluated.

Some PAHs are toxic to soil invertebrates at concentrations that will remain after the human health remediation. For example, in a toxicity study of fluorene, a concentration of 170 mg/kg was lethal to 50 percent of the earthworms used in the test (Neuhauser *et al*, 1986). Since soil invertebrates are primary prey items for a variety of birds and mammals, reduced populations of soil invertebrates could impact populations of upper level receptors by decreasing their food supply. The soil-to-invertebrate pathway is assumed to be the primary pathway of exposure to PAHs at Site 15 (Figure 2). Adverse impacts to plants from PAHs are rare (Eisler, 1987) and risks to plants from PAHs will not be evaluated.

3.0 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" (EPA, 1997). Measurement endpoints represent the assessment endpoints chosen for a site, and are measures of biological effects (EPA, 1997). The appropriate selection of assessment and measurement endpoints is critical for the evaluation of ecological risks and the establishment of remediation goals. A discussion of assessment endpoints, risk questions, and measurement endpoints for lead is presented below, and is followed by a similar discussion for PAHs.

3.1 Lead

3.1.1 Assessment Endpoints

Based on the conceptual model for Site 15, assessment endpoints for lead have been developed for soil invertebrates, birds, and mammals. Soil invertebrates serve as prey for rodents, shrews, moles, and birds, which are preyed upon by carnivores such as hawks, owls, foxes, weasels, and bobcats. Thus, soil invertebrates are vital components of the ecosystem at Site 15. With this in mind, the first assessment endpoint for lead at Site 15 is as follows:

- Survival of soil invertebrate populations typical in pine flatwoods habitat.

As mentioned above, birds and small mammals serve as prey items for carnivores such as hawks, owls, foxes, weasels, and bobcats. Thus, contaminant-related reduced populations of birds and small mammals could result in reduced populations of receptors higher in the food chain. With this in mind, the two remaining assessment endpoints for lead at Site 15 are as follows:

- Growth and reproduction of residential and migratory avian populations typical in pine flatwoods habitat.
- Growth and reproduction of mammalian populations typical in pine flatwoods habitat.

An important distinction pertaining to the latter two assessment endpoints above is that lead in soil could potentially cause adverse impacts to predators *directly* through ingestion of contaminated prey and *indirectly* through a reduced food supply (which could result from a toxicity-related decline in prey populations).

3.1.2 Risk Questions

Ecological risk questions are based on assessment endpoints and provide a basis for developing the study design (EPA, 1997). Based on the conceptual model and the assessment endpoints, the primary risk questions involving lead contamination at Site 15 are as follows:

- At what soil concentration does lead at Site 15 cause (or potentially cause) reduced survival of soil invertebrates?
- At what soil concentration does lead at Site 15 cause (or potentially cause) reduced diversity and abundance of soil invertebrates?
- At what soil concentration does the ingestion of lead at Site 15 cause (or potentially cause) adverse effects to avian and mammalian receptors?

3.1.3 Measurement Endpoints

The measurement endpoint for each of the lead-associated risk questions is provided below.

3.1.3.1 Survival of Soil Invertebrates

The measurement endpoint for the first risk question in Section 3.1.2 will be the survival of earthworms in 14-day laboratory toxicity tests using soil samples collected from Site 15 and a reference area. The purpose of the toxicity tests will be to determine if lead concentrations in site soil samples are correlated with mortality of the organisms associated with this assessment endpoint (i.e., soil invertebrates). The survival of laboratory-reared earthworms (*Eisenia fetida*) in site soil samples will be evaluated following standardized methods (ASTM, 1998). Survival will be measured at 14 days, since this is the typical duration of toxicity tests using *Eisenia fetida* when mortality is the endpoint (ASTM, 1998). Although

laboratory toxicity tests do not reflect actual field conditions, their use allows the control of factors such as temperature, moisture, predation, etc. that could confound conclusions regarding site-related contaminants.

Earthworms will be used to represent other soil invertebrates that occur on the site, since toxicity test methodologies using earthworms have been standardized, whereas toxicity tests using other invertebrates have not. Unfortunately, there are no data in the literature on the comparability of earthworms versus other terrestrial invertebrates regarding lead toxicity. However, earthworms are generally considered to be representative of soil invertebrates in ecological risk assessments (Sample *et al*, 1997). Earthworms have been shown to be more sensitive than insects to chemicals such as cadmium and PCBs (Parmelee *et al*, 1997), and many researchers have proposed that conclusions derived from earthworms should apply at least somewhat to other soil invertebrates (Beyer and Stafford, 1993). The uncertainty resulting from the lack of data on the comparability between earthworms and insects will be partially mitigated by the measurement endpoint discussed in Section 3.1.3.2.

Twelve samples will be collected from Site 15 for toxicity tests. This number of samples is expected to be sufficient to determine if lead concentrations in site soils are correlated with survival of earthworms in the toxicity tests, and will provide sufficient data for the measurement endpoint discussed in Section 3.1.3.2. Lead chemistry data from previous sampling events at Site 15 were used to identify a gradient of lead concentrations in surface soil represented by four intervals: 197 to 499 mg/kg, 500 to 999 mg/kg, 1,000 to 4,999 mg/kg, and >5,000 mg/kg. The 197 mg/kg value is the concentration indicative of background soil concentrations of lead at NAS Cecil Field (NAS Cecil Field Inorganic Background Data Set; HLA, 1998). The remaining interval boundaries were selected based on lead toxicity data in the literature. Existing PAH data were evaluated to select sampling locations with minimal expected PAH concentrations in order to minimize the possibility that PAHs would confound any conclusions regarding lead toxicity. Three soil samples in each lead concentration interval and three samples from the reference area will be collected for a total of 15 soil samples (Figure 3).

Soil samples collected for toxicity tests at Site 15 and at the reference location will consist of the first three inches of mineral soil plus the overlying duff layer atop the mineral horizon, since this is the predominant stratum in which soil invertebrates exist at the site. Each soil sample will consist of five composites from throughout 15 ft x 15 ft quadrats. The five composites will be homogenized in the field and split into sub-samples for chemical analyses and toxicity tests. Soil samples will be subjected to a quick laboratory turnaround (7 days maximum) for lead and total PAH analyses. Toxicity tests using Site 15 samples will be analyzed only when lead concentrations exceed 197 mg/kg (NAS Cecil background).

As explained above, the 12 locations from which samples will be collected for toxicity tests at Site 15 (Figure 3) are based on lead data from previous sampling events. However, most existing soil lead data from Site 15 are based on samples that were composites of 0 to 12 inches below the surface, while samples in the current study will consist of the upper 3 inches of soil plus the overlying duff layer. Therefore, the lead concentrations in the samples to be collected for toxicity tests could be greater or less than concentrations suggested by existing lead data. Because of this uncertainty, and since samples are desired from a gradient of lead concentrations, field-portable x-ray fluorescence (XRF) equipment will be utilized to select the sampling locations. Thus, the locations shown in Figure 3 can be considered as provisional.

The three reference samples will be collected from a forested area approximately 2,000 feet east of Site 15 (Figure 4). Existing soil types, vegetation, and habitats in this area are similar to those at Site 15. The XRF will be used to select three sample locations where lead concentrations are at or below 197 mg/kg (NAS Cecil background).

As explained above, the 12 soil samples collected for toxicity tests and chemical analyses at Site 15 will consist of the first three inches of mineral soil plus the overlying duff layer. At each of the 12 sampling locations, one additional soil sample will be collected and archived for possible future analyses of lead. These additional samples will consist of mineral soil only (no overlying duff) and will be composites of 0 to 12 inches below the surface.

3.1.3.2 Diversity and Abundance of Soil Invertebrates

The diversity and abundance of soil invertebrates will be evaluated by collecting soil invertebrates from a gradient of lead concentrations at Site 15 and from three locations at a reference area. The soil invertebrates will be collected simultaneously with, and from the same soil/duff stratum at the same 15 locations, as the soil samples that are collected for the soil toxicity tests (Section 3.1.3.1). After removing overlying leaves, limbs, and debris from the surface, invertebrates in the duff layer atop the mineral horizon will be collected by hand during a careful examination of surface litter from the 15 ft x 15 ft sampling quadrats. Invertebrate species that are not normally in close contact with soil and/or duff (e.g., butterflies, dragonflies, ticks) will not be collected.

Invertebrates will be classified to the genus level to the maximum practical extent. When this level of classification becomes excessively problematic for a qualified entomologist/taxonomist, classification to family level will be acceptable. Earthworms, however, will be classified simply as "earthworms". The number of invertebrates within each genus or family will be recorded at each 15 x 15 ft quadrat. Ants will not be enumerated; however, their presence will be noted and the number of mounds or colonies within each quadrat will be recorded. Habitat characteristics such as soil type, duff thickness, plant species

composition, and percent coverage of overstory, midstory, and understory layers of trees, shrubs, etc. will be recorded. Attempts will be made to select sampling locations such that habitat characteristics are similar among stations.

Many factors other than chemistry can affect the diversity and abundance of soil invertebrates. These factors include vegetation species and abundance in the vicinity, soil litter characteristics, amount of sunlight, weather events, and soil characteristics such as moisture, acidity, and organic matter content of the soil. In addition, since invertebrate populations vary seasonally, soil invertebrate surveys are frequently conducted throughout one full year, and often for two years. Surface crawling invertebrates are generally collected in pitfall traps made from buried cups, cans, jars, or troughs. Pitfall traps are usually checked once or twice each day, since less frequent collection allows samples to be preyed upon by organisms such as birds, small mammals, and fire ants. Invertebrates are often sorted into trophic groups such as fungivores, bacterivores, herbivores, omnivores, and predators. The invertebrate collection proposed for Site 15 is not intended to be such an exhaustive investment of time and resources. Instead, the diversity and abundance data will provide a "snapshot" of conditions during the approximately 10-day period in which sampling activities are conducted.

3.1.3.3 Impacts to Birds and Small Mammals

The measurement endpoint for determining the soil concentration at which the ingestion of lead causes adverse effects to avian and mammalian receptors will be concentrations of lead in soil and in soil invertebrates collected from the site. The purpose of the invertebrate tissue analyses is to measure lead concentrations in prey items consumed by the species associated with the assessment endpoints. This will allow the development of soil-to-invertebrate bioaccumulation factors (BAFs) for Site 15 with which soil remedial goals can be calculated (Section 4.1).

Lead concentrations will be measured in soil invertebrates and in co-located soil samples. The soil samples will be sub-samples of those collected for the soil toxicity tests (see Section 3.1.3.1), and the invertebrate samples will be those collected and described in Section 3.1.3.2. Thus, 15 soil and 15 invertebrate samples will be collected. The analytical laboratory selected for tissue analyses indicates that approximately 1.3 grams (g) of tissue will be required for lead analyses. Invertebrate tissues from Site 15 samples will be analyzed only when lead concentrations in co-located soil samples from Site 15 exceed 197 mg/kg (NAS Cecil background).

As mentioned in Section 3.1.3.1, soil samples will be collected from the top three inches of mineral soil and the duff atop the mineral soil. Since invertebrates are scarce in Site 15 soil at depths greater than approximately three inches below the surface, lead at deeper depths poses negligible risk to soil invertebrates and organisms that consume these invertebrates.

3.2 PAHs

3.2.1 Assessment Endpoints

As discussed in Section 2.4.2, the soil-to-invertebrate pathway is assumed to be the primary pathway of exposure to PAHs at Site 15. Invertebrates in soil serve as prey items for birds and many small mammals. Therefore, even though PAH-related toxicity to upper level receptors via the terrestrial food web is negligible, PAH-related toxicity to soil invertebrates could result in reduced populations of vermivorous/insectivorous birds and mammals at the site, which could result in reduced populations of carnivorous birds and mammals. For this reason, the assessment endpoint for PAHs at Site 15 is as follows:

- Survival of soil invertebrate populations typical in pine flatwoods habitat.

3.2.2 Risk Questions

Based on the conceptual model and the above assessment endpoints, the primary risk questions involving PAH contamination at Site 15 are as follows:

- At what soil concentrations do PAHs at Site 15 cause (or potentially cause) reduced survival of soil invertebrates?
- At what soil concentration do PAHs at Site 15 cause (or potentially cause) reduced diversity and abundance of soil invertebrates?

3.2.3 Measurement Endpoints

The measurement endpoint for each of the lead-associated risk questions is provided below.

3.2.3.1 Survival of Soil Invertebrates

The measurement endpoint for the first risk question in Section 3.2.2 will be the survival of earthworms in 14-day laboratory toxicity tests using soil samples collected from Site 15 and a reference area. The purpose of the soil toxicity tests will be to determine if PAH concentrations in site soil samples are correlated with mortality of the species associated with the assessment endpoint.

Fourteen-day survival of laboratory-reared earthworms (*Eisenia fetida*) in site soil samples will be evaluated following standardized methods (ASTM, 1998). The appropriateness of laboratory toxicity tests, and of using earthworms to represent other soil invertebrates, was discussed in Section 3.1.3.1.

Twelve samples will be collected from areas of elevated PAHs for toxicity tests. This number of samples is expected to be sufficient to determine if PAH concentrations in site soils are correlated with survival of earthworms in the toxicity tests. PAH data from previous sampling events were used to generate a

gradient of total PAH concentrations in surface soil represented by four intervals: 20,000 to 49,999 µg/kg, 50,000 to 499,999 µg/kg, and > 500,000 µg/kg.

Three soil samples in each PAH concentration interval and three samples from the previously mentioned reference area will be collected for a total of 15 soil samples (Figure 5). Existing lead data were evaluated to select locations with minimal expected lead concentrations so as to minimize the possibility that lead would confound any conclusions regarding PAH toxicity. Soil samples will be subjected to a quick laboratory turnaround (7 days maximum) for analyses of total PAHs and lead.

Soil samples will consist of the first three inches of mineral soil plus the duff layer atop the mineral horizon. Soil samples will consist of five composites from throughout 15 ft x 15 ft quadrats, and will be homogenized in the field and split into sub-samples for chemical analyses and toxicity tests.

3.2.3.2 Diversity and Abundance of Soil Invertebrates

The diversity and abundance of soil invertebrates will be measured by collecting soil invertebrates from a gradient of PAH concentrations at Site 15 and from three locations at a reference area. The diversity and abundance of invertebrates in the samples from Site 15 will then be compared to the results from the reference area. The methodology to be employed for data collection and evaluation will be the same as that discussed in Section 3.1.3.2.

4.0 DEVELOPMENT OF PRGs

If lead concentrations in all soil samples collected for this study are less than 197 mg/kg (NAS Cecil background value; HLA, 1998) further evaluation of lead and concomitant calculation of remediation goals will be considered unnecessary. The section below describes how PRGs will be developed for lead, and is followed by a description of how PRGs will be developed for PAHs.

4.1 Lead PRG Development for Soil Invertebrates

4.1.1 Toxicity Tests

The toxicity test data will be statistically analyzed to determine whether there are significant differences between survival in the Site 15 soil samples versus survival in the reference samples. The survival data will be analyzed using a commercial computer program, the details of which will be provided by the laboratory selected for the toxicity tests. All statistical analyses will be performed at the 0.05 probability level. Backward elimination stepwise regression analyses will be used to determine which parameters account for the variability in survival between samples. Independent variables included in the regression analyses will be lead concentrations, PAH concentrations, soil pH, soil cation exchange capacity (CEC), soil total organic carbon (TOC), and soil grain size.

If the lead concentrations are correlated with earthworm mortality in the toxicity tests, protective concentrations within the exposure-response curve can be identified. Specifically, the protective concentration is bounded by the no-observed-effect-concentration (NOEC) and the lowest-observed-effect-concentration (LOEC) from the toxicity tests. Therefore, remedial goals for consideration by the risk managers will consist of the NOEC and LOEC. If lead concentrations are not correlated with earthworm survival, remedial goals associated with the assessment endpoint for invertebrates will be evaluated using all available data in a lines of evidence approach.

4.1.2 Diversity and Abundance of Soil Invertebrates

The data collection methods for invertebrate diversity and abundance at the site are not designed for definitive statistical analyses. Instead, the analyses of diversity and abundance data will be qualitative only. Differences among locations along lead gradients, PAH gradients, and at reference locations will be evaluated by visually examining bar graphs of the data. If the diversity or abundance differs among sampling locations, all available data for the samples in question (*e.g.*, soil lead concentration, habitat characteristics) will be evaluated in a "lines of evidence" approach to assess the likelihood that site-related lead toxicity is occurring. No "decision point" will be generated by this qualitative analysis. Instead, the data will assist the risk managers in their evaluation of remedial options for Site 15.

4.2 Lead PRG Development for Birds and Small Mammals

The equation below describes potential risks to birds and mammals that prey upon soil invertebrates. The equation combines the hazard from the incidental ingestion of soil and the hazard from ingestion of contaminated prey.

$$HQ = [(C_s \times AUF \times SA_s \times AF \times F)/(TRV \times WR \times CF)] + [(C_{prey} \times FA \times AUF \times AF \times F)/(TRV \times WR \times CF)] \quad (1)$$

where:

HQ	=	hazard quotient
C_s	=	lead concentration in soil (mg/kg)
AUF	=	area use factor (portion of home range that overlaps impacted area)
SA_s	=	soil as a portion of diet
AF	=	absorption faction (unitless)
F	=	total amount of food plus soil consumed (mg/day)
TRV	=	toxicity reference value for lead (mg/kg/day)
WR	=	weight of receptor (kg)
CF	=	conversion factor (kg to mg)
FA	=	portion of diet consisting of invertebrates (1.0 minus soil portion of diet)
C_{prey}	=	lead concentration in invertebrates (mg/kg)

Equation # 1 will be used to calculate soil concentrations (i.e., soil PRGs) that pose acceptable risk to birds and mammals that prey upon soil invertebrates at Site 15. To do this, the lead concentration in invertebrates (C_{prey} in equation # 1) must be expressed as a function of the lead concentration in soil. Thus, C_{prey} is rewritten as C_s x BAF, where BAF is the soil-to-invertebrate bioaccumulation factor. By rearranging equation # 1 to solve for C_s, and setting the hazard quotient equal to 1.0, remediation goals will be calculated as follows:

$$C_S = \frac{TRV \times WR \times CF}{(AUF \times AF \times F) \times (SA_S + BAF \times FA)} \qquad (2)$$

The least shrew will be used to represent mammals that prey upon soil invertebrates at Site 15, and the northern mockingbird will be used to represent birds that prey upon soil invertebrates. These two species have a high probability of exposure to lead in soil at the site based on their diet and habitat preferences.

The northern mockingbird is a familiar songbird known to be present at Site 15. Mockingbirds in Florida are non-migratory and highly territorial throughout the year. Body mass averages 49 g (Derrickson and Breitwisch, 1992). The diet of adult mockingbirds is about 50 percent invertebrates (especially beetles, ants, bees, grasshoppers), and 50 percent fruit. The proportion of animal prey in the diet increases to approximately 85 percent during the breeding season and decreases in winter to approximately 13 percent (Derrickson and Breitwisch, 1992). Using Nagy's (1987) equation for passerine birds (commonly known as "song birds"), the expected food consumption for a mockingbird is 10.9 g dry mass/day. This equates to 37.6 g fresh mass/day based on 71 percent moisture content in food items. Average territory sizes of mockingbirds in south-central Florida varied from 0.31 ha (0.8 acres) in winter to 1.27 ha (3.1 acres) during the May and June breeding season (Derrickson and Breitwisch 1992).

The least shrew inhabits pine flatwoods and other habitats in Florida (Abrahamson and Hartnett, 1990; Brown, 1997), and is expected to be present at Site 15. It weighs about 3.5 to 6.5 g (Choate et al, 1994). This species uses runways and burrows of other animals, but also makes its own tunnels in loose, soft soils. Least shrews consume large numbers of insects and other invertebrates, and are food items for predators such as owls, hawks, weasels, and skunks (Brown, 1997). Using Nagy's (1987) equation for mammals, the expected food consumption of the least shrew is 0.954 g dry mass/day. This equates to 3.3 g fresh mass/day based on 71 percent moisture content in food items. The 71 percent moisture value is the average of moisture contents in earthworms (84 percent), crickets and grasshoppers (69 percent) and adult beetles (61 percent) (EPA, 1993). Home ranges for the least shrew usually vary from approximately 0.4-1.4 ha (1-3.5 acres) (Choate and Fleharty, 1973) but home ranges in some studies have been reported to be as small as 0.5 acre (Choate et al, 1994).

The BAF term in equation # 2, expressed as mg lead/kg tissue ÷ mg lead/kg soil, will be derived from lead concentrations in the 12 soil and corresponding invertebrate samples described in Section 3.1.3.3. Regression analyses will be used to derive the BAF. It is possible, however, that the correlation of soil and invertebrate lead concentrations will be poor. This could result from variable invertebrate composition among samples, or from other factors. If the correlation of soil and invertebrate lead concentrations is poor, the BAF used in equation # 2 will be represented by the mean of the BAFs derived from the 12 individual soil and corresponding invertebrate samples. The maximum BAF from the 12-sample data set will also be used to derive a worst case PRG.

Exposure parameters for the WR and F terms to be used in the above equation for the least shrew and mockingbird are summarized in Table 2.

An accurate SA_s term in equation # 2 is difficult to determine for the shrew. EPA (2000) estimates that three percent of a shrew's diet is soil. This value is the 90th percentile of data from analyses of gastrointestinal (GI) tracts of short-tailed shrews (*Blarina spp.*) collected in an area where earthworms were plentiful (EPA 2000; Sample, 2001), and thus, the shrews probably fed heavily on earthworms. Wildlife species whose diets consist largely of earthworms generally have high soil ingestion rates (EPA, 1993), since earthworms are typically 20-30 percent soil by weight (Beyer *et al*, 1994). Based on previous site visits, arthropods such as beetles, centipedes and millipedes probably comprise a considerably greater portion of the diets of small mammals than do earthworms. Soil ingestion rates for shrews at Site 15 cannot be quantified with existing data, but are probably less than the literature values for shrews. A value of 0.015 will be used as the SA_s term for the shrew; this value is approximately the mean (0.0156) of data for the short tailed shrew in EPA (2000), and appears to be a reasonable approximation based on the factors discussed above.

For similar reasons, an accurate soil ingestion rate for mockingbirds at Site 15 cannot be quantified with existing data. The soil ingestion rate in Table 2 for the mockingbird is based on GI tract data for the American woodcock (*Scolopax minor*), whose diet consists largely of earthworms and was 99 percent earthworms in one study (Beyer *et al*, 1994; EPA, 1993). The SA_s term in equation # 2 for the mockingbird will be assigned two values. In one scenario, a value of 0.02 will be used as the SA_s term for the mockingbird, and is derived following the approach of Sample and Suter (1994). Specifically, if the diet of the woodcock is 99 percent earthworms and 10.4 percent of the woodcock diet is soil (Beyer *et al*, 1994), then a mockingbird consuming 20 percent earthworms (a conservative upper estimate for Site 15), will consume 2 percent soil. In the second scenario, a value of 0.093 (9.3 percent) will be used as the SA_s term for the mockingbird. This value is the soil ingestion rate for the wild turkey (*Meleagris gallopavo*) based on data presented by Beyer *et al* (1994). Although the wild turkey is much larger than the

mockingbird, prey items for these two species are similar, and both species forage by visually locating prey in the soil litter.

The area use factor in equation # 2, calculated as the portion of the representative receptor's home range that overlaps the impacted area, will be assigned a value of 1.0 for the shrew and mockingbird. This assumes that the receptors spend 100 percent of their life on the site. This is a valid assumption for the least shrew, since its home range is 3.5 acres or less. Unfortunately, home range data for the mockingbird were not available. As discussed above, average territory sizes for this bird range from 0.8 to 3.1 acres. The term "territory" refers to the area occupied by an animal or group of animals that is forcibly defended against by intruders of the same species. The home range is the area within which an animal normally spends all, or most, of its time in the course of a season (Dasmann, 1981), and home ranges of birds are usually larger than their territories. For this evaluation, it will be conservatively assumed that Site 15 encompasses the home range of the mockingbird.

No-observed-adverse-effect-levels (NOAELs) and lowest-observed-adverse-effect-levels (LOAELs) that could be used as TRVs in equation # 2 cover a wide range of values. Screening level ecological risk assessments often use NOAELs to identify contaminants of concern for ecological receptors. NOAELs are conservative because they represent the lowest dose that produces "no effect" in a toxicity study, or in a database of several toxicity studies. The use of a NOAEL as a threshold toxicity value estimates a point below which effects are unlikely, and above which effects are uncertain. Hence their value in screening-level risk assessments. The uncertainty associated with site-related doses that lie between the NOAEL and LOAEL is often not acceptable for setting PRGs, because of the expense and habitat disruption that is often involved in remediation to these PRGs. In order to avoid unnecessary remediation, LOAELs are often used to set PRGs. LOAELs, when used as threshold toxicity values, estimate points above which effects are likely, and below which effects are uncertain. LOAELs reflect the most sensitive species and the most sensitive appropriate endpoints available, and therefore a measure of conservativeness is retained. The results of a literature search for lead TRVs have previously been presented to the NAS Cecil Field Partnering Team. Based on the results of the literature search, the NAS Cecil Field Partnering Team has approved the following values as TRVs for lead. A LOAEL of 11.3 mg/kg/day will be used as the avian TRV. This value is based on reduced egg hatching in a reproduction study in which Japanese quail (a laboratory surrogate for avian species at Site 15) were exposed to lead in their diet for 12 weeks (Edens et al., 1976). A LOAEL of 80 mg/kg/day will be used as the mammal TRV. This value is based on reduced offspring weights and kidney damage in offspring and was derived from a one-year reproduction study in which three generations of rats were exposed to lead in their diet (Azar et al., 1973).

The bioavailability of ingested lead (i.e., the absorption fraction [AF] in equation # 2) refers to the portion of lead that is absorbed from the gastrointestinal tract. An AF of 1.0 (100 percent) will be used in the most conservative PRG scenario. The actual bioavailability of lead after ingestion depends upon a variety of factors, including the chemical form of lead, the species of organism, and the age, sex, and nutritional status of the individual (Eisler, 1988). Most toxicity studies of dietary lead exposure (including the two cited for the LOAEL values) used lead acetate as a test substance. Lead acetate is considered to be 100 percent bioavailable (Wilson and Davies, 1993). Lead in oyster meat was 69-75% percent bioavailable relative to lead acetate when mixed in a standard bird diet and fed to Japanese quail (Stone *et al*, 1981). Absorption rates for lead in other food items of birds and small mammals were not available, but are probably less than 100 percent. Thus, using an AF of 1.0 in equation # 2 will overestimate the potential risks of lead ingestion under field conditions. A less conservative value of 72 percent (the average of values in the Stone et al [1981] study) will be used to represent the AF in equation # 2 for each of the representative receptors. This will result in a range of PRGs for consideration by the risk managers.

The total food consumption (F) used in equation # 2 for the mockingbird will be assigned two values. In the most conservative scenario, the non-soil portion of the mockingbird's diet will be assumed to consist of 100 percent invertebrates. However, the average diet of adult mockingbirds is about 50 percent invertebrates and 50 percent fruit. Therefore, a second PRG will be generated by assuming that the non-soil portion of the mockingbird's diet consists of 50 percent invertebrates and 50 percent fruit. In this scenario, lead will be assumed to be absent in the fruit portion of the diet. Within above-ground tissues, concentrations of lead in plants are higher in stems than in leaves, and are higher in leaves than in reproductive tissues. Lead is rarely transferred to reproductive organs in plants (Morel, 1997). Edible portions of vegetables (*e.g.*, green beans, corn, tomatoes) grown in sandy soils amended with four sewage sludges showed negligible accumulation of lead, while leaves of the same plants accumulated lead at concentrations considered to be toxic to humans (Keefer *et al*, 1986). Therefore, based on available data, the contribution of lead in berries and seeds appears to be insignificant, and the collection and analyses of berries and seeds at the site does not appear to be warranted.

4.3 PRG Development for PAHs

Since soil invertebrates are the primary receptors at risk from PAHs at the site, the development of an associated remedial goal follows the procedure described for lead in Section 4.1. The only difference is that an NOEC and LOEC for PAHs (rather than lead) will be generated.

5.0 SUMMARY

Previous sampling of media at Site 15 indicates that lead and PAHs in surface soil in some portions of the site may pose risk to ecological receptors. Site-specific PRGs for lead and PAHs in soil at Site 15 are

needed for risk managers to evaluate remedial options at the site. Based on the toxicological characteristics of lead and PAHs, and on the physical characteristics and ecological receptors at Site 15, a site conceptual model was developed through which ecological assessment endpoints and measurement endpoints were established. The primary receptors at risk from lead are soil invertebrates, and birds and mammals that prey on soil invertebrates. The primary receptors at risk from PAHs are soil invertebrates.

Lead chemistry data previously collected were used to select tentative locations from which further samples will be collected and analyzed for lead. Final locations will be determined using XRF equipment. Composite soil samples will be collected along a gradient of soil lead concentrations, and from a reference location. A sub-sample of each composited soil sample will be analyzed for lead, total PAHs, pH, TOC, CEC, grain size, and moisture content. The remaining sub-sample will be used in standardized toxicity tests in which the survival of laboratory-reared earthworms (*Eisenia fetida*) will be measured. Soil dwelling invertebrates will be collected from co-located soil samples simultaneously with the soil samples. The diversity and abundance of invertebrates in Site 15 samples will be compared to results in reference samples. Results of the toxicity tests and the diversity and abundance data will be used to generate remedial goals for lead that pose acceptable risk to soil invertebrates. The collected soil invertebrates will also be analyzed for lead. Concentrations of lead in soil and invertebrates will be used to estimate ingestion doses for representative avian and mammalian receptors. This will allow the development of soil concentrations (remediation goals) that pose acceptable risk to the selected representative receptors.

PAH chemistry data previously collected were used to select locations from which further samples will be collected and analyzed for total PAHs. Composite soil samples will be collected along a gradient of soil concentrations of total PAHs, and from a reference site. A sub-sample of each composited soil sample will be analyzed for total PAHs, lead, pH, TOC, CEC, grain size, and moisture content. The remaining sub-sample will be used in standardized toxicity tests in which the survival of laboratory-reared earthworms (*Eisenia fetida*) will be measured. Soil dwelling invertebrates will be collected from co-located soil samples simultaneously with the soil samples. The diversity and abundance of invertebrates in Site 15 samples will be compared to results in reference samples. Results of the toxicity tests and the diversity and abundance data will be used to generate remedial goals for PAHs that pose acceptable risk to soil invertebrates.

TABLE 1

FOOD INGESTION RATES IN HERBIVOROUS AND OMNIVOROUS MAMMALS

SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

Mammal	Food Ingestion (g/g bw/day) *	Food Habits	Source
mole	~0.5	insectivorous/vermivorous	Gorman and Stone, 1990
short tailed shrew	0.49 – 0.62	insectivorous/vermivorous	EPA, 1993
deer mouse	0.18 – 0.45	omnivorous	EPA, 1993
prairie vole	0.09 – 0.14	largely herbivorous	EPA, 1993
meadow vole	0.30 – 0.35	largely herbivorous	EPA, 1993
muskrat	0.26 – 0.34	herbivorous	EPA, 1993

* g/g bw/day = food (grams, fresh weight) per gram of body weight per day

TABLE 2

EXPOSURE PARAMETERS FOR REPRESENTATIVE ECOLOGICAL RECEPTORS

SITE 15, BLUE 10 ORDINANCE DISPOSAL AREA

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

Receptor	Body Weight (grams)	Food Ingestion[1] (grams/day)	Assumed Diet for Exposure Assessment	Home Range (acres)
Least shrew (*Cryptotis parva*)	5.5[2]	3.3[3]	98.5% invertebrates 1.5% soil[4]	0.5 to 3.5 [5]
Northern mockingbird (*Mimus polyglottus*)	49[6]	37.6[7]	49% invertebrates 49% vegetation 2% soil[8]	Not available[9]

1 Food ingestion values include intended food items plus incidentally ingested soil.

2 Nowak (1991), Cothran et al (1991)

3 Calculated using mammal equation Nagy (1987); converted to fresh weight assuming 71 percent water content in food items.

4 See Section 4.1 of text.

5 Choate and Fleharty (1973), Choate et al (1994).

6 Derrickson and Breitwisch (1992)

7 Calculated using passerine equation Nagy (1987); converted to fresh weight assuming 71 percent water content in food items.

8 Diet from Derrickson and Breitwisch (1992), see Section 4.1 of text for other soil ingestion scenarios.

9 Home range data not available, but based on non-migratory and territorial nature of this species (Derrickson and Breitwisch, 1992), home range is assumed to be contained within Site 15.

REFERENCES

ABB (ABB Environmental Services, Inc). 1997. Remedial Investigation, Operable Unit 5, Sites 14 and 15, Naval Air Station Cecil Field, Jacksonville, Florida. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina, October.

Abrahamson, W.G. and D.C. Hartnett. 1990. *Pine Flatwoods and Dry Prairies*, in Myers, R. L. and J. J. Ewel (eds.), 1990, *Ecosystems of Florida*, University of Central Florida Press, Orlando, Florida.

American Society for Testing and Materials (ASTM). 1998. Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm *Eisenia Fetida*). E 1676-97, West Conshohocken, Pennsylvania.

Azar, A., H. J. Trochimowicz, and M. E. Maxwell. 1973. Review of lead studies in animals carried out at Haskell Laboratory: two-year feeding study and response to hemorrhage study. In: *Environmental Health Aspects of Lead: Proceedings, International Symposiu*m, D. Barth et al., eds. Commission of European Communities. pp. 199-210, in Sample, B.E., D. M. Opresko, and G. W. Suter II. 1996. Toxicological Benchmarks for Wildlife, 1996 Revision. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Baer, K.N., D.G Hutton, R.L. Boeri, T.J. Ward, and R.G. Stahl, Jr. 1995. *Toxicity evaluation of trap and skeet shooting targets to aquatic test species*. Ecotoxicology, 4: 385-392.

Beyer, W.N., E.E. Connor, and S. Gerould. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management, 58 (2): 375-382.

Beyer, W.N and C Stafford. 1993. Survey and evaluation of contaminants in earthworms and in soils derived from dredged material at confined disposal facilities in the Great Lakes region. Environmental Monitoring and Assessment 24: 151-165.

Brown, L.N. 1997. A Guide to the Mammals of the Southeastern United States. University of Tennessee Press, Knoxville, Tennessee, pp 236.

Choate, J. R. and Fleharty, E. D. 1973. Habitat preference and spatial relations of shrews in a mixed grassland in Kansas. Southwestern Naturalist 18:110-112.

Choate, J.R., J.K. Jones, Jr., and C. Jones. 1994. Handbook of Mammals of the South-Central States, Louisiana State University Press, Baton Rouge, Louisiana, pp 304.

Cothran, E.G., M.H. Smith, J.O. Wolff, and J.B. Gentry. 1991. Mammals of the Savannah River Site, SRO-NERP-21, Savannah River Ecology Laboratory, Aiken, South Carolina, pp 191.

Custer, T.W., J.C. Franson, and O.H. Pattee. 1984. Tissue lead distribution and hematologic effects in American kestrels (Falco sparverius L.) fed biologically incorporated lead. Journal of Wildlife Diseases, 20(1): 39-43.

Dasmann, R.F. 1981. Wildlife Biology. John Wiley & Sons, Inc., New York, New York, pp 212.

Derrickson, K. C. and Breitwisch. 1992. Northern mockingbird. In: *The Birds of North America,* No. 7 (A. Poole, P. Stettenheim, and F. Gill, eds.). Philadelphia, the Academy of Natural Sciences, Washington, D.C.: The American Ornithologists' Union.

Edens, F., W. E. Benton, S. J. Bursian, and G. W. Morgan. 1976. Effect of Dietary Lead on Reproductive Performance in Japanese Quail, *Coturnix coturnix japonica*. *Toxicol. Appl. Pharmaco*l. 38: 307-314, in Sample, B.E., D. M. Opresko, and G. W. Suter II. 1996. Toxicological Benchmarks for Wildlife, 1996 Revision. Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Eisler, R. 1987. Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. USFWS Biological Report 85(1.11).

Eisler, R. 1988. Lead Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. USFWS Biological Report 85(1.14).

EPA (U.S. Environmental Protection Agency). 2000. Ecological Soil Screening Level Guidance – Draft. Office of Emergeny and Remedial Response, Washington, D.C. July 10.

EPA (U.S. Environmental Protection Agency). 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, June 5, Edison, New Jersey.

EPA (U.S. Environmental Protection Agency). 1993. Wildlife Exposure Factors Handbook: Volume I. EPA/600/R-93/187. U.S. EPA Office of Research and Development, Washington, D.C.

Gorman, M.L. and R.D. Stone. 1990. *The Natural History of Moles.* Comstock Publishing Associates, Ithica, New York. pp 138.

Henny, C.J., L.J. Blus, D.J. Hoffman, and R.A. Grove. 1994. Lead in hawks, falcons and owls downstream from a mining site on the Coeur d'Alene River, Idaho. Environmental Monitoring and Assessment 29: 267-288.

HLA (Harding Lawson Associates). 1998. Inorganic Background Data Set.

Keefer, R.F., R.N. Singh, and D.J. Horvath. 1986. Chemical composition of vegetables grown on an agricultural soil amended with sludge. J. Environ. Qual., 15, 146. Cited in Morel, J. 1997. "Bioavailability of trace elements to terrestrial plants". In Tarradellas, J., G. Bitton, and D. Rossel (eds.). 1997. *Soil Ecotoxicology.* Lewis Publishers, Boca Raton, Florida.

Lingenfelser, S. 2000. Addendum to the Final Work Plan for the Former Skeet Range (Site 17B), U.S. Army Transportation Center, Fort Eustis, Virginia. U.S. Fish and Wildlife Servce, September 7.

MHSP&E (Ministry of Housing, Spatial Planning and Environment). 1994. Intervention values and target values – soil quality standards. Department of Soil Protection, The Hague, The Netherlands; in Friday, G.P. 1998. *Ecological Screening Values for Surface Water, Sediment, and Soil.* Westinghouse Savannah River Company, Savannah River Site, Aiken, South Carolina. WSRC-TR-98-00110. November.

Morel, J. 1997. "Bioavailability of trace elements to terrestrial plants". In Tarradellas, J., G. Bitton, and D. Rossel (eds.). 1997. *Soil Ecotoxicology.* Lewis Publishers, Boca Raton, Florida.

Nagy, K.A. 1987. Field metabolic rate and food requirement scaling in mammals and birds. Ecological Monographs, 57: 111-128, in EPA (U.S. Environmental Protection Agency). 1993. Wildlife Exposure Factors Handbook: Volumes I and II. EPA/600/R-93/187. U.S. EPA Office of Research and Development, Washington, D.C.

Neuhauser, E.F., P.R. Durkin, M.R. Malecki, and M. Anatra. 1986. Comparative toxicity of ten organic chemicals to four earthworm species. *Comp. Biochem. Physiol.* 83C(1):197-200.

Nowak, R. M. 1991. *Walker's Mammals of the World.* Fifth ed. Baltimore, Maryland: John Hopkins University Press.

ORNL (Oak Ridge National Laboratory). 1998. (Author not provided). *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation.* BJC/OR-112, Oak Ridge National Laboratory, Oak Ridge Tennessee.

Parmelee, R.W., C.T. Phillips, R.T. Checkai, and P.J. Bohlen. 1997. Determining the effects of pollutants on soil faunal communities and trophic structure using a refined microcosm system. Environmental Toxicology and Chemistry, 16 (6), pp 1212-1217.

Sample, B. E. and G. W. Suter, 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sample, B.E., M.S. Alpin, R.A. Efroymson, G. W. Suter II, and C.J.E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. ORNL/TM-13391. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G. W. Suter II, and T.L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. ES/ER/TM/-220. Environmental Restoration Program, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

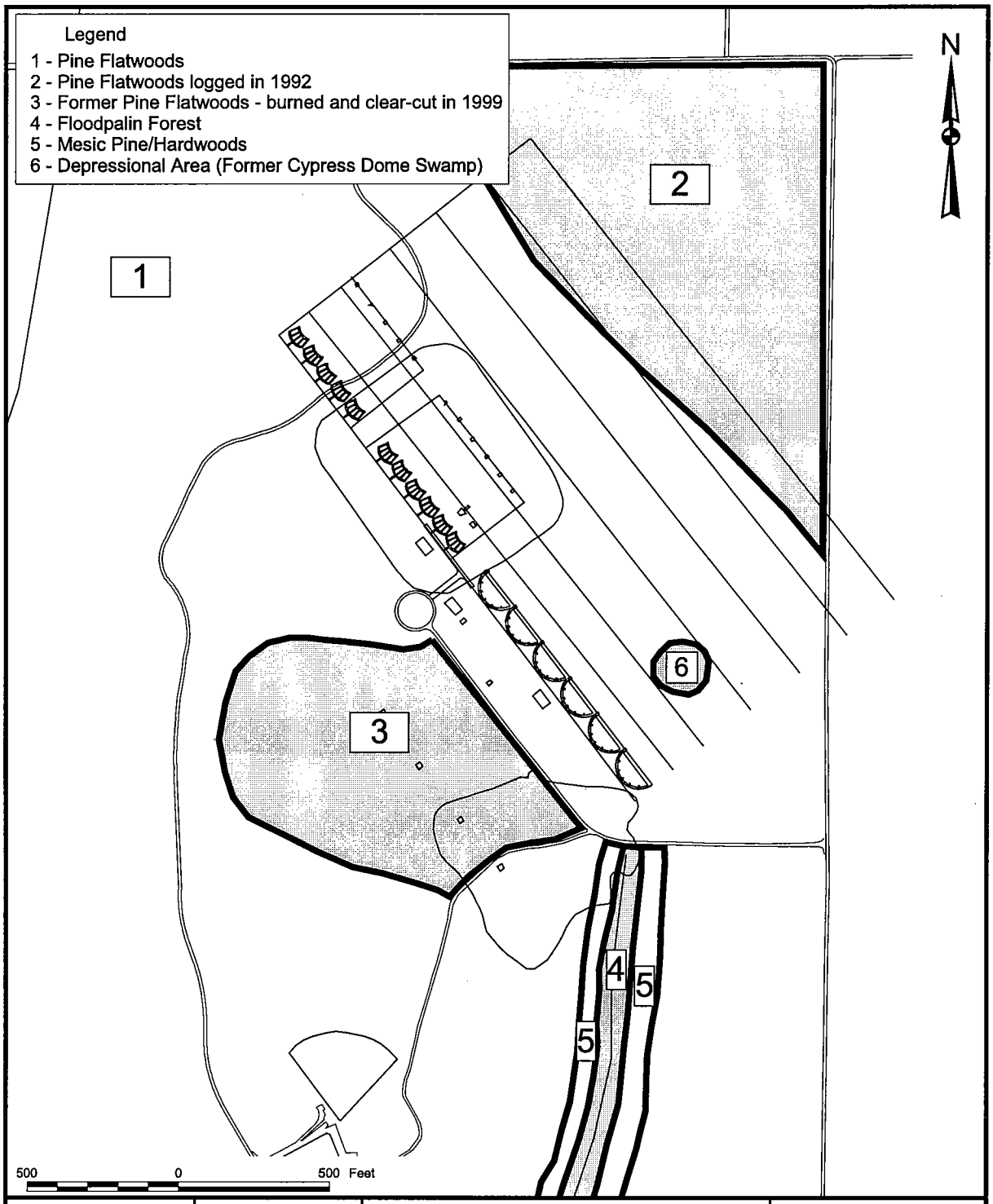
Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G. W. Suter II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. ES/ER/TM/-219. Environmental Restoration Program, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sample, B.E. (CH2MHill, Sacramento, California). 2001. Personal Communication with M.L. Whitten, March 20 (Tetra Tech NUS, Inc, Aiken, South Carolina).

Stone, C.L., M.R.S. Fox, and K.S. Hogye. 1981. Bioavailability of lead in oysters fed to young Japanese quail. Environmental Research, 26: 409-421.

Swartjes, F.A. 1999. Risk based assessment of soil and groundwater quality in the Netherlands: standards and remediation urgency. Risk Analysis, 19 (6): 1235-1249.

Wixson, B. G. and B. E. Davies. 1993. *Bioavailability of Lead for Animals*, Lead in Soil Task Force Recommended Guidelines, Society for Environmental Geochemistry and Health. Science Reviews, pp 132.



DRAWN BY MJJ	DATE 19Dec00	SITE 15 HABITAT MAP NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 19Dec00 MJJ Layout03

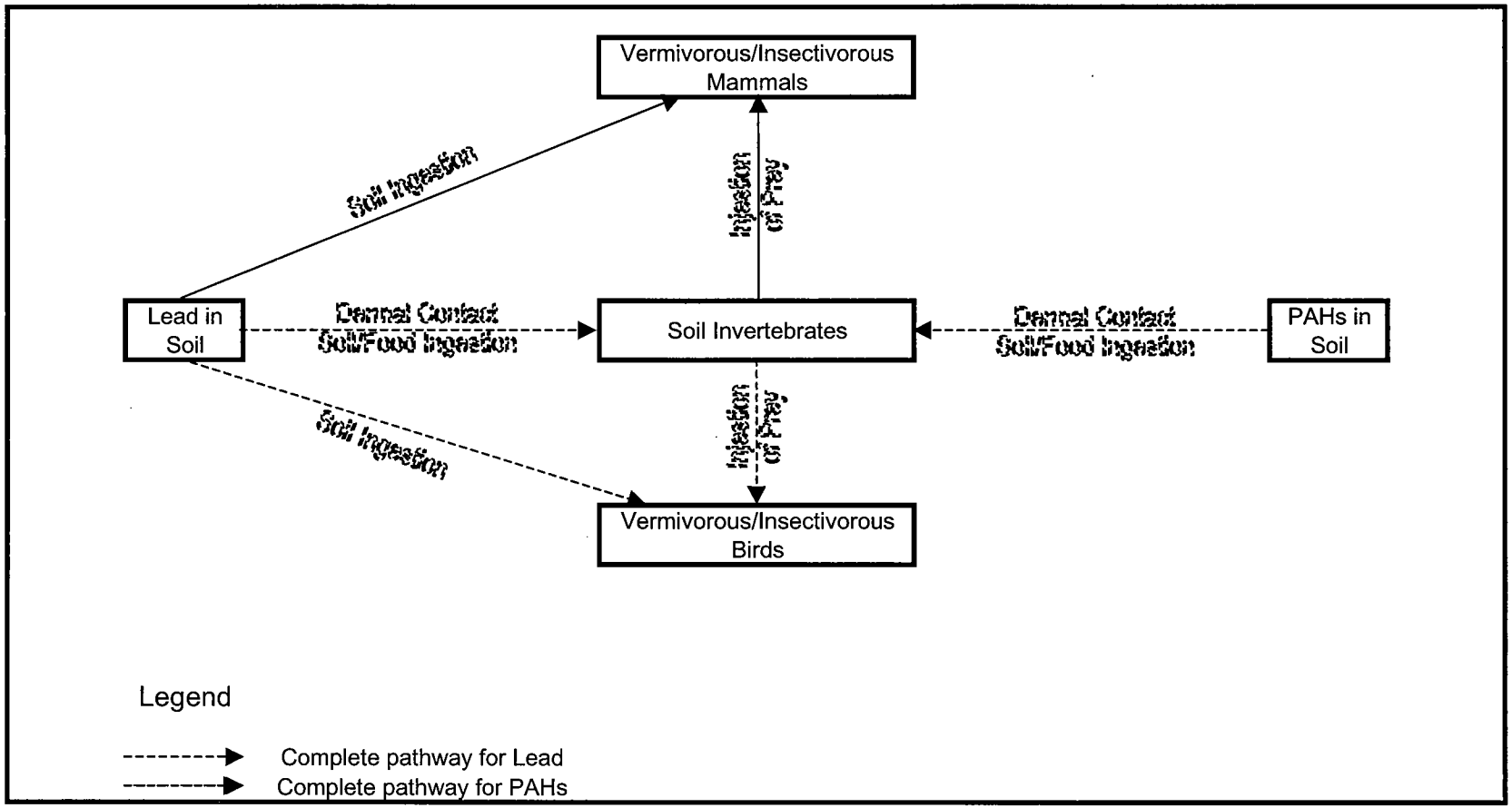
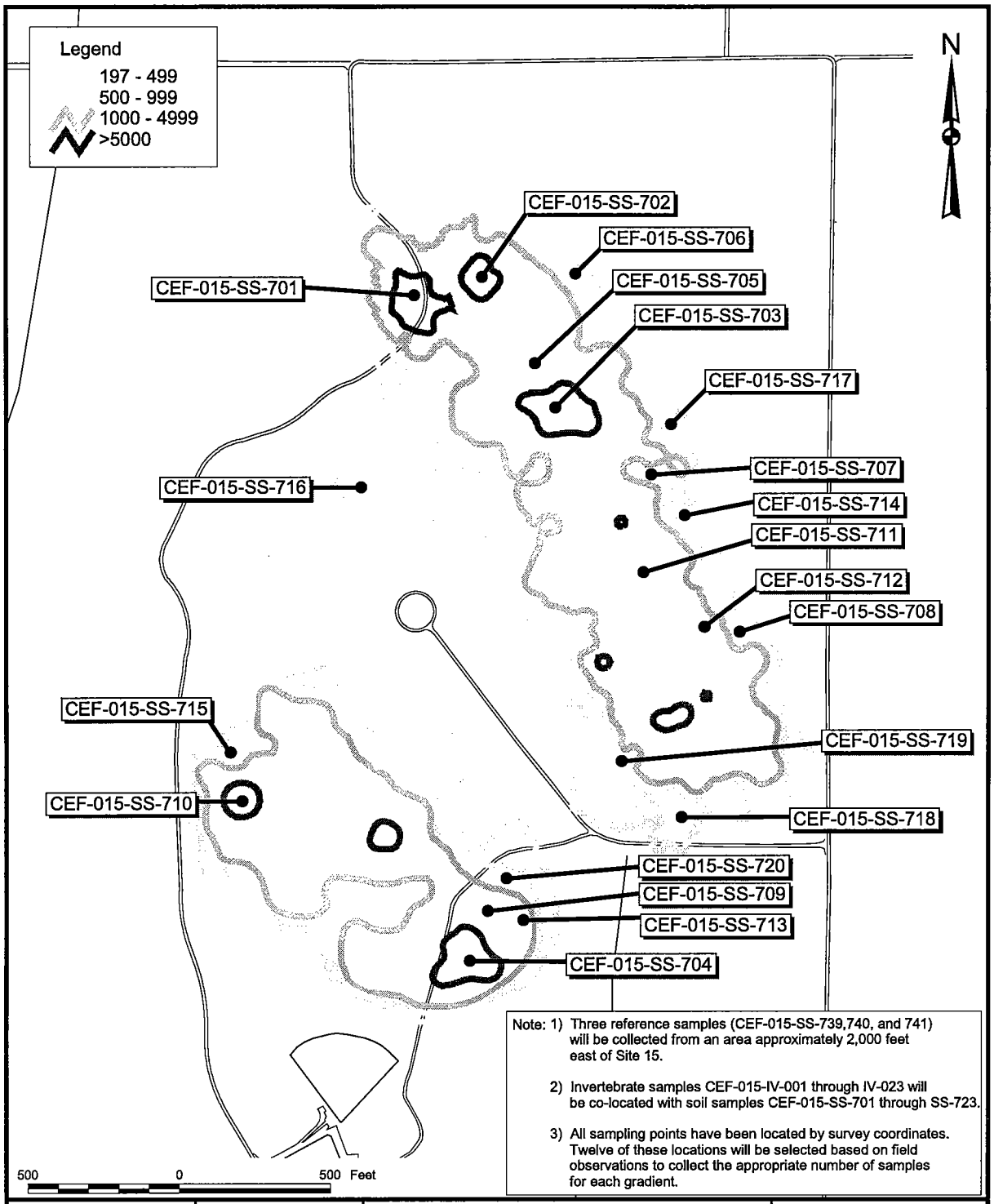


Figure 2

Contaminant Pathways at Site 15
NAS Cecil Field, Jacksonville, Florida



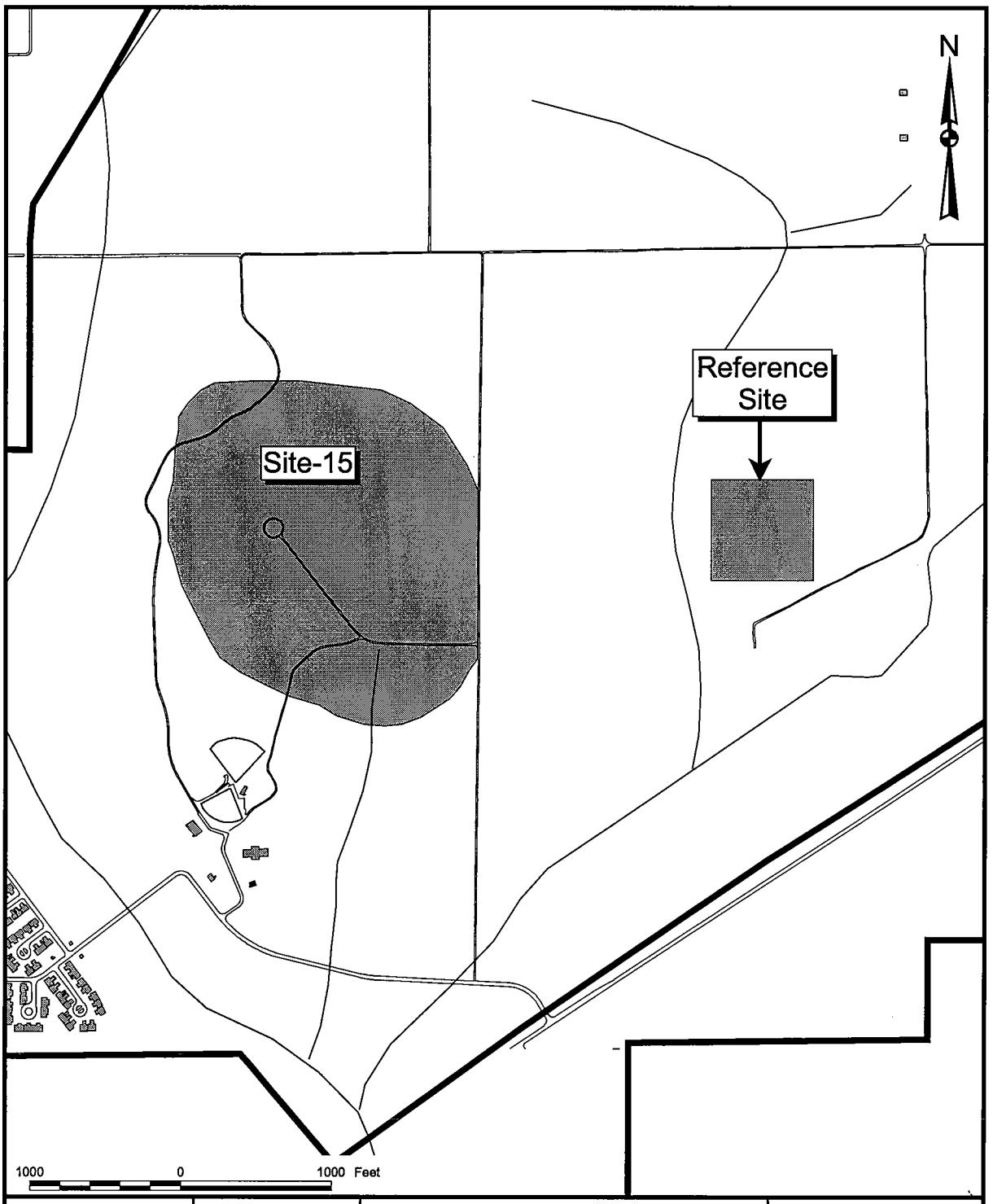
Note: 1) Three reference samples (CEF-015-SS-739,740, and 741) will be collected from an area approximately 2,000 feet east of Site 15.

2) Invertebrate samples CEF-015-IV-001 through IV-023 will be co-located with soil samples CEF-015-SS-701 through SS-723.

3) All sampling points have been located by survey coordinates. Twelve of these locations will be selected based on field observations to collect the appropriate number of samples for each gradient.

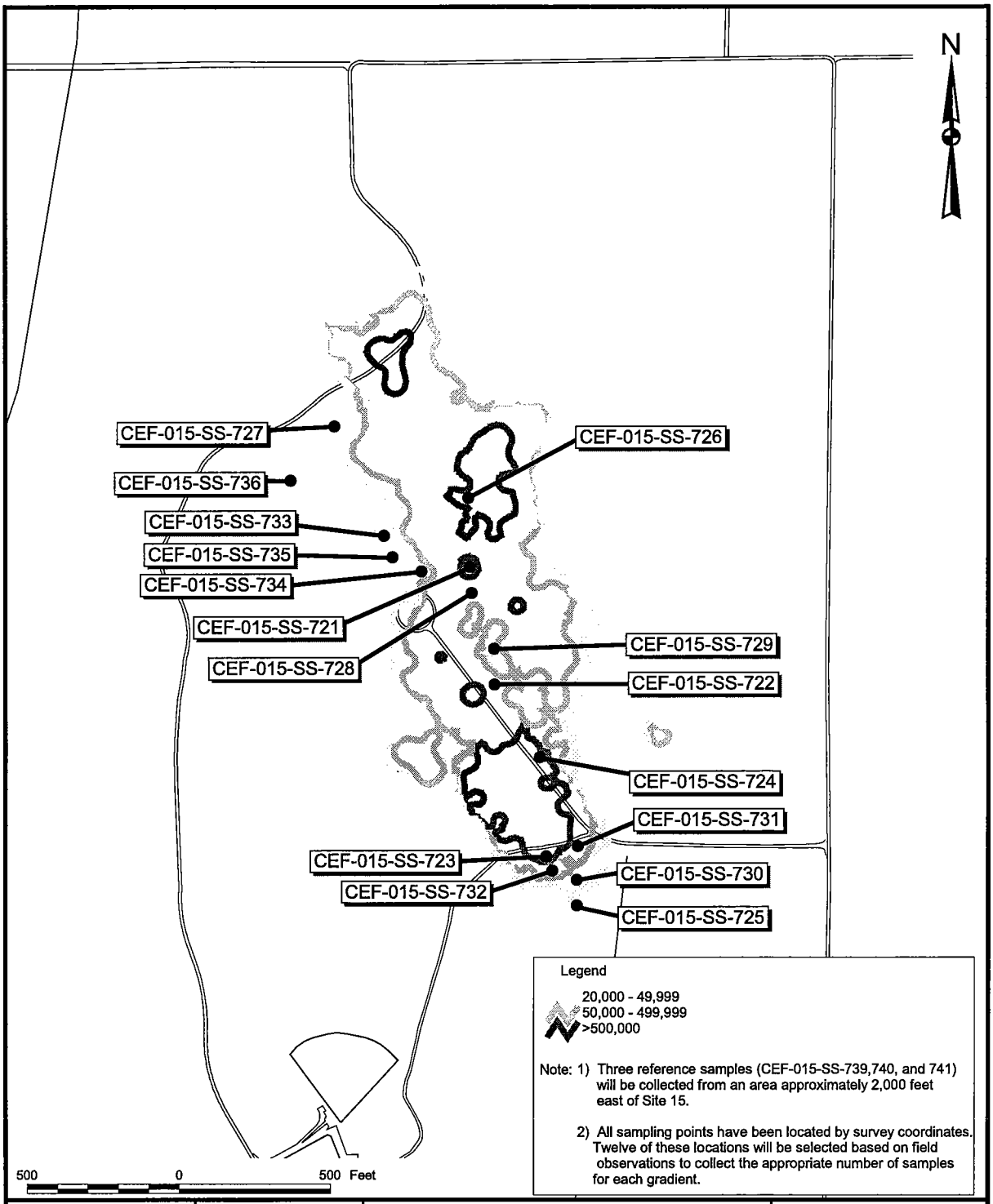
DRAWN BY MJJ	DATE 19Dec00	ISOCONCENTRATION CONTOURS FOR LEAD IN SOIL (mg/kg) AND PROPOSED SAMPLE LOCATIONS SITE 15 NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 3 REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 21May01 MJJ Layout01



DRAWN BY MJJ	DATE 05Jan01	SITE 15 AND REFERENCE SITE LOCATION SITE 15 NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 4 REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 08Jan01 MJJ Layout1



DRAWN BY MJJ	DATE 19Dec00	ISOCONCENTRATION CONTOURS FOR TOTAL PAHs IN SOIL (ug/kg) AND PROPOSED SAMPLE LOCATIONS SITE 15 NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 5 REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 21May01 MJJ Layout02

APPENDIX A

SITE 15, BLUE 10 ORDNANCE DISPOSAL AREA
PHASE VIII SAMPLING AND ANALYSIS WORK PLAN

APPENDIX A

Phase VIII Sampling and Analysis Work Plan
Site 15, Blue 10 Ordnance Disposal Area
Naval Air Station Cecil Field
Jacksonville, Florida

Phase VIII sampling and analysis of surface soil and soil invertebrates are proposed for Site 15 as identified in Figures A-1 and A-2. Sampling and analysis will be conducted to generate remediation goals for lead and polynuclear aromatic hydrocarbons (PAHs) in surface soil at the site. A total of 27 soil samples and 15 invertebrate samples will collected during this sampling event. Soil samples to be collected include 3 samples from each of 4 lead concentration gradients (12 samples), 4 samples from each of 3 PAH concentration gradients (12 samples) and 3 samples from a reference location. Sample locations for the 27 soil samples will be chosen from the 38 potential sampling locations identified on Figures A-1 and A-2 and summarized in Tables A-1 and A-2 based on field observations.

Soil samples will consist of the first three inches of mineral soil and the overlying duff (decaying organic matter) atop the mineral horizon. Invertebrates observed in the soil and duff will be manually collected from co-located soil sample locations, each of which shall consist of an area approximately 15 feet x 15 feet in size. The invertebrates will be collected simultaneously with, and from the same soil/duff stratum, as the soil samples. Soil samples will consist of five composites from throughout the 15 ft x 15 ft areas, and will be homogenized in the field and split into sub-samples for chemical analyses and standardized toxicity tests in which the survival of laboratory-reared earthworms (*Eisenia fetida*) will be measured.

Personnel protection equipment and other waste trash (e.g. disposable trowels) will not be considered hazardous and will be disposed in a municipal landfill. Such trash will be collected in a plastic bag and disposed in a suitable trash receptacle. Removed soil and invertebrates in excess of sampling volume requirements will be placed back on the ground and the ground cover will be replaced.

The sampling activities and procedures described in this Work Plan will be performed in accordance with the U. S. EPA Region IV Environmental Investigation Standard Operating Procedures and Quality Assurance Manual (EISOPQAM) and the Base-Wide Generic Work Plan for Naval Air Station (NAS) Cecil Field. Specifically, the Base-Wide Generic Work Plan includes procedures for management of investigation-derived wastes in Volume I and standard operating procedures in the Project Operations Plan in Volume II.

Surface soil and invertebrate samples will be collected using plastic, disposable trowels. Decontamination of this disposable equipment will not be required. Non-disposable sampling equipment may also be used, and decontamination of this equipment will be conducted in accordance with the EISPOQAM and Base-Wide Generic Work Plan. The proposed samples will be collected at previous sampling locations that will be located by surveying prior to or during the sampling event.

The following laboratories have been subcontracted:

<u>Lead, PAHs, TOC, and CEC in soil</u>:

ACCUTEST SOUTHEAST
4405 Vineland Road, Suite C-15
Orlando, Florida 32881
Attention: Linda Williams
(407) 425-6700
Fax: (407) 425-0707

<u>Grain Size (Soils Geotech Lab)</u>:

Civil Services, Inc.
2394 St. Johns Bluff Road, South
Jacksonville, FL 32246
Attention: Bruce Khosorozadeh
(904) 641-1834

Earthworm Toxicity Lab:

Springborn Laboratories, Inc.
Massachusetts Research Center
790 Main Street
Wareham, MA 02571-1075
Attn: Arthur Putt
(508) 295-2550
Fax: (508) 295-8170

Invertebrate Lead Lab:

Severn Trent Laboratories
4101 Shuffel Drive, NW
North Canton, OH 44720
Attention: Becky Strait
(330) 497-9396

Sample handling requirements, the bottleware required, preservation, and holding time requirements for the analysis proposed for this sampling event are as identified in the following table:

Analysis	Analytical Method	Bottleware	Preservation	Holding Time[1]
SOILS				
By Accutest				
PAHs	SW-846 8310	8-oz. glass jar	Cool to 4°C	14 days to extraction; 40 days to analysis
Lead	SW-846 6010B	8-oz. glass jar	Cool to 4°C	180 days to analysis
TOC	Lloyd Kahn	8-oz. glass jar	Cool to 4°C	28 days to analysis
CEC	SW-846 9081	8-oz. glass jar	Cool to 4°C	28 days to analysis
By Soils Geotech Lab				
Grain Size	ASTM D422	8-oz. glass jar	Cool to 4°C	28 days to analysis
By Earthworm Tox Lab				
Earthworm Toxicity (including pH and % moisture)	ASTM E1676-97; SW-846 9045C; ASTM 2216	To be determined by the lab	Cool to 4°C	14 days to analysis
INVERTEBRATES				
By Invertebrate Lead Lab				
Lead	SW-846 6010B	1.3 g sample mass; botleware to be determined by lab	Cool to 4°C	180 days to analysis

1 Holding times are measured from the date/time of sample collection.

Analytical results for soil samples for ***PAHs and lead*** will be provided on a ***7-day*** turn around basis. All ***other analyses*** are ***21-day*** turnaround.

As agreed upon by the BCT, the collection of rinsate and trip blanks has been eliminated at NAS Cecil Field. In addition, field blanks will not be collected during this sampling program because there will be minimal decontamination of sampling equipment. In accordance with these changes, the following table summarizes the frequency and type of field Quality Assurance/Quality Control (QA/QC) samples to be collected for this sampling program regarding soil samples. Field duplicates are not applicable for invertebrates.

Type of Samples	Frequency	Samples to be Collected
Field Duplicate	1/10 samples (soil)	4 Soil (PAH and lead)
Lab MS/MSD	1/20 samples/matrix	2 Soil (PAH and lead)/ 1 Tissue[1]

1 MS/MSD is a Laboratory QA/QC requirement, separate sample not required, only additional volume.

As agreed upon by the BCT, formal data validation has been eliminated from the installation restoration program at NAS Cecil Field. However, the analytical data packages generated by the analytical laboratory will be reviewed by Tetra Tech NUS personnel to eliminate false positives and false negative results.

Table A-1
Phase VIII Sampling and Analysis
Surface Soil
Site 15, Blue 10 Ordnance Disposal Area

Sample ID CEF-015	Location	PAHs 8310	Lead	Soil Physical Characteristics[1]	14-Day Soil Toxicity
SS-701	Within area of lead concentration >5,000 ppm	X	X	X	X
SS-702	Within area of lead concentration >5,000 ppm	X	X	X	X
SS-703	Within area of lead concentration >5,000 ppm	X	X	X	X
SS-704	Within area of lead concentration >5,000 ppm	X	X	X	X
SS-705	Within lead concentration range of 1,000 to 4,999 ppm	X	X	X	X
SS-706	Within lead concentration range of 197 to 499 ppm	X	X	X	X
SS-707	Within lead concentration range of 500 to 999 ppm	X	X	X	X
SS-708	Within lead concentration range of 500 to 999 ppm	X	X	X	X
SS-709	Within lead concentration range of 1,000 to 9,999 ppm	X	X	X	X
SS-710	Within area of lead concentration >5,000 ppm	X	X	X	X
SS-711	Within lead concentration range of 1,000 to 4,999 ppm	X	X	X	X
SS-712	Within lead concentration range of 1,000 to 4,999 ppm	X	X	X	X
SS-713	Within lead concentration range of 1,000 to 4,999 ppm	X	X	X	X
SS-714	Within lead concentration range of 197 to 499 ppm	X	X	X	X
SS-715	Within lead concentration range of 500 to 999 ppm	X	X	X	X
SS-716	Within lead concentration range of 197 to 499 ppm	X	X	X	X
SS-717	Within lead concentration range of 197 to 499 ppm	X	X	X	X
SS-718	Within lead concentration range of 197 to 499 ppm	X	X	X	X
SS-719	Within lead concentration range of 500 to 999 ppm	X	X	X	X

Table A-1 (continued)
Phase VIII Sampling and Analysis
Surface Soil
Site 15, Blue 10 Ordnance Disposal Area

Sample ID CEF-015	Location	PAHs 8310	Lead	Soil Physical Characteristics[1]	14-Day Soil Toxicity
SS-720	Within lead concentration range of 500 to 999 ppm	X	X	X	X
SS-721	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-722	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-723	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-724	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-725	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-726	Within area of PAH concentration >500,000 ppb	X	X	X	X
SS-727	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-728	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-729	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-730	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-731	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-732	Within total PAH concentration range of 50,000 to 499,999 ppb	X	X	X	X
SS-733	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-734	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-735	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-736	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-737	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-738	Within total PAH concentration range of 20,000 to 49,999 ppb	X	X	X	X
SS-739*	From reference area approximately 2,000 feet east of Site 15	X	X	X	X
SS-740*	From reference area approximately 2,000 feet east of Site 15	X	X	X	X
SS-741*	From reference area approximately 2,000 feet east of Site 15	X	X	X	X

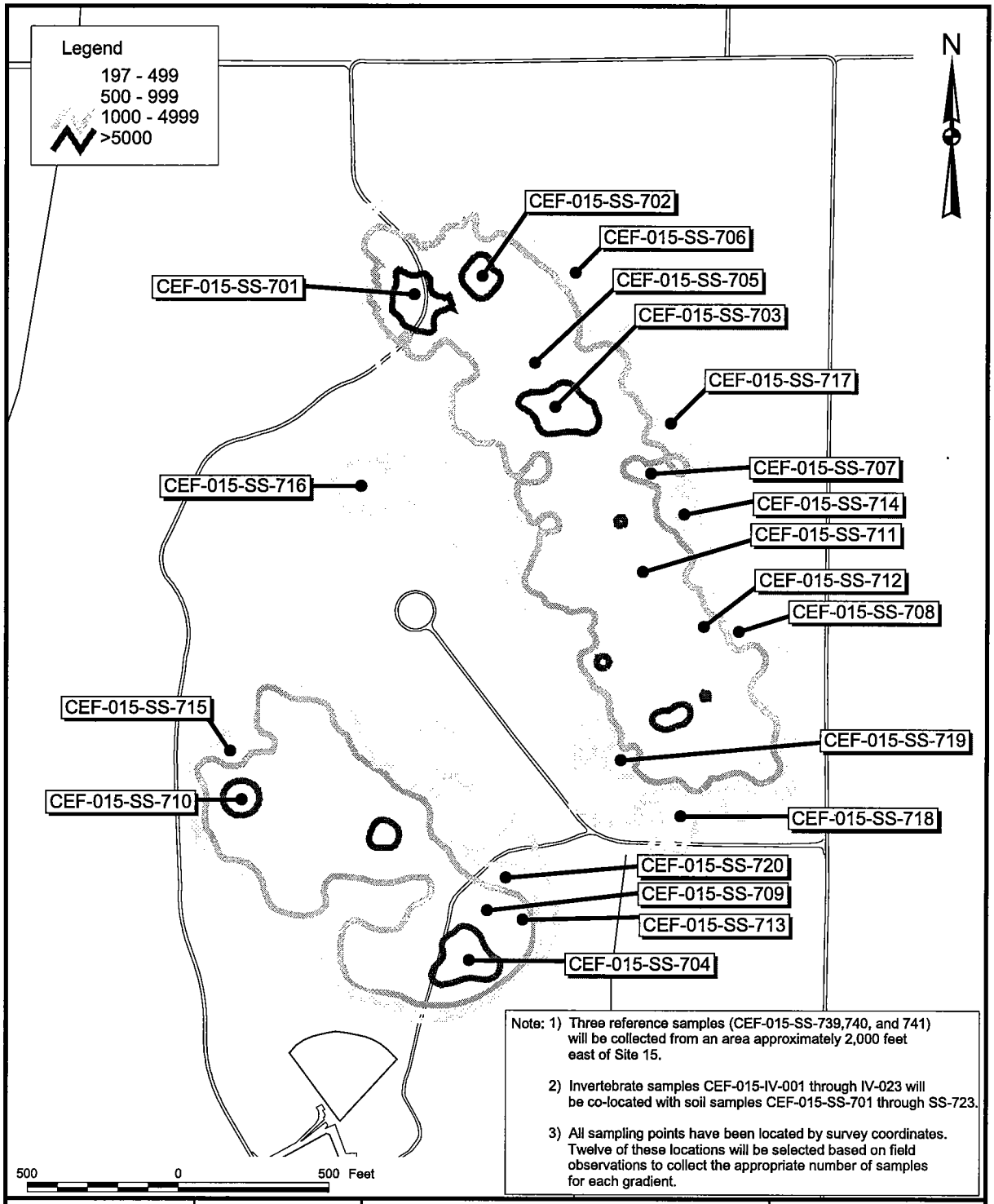
1 Total organic carbon, pH, grain size, and moisture content.
* These samples will be collected from the reference site.
NOTE: Based on field observations, 12 soil samples will be collected from the 20 potential locations determined based on lead gradients, and 12 soil samples will be collected from the 18 potential locations determined based on PAH gradients. Three samples also will be collected from the reference area, resulting in a total of 27 samples.

Table A-2

Phase VIII Sampling and Analysis
Invertebrates
Site 15, Blue 10 Ordnance Disposal Area

Sample ID	Location	Lead
CEF-015-IV-001	At CEF-015-SS-701 location	X
CEF-015-IV-002	At CEF-015-SS-702 location	X
CEF-015-IV-003	At CEF-015-SS-703 location	X
CEF-015-IV-004	At CEF-015-SS-704 location	X
CEF-015-IV-005	At CEF-015-SS-705 location	X
CEF-015-IV-006	At CEF-015-SS-706 location	X
CEF-015-IV-007	At CEF-015-SS-707 location	X
CEF-015-IV-008	At CEF-015-SS-708 location	X
CEF-015-IV-009	At CEF-015-SS-709 location	X
CEF-015-IV-010	At CEF-015-SS-710 location	X
CEF-015-IV-011	At CEF-015-SS-711 location	X
CEF-015-IV-012	At CEF-015-SS-712 location	X
CEF-015-IV-013	At CEF-015-SS-713 location	X
CEF-015-IV-014	At CEF-015-SS-714 location	X
CEF-015-IV-015	At CEF-015-SS-715 location	X
CEF-015-IV-016	At CEF-015-SS-716 location	X
CEF-015-IV-017	At CEF-015-SS-717 location	X
CEF-015-IV-018	At CEF-015-SS-718 location	X
CEF-015-IV-019	At CEF-015-SS-719 location	X
CEF-015-IV-020	At CEF-015-SS-720 location	X

NOTE: A total of 12 samples will be collected corresponding to the locations chosen for soil samples.



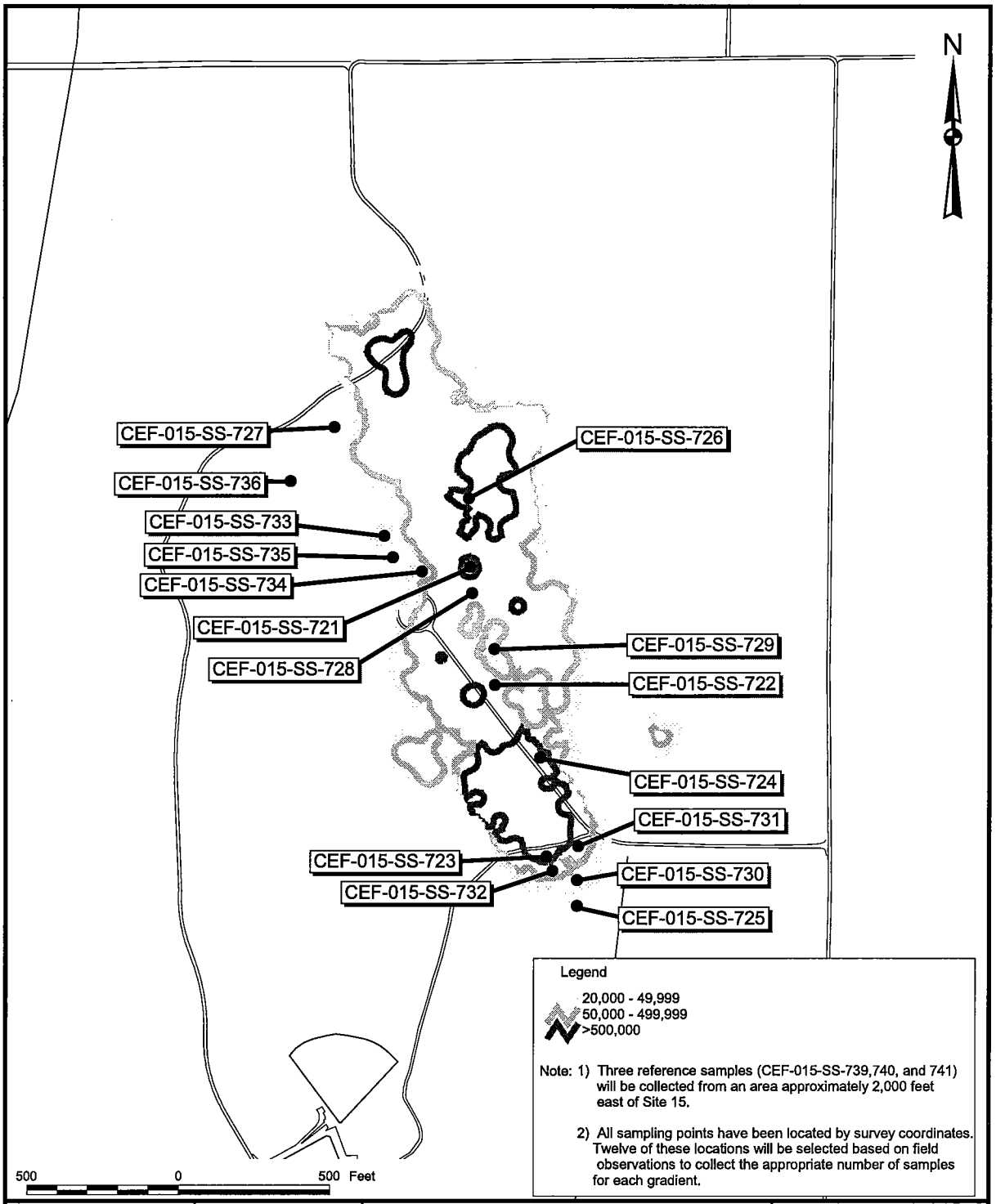
Note: 1) Three reference samples (CEF-015-SS-739,740, and 741) will be collected from an area approximately 2,000 feet east of Site 15.

2) Invertebrate samples CEF-015-IV-001 through IV-023 will be co-located with soil samples CEF-015-SS-701 through SS-723.

3) All sampling points have been located by survey coordinates. Twelve of these locations will be selected based on field observations to collect the appropriate number of samples for each gradient.

DRAWN BY MJJ	DATE 19Dec00	ISOCONCENTRATION CONTOURS FOR LEAD IN SOIL (mg/kg) AND PROPOSED SAMPLE LOCATIONS SITE 15 NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE A-1 REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 21May01 MJJ Layout01



DRAWN BY MJJ	DATE 19Dec00	ISOCONCENTRATION CONTOURS FOR TOTAL PAHs IN SOIL (ug/kg) AND PROPOSED SAMPLE LOCATIONS SITE 15 NAS CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 7653
CHECKED BY	DATE		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE A-2 REV 0

P:\GIS\NAS_CecilField\Site-15_eco.apr 21May01 MJJ Layout02

APPENDIX B

LABORATORY ANALYTICAL DATA

B-1 INVERTEBRATE LEAD DATA

B-2 SOIL PAH, LEAD, TOC, AND CEC DATA

B-3 SOIL GRAIN SIZE ANALYSIS RESULTS

B-1

INVERTEBRATE LEAD DATA

INVERTEBRATE SAMPLE IDs vs. SOIL SAMPLE IDs

Invertebrate Sample ID	Corresponding Soil Sample ID
CEF-015-IV-003	CEF-015-SS-703
CEF-015-IV-004	CEF-015-SS-704
CEF-015-IV-006	CEF-015-SS-706
CEF-015-IV-007	CEF-015-SS-707
CEF-015-IV-007A	CEF-015-SS-707A
CEF-015-IV-008	CEF-015-SS-708
CEF-015-IV-008A	CEF-015-SS-708A
CEF-015-IV-009	CEF-015-SS-709
CEF-015-IV-017	CEF-015-SS-717
CEF-015-IV-019	CEF-015-SS-719
CEF-015-IV-019A	CEF-015-SS-719A
CEF-015-IV-021	CEF-015-SS-739
CEF-015-IV-022	CEF-015-SS-740
CEF-015-IV-023	CEF-015-SS-741
CEF-015-IV-024	CEF-015-SS-701

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**AUGUST 3, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – LEAD**
CTO-039 NAS CECIL FIELD
SAMPLE DELIVERY GROUP (SDG) – CF001

SAMPLES: 15/Tissue/

CEF-015-IV-003	CEF-015-IV-004	CEF-015-IV-006
CEF-015-IV-007	CEF-015-IV-007A	CEF-015-IV-008
CEF-015-IV-008A	CEF-015-IV-009	CEF-015-IV-017
CEF-015-IV-019	CEF-015-IV-019A	CEF-015-IV-021
CEF-015-IV-022	CEF-015-IV-023	CEF-015-IV-024

Overview

The sample set for CTO 039, NAS Cecil Field, SDG CF001, consists of fifteen (15) environmental tissue samples.

All samples were analyzed for lead. The samples were collected by TetraTech NUS from June 23-27, 2001 and analyzed by Severn Trent Laboratories under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Lead analyses were conducted using SW 846 method 6010B.

Lead analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

These data were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Recoveries
* • Laboratory Blank Analyses
* • Detection Limits

* - All quality control criteria were met for this parameter.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Erin M Faust

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A
QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
N01 = Internal Standard Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

CTO039-NAS CECIL FIELD
SOIL DATA
STL-NORTH CANTON
SDG: CF001

SAMPLE NUMBER:	CEF-015-IV-003	CEF-015-IV-004	CEF-015-IV-006	CEF-015-IV-007
SAMPLE DATE:	06/27/01	06/26/01	06/27/01	06/25/01
LABORATORY ID:	A1F300102015	A1F300102012	A1F300102014	A1F300102008
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	100.0 %	100.0 %	100.0 %	100.0 %
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	46.5			36.7			333			3.8		

SAMPLE NUMBER:	CEF-015-IV-007A			CEF-015-IV-008			CEF-015-IV-008A			CEF-015-IV-009		
SAMPLE DATE:	06/25/01			06/26/01			06/23/01			06/26/01		
LABORATORY ID:	A1F300102007			A1F300102010			A1F300102006			A1F300102011		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	100.0 %			100.0 %			100.0 %			100.0 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	1.7			157			3.5			11.6		

CTO039-NAS CECIL FIELD
SOIL DATA
STL-NORTH CANTON
SDG: CF001

SAMPLE NUMBER:	CEF-015-IV-017	CEF-015-IV-019	CEF-015-IV-019A	CEF-015-IV-021
SAMPLE DATE:	06/27/01	06/26/01	06/23/01	06/24/01
LABORATORY ID:	A1F300102013	A1F300102009	A1F300102005	A1F300102001
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	100.0 %	100.0 %	100.0 %	100.0 %
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	3.7			0.70			1.7			0.16	U	

SAMPLE NUMBER:	CEF-015-IV-022	CEF-015-IV-023	CEF-015-IV-024	
SAMPLE DATE:	06/24/01	06/24/01	06/23/01	/ /
LABORATORY ID:	A1F300102002	A1F300102003	A1F300102004	
QC_TYPE:	NORMAL	NORMAL	NORMAL	
% SOLIDS:	100.0 %	100.0 %	100.0 %	100.0 %
UNITS:	MG/KG	MG/KG	MG/KG	
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	0.16	U		0.16	U		5.2					

APPENDIX B
RESULTS AS REPORTED BY THE LABORATORY

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFTAC **Client ID** CEF-015-IV-003

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	46.5		1	ICPST	7/17/01	18:18

Comments: Lot #: A1F300102 Sample #: 15

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR97 **Client ID** CEF-015-IV-004

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	36.7		1	ICPST	7/17/01	18:04

Comments: Lot #: A1F300102 Sample #: 12

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFTAA **Client ID** CEF-015-IV-006

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 0.50 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.32	0.60	333		1	ICPST	7/17/01	18:14

Comments: Lot #: A1F300102 Sample #: 14

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR92 **Client ID** CEF-015-IV-007

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	3.8		1	ICPST	7/17/01	22:22

Comments: Lot #: A1F300102 Sample #: 8

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR91 **Client ID** CEF-015-IV-007A

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	1.7		1	ICPST	7/17/01	22:17

Comments: Lot #: A1F300102 Sample #: 7

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR95 **Client ID** CEF-015-IV-008

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	157		1	ICPST	7/17/01	22:42

Comments: Lot #: A1F300102 Sample #: 10

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR90 **Client ID** CEF-015-IV-008A

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	3.5		1	ICPST	7/17/01	22:12

Comments: Lot #: A1F300102 Sample #: 6

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR96 **Client ID** CEF-015-IV-009

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	11.6		1	ICPST	7/17/01	22:47

Comments: Lot #: A1F300102 Sample #: 11

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR99 **Client ID** CEF-015-IV-017

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	3.7		1	ICPST	7/17/01	18:09

Comments: Lot #: A1F300102 Sample #: 13

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR94 **Client ID** CEF-015-IV-019

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	0.70		1	ICPST	7/17/01	22:37

Comments: Lot #: A1F300102 Sample #: 9

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR9X **Client ID** CEF-015-IV-019A

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	1.7		1	ICPST	7/17/01	22:07

Comments: Lot #: A1F300102 Sample #: 5

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR9R **Client ID** CEF-015-IV-021

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.353	0.16	0.30	0.16	U	1	ICPST	7/17/01	16:13

Comments: Lot #: A1F300102 Sample #: 1

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR9T **Client ID** CEF-015-IV-022

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.353	0.16	0.30	0.16	U	1	ICPST	7/17/01	16:22

Comments: Lot #: A1F300102 Sample #: 2

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR9V **Client ID** CEF-015-IV-023

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.353	0.16	0.30	0.16	U	1	ICPST	7/17/01	16:27

Comments: Lot #: A1F300102 Sample #: 3

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form 1 Equivalent

STL North Canton

Metals Data Reporting Form

Sample Results

Lab Sample ID EFR9W **Client ID** CEF-015-IV-024

Matrix: Biological **Units:** mg/kg **Prep Date:** 7/11/01 **Prep Batch:** 1192095

Weight: 1.00 **Volume:** 100 **Percent Moistur** NA

Element	WL/ Mass	IDL	Report Limit	Conc	Q	DF	Instr	Anal Date	Anal Time
Lead	220.35	0.16	0.30	5.2		1	ICPST	7/17/01	22:02

Comments: Lot #: A1F300102 Sample #: 4

Version 4.10.5

U Result is less than the IDL

B Result is between IDL and RL

Form I Equivalent

B-2

SOIL PAH, LEAD, TOC, AND CEC DATA

Tetra Tech NUS

INTERNAL CORRESPONDENCE

TO:	**M. SPERANZA**	**DATE:**	**AUGUST 10, 2001**
FROM:	**DOUGLAS S. SCHLOER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION – PAH CTO 039, NAS CECIL FIELD SDGs: F10200 and F10146**		
SAMPLES:	17/ Solid / PAH		

CEF-015-SS-703	CEF-015-SS-704	CEF-015-SS-706
CEF-015-SS-708	CEF-015-SS-709	CEF-015-SS-717
CEF-015-SS-719A	CEF-015-SS-724B	CEF-015-SS-001
CEF-015-SS-707	CEF-015-SS-707A	CEF-015-SS-708A
CEF-015-SS-719	CEF-015-SS-739	CEF-015-SS-740
CEF-015-SS-741	CEEF-015-SS-DUP3	

OVERVIEW

The sample set for CTO 039, NAS Cecil Field; SDGs F10200 and F10146 consist of seventeen (17) environmental soil samples. The samples were analyzed for polynuclear aromatic hydrocarbons (PAHs). One field duplicate pair was included in SDG 10146: CEF-015-SS-719A and CEF-015-SS-DUP3.

The samples were collected by TetraTech NUS on June 23rd through 27th, 2001 and analyzed by Accutest Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8310 analytical and reporting protocol. The data contained in this SDG were validated with regard to the following parameters:

- * Data completeness
- * Holding times
- * Initial/continuing calibrations
- * Laboratory method blank results
- Surrogate recovery
- Matrix Spike/Matrix Spike Duplicate
- * Field Duplicate Results
- Detection Limits

The symbol (*) indicates that quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

The text of this report is formulated to address only gross noncompliances resulting in the rejection of data and the elimination of false positives.

PAH

Calibration verification percent Differences (%Ds) exceeded the 15% quality control limit on one analytical detector for benzo(k)fluoranthene and Indeno(1,2,3-cd)pyrene on instrument HPCHEM1, on 7/2/01, at 15:54. No action was warranted based on these noncompliances due to the nature of this data review.

The surrogates o-terphenyl and p-terphenyl were not recovered for the analysis of sample CEF-015-SS-001. However, since the sample required a 100X dilution for analysis, no action was taken based on this noncompliance.

Due to sample matrix interference, all samples in SDG F10200 were analyzed and reported at a 4X dilution. This accounts for the elevated reporting limits for these samples.

Due to sample matrix interference, the following samples were analyzed and reported at the dilution factors indicated below:

CEF-015-SS-741	2X	CEF-015-SS-708A	4X
CEF-015-SS-739	4X	CEF-015-SS-707	5X
CEF-015-SS-707A	5X	CEF-015-SS-719A	5X
CEF-015-SS-740	5X	CEF-015-SS-DUP3	5X

This accounts for the elevated reporting limits for these samples.

Due to the presence of target compounds that exceeded the linear range of the instrument calibration, sample CEF-015-SS-001 was analyzed and reported at a 100X dilution. This accounts for the elevated reporting limits for this sample.

EXECUTIVE SUMMARY

Laboratory Performance Issues: The continuing calibration of several compounds failed to meet the %D criteria on one analytical detector.

Other Factors Affecting Data Quality: None

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (10/99) and the NFESC guidelines "Navy IRCDQM" (Sept 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS

Douglas S. Schloer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

FIELD DUPLICATE SUMMARY
NAS CECIL FIELD CTO 039

Analytical Fraction	Compound	CEF-015-SS-719A	CEF-015-SS-DUP3	RPD
PAH				
	Benzo(a)pyrene	292 J	282 J	3.5
	Benzo(b)fluoranthene	368 J	424 J	-14.1
	Benzo(k)fluoranthene	1512 J	ND J	NC
	Indeno(1,2,3-cd)pyrene	305 J	313 J	-2.6

ND - Compound not detected.
NC - RPD not calculated.

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-703			CEF-015-SS-704			CEF-015-SS-706			CEF-015-SS-708		
SAMPLE DATE:	06/27/01			06/26/01			06/27/01			06/26/01		
LABORATORY ID:	F10200-7			F10200-4			F10200-6			F10200-2		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	79.4 %			81.2 %			81.7 %			59.6 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	1700	U		1600	U		1600	U		2200	U	
2-METHYLNAPHTHALENE	1700	U		1600	U		1600	U		2200	U	
ACENAPHTHENE	3400	U		3300	U		3300	U		4500	U	
ACENAPHTHYLENE	3400	U		3300	U		3300	U		4500	U	
ANTHRACENE	1700	U		1600	U		1600	U		2200	U	
BENZO(A)ANTHRACENE	1700	U		1600	U		1600	U		1720	J	P
BENZO(A)PYRENE	340	U		325	J	P	282	J	P	2120		
BENZO(B)FLUORANTHENE	340	U		219	J	P	188	J	P	1500		
BENZO(G,H,I)PERYLENE	340	U		366			298	J	P	1960		
BENZO(K)FLUORANTHENE	340	U		151	J	P	330	U		999		
CHRYSENE	1700	U		1600	U		1600	U		1720	J	P
DIBENZO(A,H)ANTHRACENE	340	U		330	U		330	U		450	U	
FLUORANTHENE	1700	U		1600	U		1600	U		1990	J	P
FLUORENE	1700	U		1600	U		1600	U		2200	U	
INDENO(1,2,3-CD)PYRENE	340	U		244	J	P	191	J	P	1310		
NAPHTHALENE	1700	U		1600	U		1600	U		2200	U	
PHENANTHRENE	1700	U		1600	U		1600	U		2200	U	
PYRENE	1700	U		3200	U		1600	U		1780	J	P

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-709	CEF-015-SS-717	CEF-015-SS-719	CEF-015-SS-724B
SAMPLE DATE:	06/26/01	06/27/01	06/26/01	06/27/01
LABORATORY ID:	F10200-3	F10200-5	F10200-1	F10200-8
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	83.4 %	84.1 %	77.0 %	81.3 %
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	1600	U		1600	U		1700	U		1600	U	
2-METHYLNAPHTHALENE	1600	U		1600	U		1700	U		1600	U	
ACENAPHTHENE	3200	U		3200	U		3500	U		3300	U	
ACENAPHTHYLENE	3200	U		3200	U		3500	U		3300	U	
ANTHRACENE	1600	U		1600	U		1700	U		1600	U	
BENZO(A)ANTHRACENE	1600	U		1600	U		1060	J	P	1600	U	
BENZO(A)PYRENE	288	J	P	320	U		1330			517		
BENZO(B)FLUORANTHENE	170	J	P	320	U		800			351		
BENZO(G,H,I)PERYLENE	274	J	P	320	U		1280			585		
BENZO(K)FLUORANTHENE	320	U		320	U		625			364		
CHRYSENE	1600	U		1600	U		1000	J	P	1600	U	
DIBENZO(A,H)ANTHRACENE	320	U		320	U		350	U		330	U	
FLUORANTHENE	1600	U		1600	U		1180	J	P	1600	U	
FLUORENE	1600	U		1600	U		1700	U		1600	U	
INDENO(1,2,3-CD)PYRENE	174	J	P	320	U		850			374		
NAPHTHALENE	3200	U		3200	U		1700	U		1600	U	
PHENANTHRENE	1600	U		1600	U		1700	U		1600	U	
PYRENE	1600	U		1600	U		1300	J	P	1600	U	

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-001	CEF-015-SS-707	CEF-015-SS-707A	CEF-015-SS-708A
SAMPLE DATE:	06/23/01	06/25/01	06/25/01	06/23/01
LABORATORY ID:	F10146-2	F10146-8	F10146-7	F10146-3
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	74.2 %	67.1 %	68.4 %	71.9 %
UNITS:	UG/KG	UG/KG	UG/KG	UG/KG
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	45000	U		2500	U		2400	U		1800	U	
2-METHYLNAPHTHALENE	45000	U		2500	U		2400	U		1800	U	
ACENAPHTHENE	90000	U		5000	U		4900	U		3700	U	
ACENAPHTHYLENE	90000	U		5000	U		4900	U		3700	U	
ANTHRACENE	45000	U		2500	U		2400	U		1800	U	
BENZO(A)ANTHRACENE	74200			2500	U		2400	U		1800	U	
BENZO(A)PYRENE	72200			500	U		490	U		370	U	
BENZO(B)FLUORANTHENE	54400			500	U		490	U		370	U	
BENZO(G,H,I)PERYLENE	40600			500	U		490	U		370	U	
BENZO(K)FLUORANTHENE	38600			500	U		490	U		370	U	
CHRYSENE	79600			2500	U		2400	U		1800	U	
DIBENZO(A,H)ANTHRACENE	8030	J	P	500	U		490	U		370	U	
FLUORANTHENE	97300			2500	U		2400	U		1800	U	
FLUORENE	45000	U		2500	U		2400	U		1800	U	
INDENO(1,2,3-CD)PYRENE	47200			500	U		490	U		370	U	
NAPHTHALENE	45000	U		2500	U		2400	U		1800	U	
PHENANTHRENE	20800	J	P	2500	U		2400	U		1800	U	
PYRENE	87800			2500	U		2400	U		1800	U	

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-719A			CEF-015-SS-739			CEF-015-SS-740			CEF-015-SS-741		
SAMPLE DATE:	06/23/01			06/24/01			06/24/01			06/24/01		
LABORATORY ID:	F10146-1			F10146-4			F10146-5			F10146-6		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	71.0 %			66.2 %			77.6 %			69.2 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2300	U		2000	U		2100	U		960	U	
2-METHYLNAPHTHALENE	2300	U		2000	U		2100	U		960	U	
ACENAPHTHENE	4700	U		4000	U		4300	U		1900	U	
ACENAPHTHYLENE	4700	U		4000	U		4300	U		1900	U	
ANTHRACENE	2300	U		2000	U		2100	U		960	U	
BENZO(A)ANTHRACENE	2300	U		2000	U		2100	U		960	U	
BENZO(A)PYRENE	292	J	P	400	U		430	U		190	U	
BENZO(B)FLUORANTHENE	368	J	P	400	U		430	U		190	U	
BENZO(G,H,I)PERYLENE	470	U		400	U		430	U		190	U	
BENZO(K)FLUORANTHENE	152	J	P	400	U		430	U		190	U	
CHRYSENE	2300	U		2000	U		2100	U		960	U	
DIBENZO(A,H)ANTHRACENE	470	U		400	U		430	U		190	U	
FLUORANTHENE	2300	U		2000	U		2100	U		960	U	
FLUORENE	2300	U		2000	U		2100	U		960	U	
INDENO(1,2,3-CD)PYRENE	305	J	P	400	U		430	U		190	U	
NAPHTHALENE	2300	U		2000	U		2100	U		960	U	
PHENANTHRENE	2300	U		2000	U		2100	U		960	U	
PYRENE	2300	U		2000	U		2100	U		960	U	

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-DUP3											
SAMPLE DATE:	06/23/01			/ /			/ /			/ /		
LABORATORY ID:	F10146-9											
QC_TYPE:	NORMAL											
% SOLIDS:	4.0 %			100.0 %			100.0 %			100.0 %		
UNITS:	UG/KG											
FIELD DUPLICATE OF:	CEF-015-SS-719A											
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2200	U										
2-METHYLNAPHTHALENE	2200	U										
ACENAPHTHENE	4400	U										
ACENAPHTHYLENE	4400	U										
ANTHRACENE	2200	U										
BENZO(A)ANTHRACENE	2200	U										
BENZO(A)PYRENE	282	J	P									
BENZO(B)FLUORANTHENE	424	J	P									
BENZO(G,H,I)PERYLENE	440	U										
BENZO(K)FLUORANTHENE	440	U										
CHRYSENE	2200	U										
DIBENZO(A,H)ANTHRACENE	440	U										
FLUORANTHENE	2200	U										
FLUORENE	2200	U										
INDENO(1,2,3-CD)PYRENE	313	J	P									
NAPHTHALENE	2200	U										
PHENANTHRENE	2200	U										
PYRENE	2200	U										

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-703		
Lab Sample ID:	F10200-7	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	79.4
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004230.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3400	ug/kg	
208-96-8	Acenaphthylene	ND	3400	ug/kg	
120-12-7	Anthracene	ND	1700	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1700	ug/kg	
50-32-8	Benzo(a)pyrene	ND	340	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	340	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	340	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	340	ug/kg	
218-01-9	Chrysene	ND	1700	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	340	ug/kg	
206-44-0	Fluoranthene	ND	1700	ug/kg	
86-73-7	Fluorene	ND	1700	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	340	ug/kg	
91-20-3	Naphthalene	ND	1700	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1700	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1700	ug/kg	
85-01-8	Phenanthrene	ND	1700	ug/kg	
129-00-0	Pyrene	ND	1700	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	88%		37-158%
92-94-4	p-Terphenyl	92%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-704		
Lab Sample ID:	F10200-4	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	81.2
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004225.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3300	ug/kg	
208-96-8	Acenaphthylene	ND	3300	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	325	330	ug/kg	J
205-99-2	Benzo(b)fluoranthene	219	330	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	366	330	ug/kg	
207-08-9	Benzo(k)fluoranthene	151	330	ug/kg	J
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	330	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	244	330	ug/kg	J
91-20-3	Naphthalene	ND	1600	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene [b]	ND	3200	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	101%		37-158%
92-94-4	p-Terphenyl	102%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.
(b) Elevated reporting limits due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-706		
Lab Sample ID:	F10200-6	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	81.7
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004227.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3300	ug/kg	
208-96-8	Acenaphthylene	ND	3300	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	282	330	ug/kg	J
205-99-2	Benzo(b)fluoranthene	188	330	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	298	330	ug/kg	J
207-08-9	Benzo(k)fluoranthene	ND	330	ug/kg	
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	330	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	191	330	ug/kg	J
91-20-3	Naphthalene	ND	1600	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene	ND	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	104%		37-158%
92-94-4	p-Terphenyl	103%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708		
Lab Sample ID:	F10200-2	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	59.6
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004223.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4500	ug/kg	
208-96-8	Acenaphthylene	ND	4500	ug/kg	
120-12-7	Anthracene	ND	2200	ug/kg	
56-55-3	Benzo(a)anthracene	1720	2200	ug/kg	J
50-32-8	Benzo(a)pyrene	2120	450	ug/kg	
205-99-2	Benzo(b)fluoranthene	1500	450	ug/kg	
191-24-2	Benzo(g,h,i)perylene	1960	450	ug/kg	
207-08-9	Benzo(k)fluoranthene	999	450	ug/kg	
218-01-9	Chrysene	1720	2200	ug/kg	J
53-70-3	Dibenzo(a,h)anthracene	ND	450	ug/kg	
206-44-0	Fluoranthene	1990	2200	ug/kg	J
86-73-7	Fluorene	ND	2200	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	1310	450	ug/kg	
91-20-3	Naphthalene	ND	2200	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2200	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2200	ug/kg	
85-01-8	Phenanthrene	ND	2200	ug/kg	
129-00-0	Pyrene	1780	2200	ug/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	93%		37-158%
92-94-4	p-Terphenyl	108%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-709		
Lab Sample ID:	F10200-3	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	83.4
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004224.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3200	ug/kg	
208-96-8	Acenaphthylene	ND	3200	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	288	320	ug/kg	J
205-99-2	Benzo(b)fluoranthene	170	320	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	274	320	ug/kg	J
207-08-9	Benzo(k)fluoranthene	ND	320	ug/kg	
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	320	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	174	320	ug/kg	J
91-20-3	Naphthalene [b]	ND	3200	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene	ND	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	106%		37-158%
92-94-4	p-Terphenyl	101%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.
(b) Elevated reporting limits due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-717		
Lab Sample ID:	F10200-5	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	84.1
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004226.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3200	ug/kg	
208-96-8	Acenaphthylene	ND	3200	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	ND	320	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	320	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	320	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	320	ug/kg	
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	320	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	320	ug/kg	
91-20-3	Naphthalene [b]	ND	3200	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene	ND	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	92%		37-158%
92-94-4	p-Terphenyl	93%		59-149%

(a) Dilution required due to matrix interference.
(b) Elevated reporting limits due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

DSS 8/7/01 JAO

Report of Analysis

Client Sample ID:	CEF-015-SS-719		
Lab Sample ID:	F10200-1	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	77.0
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004222.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3500	ug/kg	
208-96-8	Acenaphthylene	ND	3500	ug/kg	
120-12-7	Anthracene	ND	1700	ug/kg	
56-55-3	Benzo(a)anthracene	1060	1700	ug/kg	J
50-32-8	Benzo(a)pyrene	1330	350	ug/kg	
205-99-2	Benzo(b)fluoranthene	800	350	ug/kg	
191-24-2	Benzo(g,h,i)perylene	1280	350	ug/kg	
207-08-9	Benzo(k)fluoranthene	625	350	ug/kg	
218-01-9	Chrysene	1000	1700	ug/kg	J
53-70-3	Dibenzo(a,h)anthracene	ND	350	ug/kg	
206-44-0	Fluoranthene	1180	1700	ug/kg	J
86-73-7	Fluorene	ND	1700	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	850	350	ug/kg	
91-20-3	Naphthalene	ND	1700	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1700	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1700	ug/kg	
85-01-8	Phenanthrene	ND	1700	ug/kg	
129-00-0	Pyrene	1300	1700	ug/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	101%		37-158%
92-94-4	p-Terphenyl	112%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-724B		
Lab Sample ID:	F10200-8	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	81.3
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	EE004231.D	4	07/07/01	MRE	07/02/01	OP3417	GEE194
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3300	ug/kg	
208-96-8	Acenaphthylene	ND	3300	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	517	330	ug/kg	
205-99-2	Benzo(b)fluoranthene	351	330	ug/kg	
191-24-2	Benzo(g,h,i)perylene	585	330	ug/kg	
207-08-9	Benzo(k)fluoranthene	364	330	ug/kg	
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	330	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	374	330	ug/kg	
91-20-3	Naphthalene	ND	1600	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene	ND	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	105%		37-158%
92-94-4	p-Terphenyl	111%		59-149%

(a) All hits confirmed by spectral match using a diode array detector. Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-001		
Lab Sample ID:	F10146-2	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	74.2
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	AA008081.D	100	07/02/01	MRE	06/28/01	OP3397	GAA337
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	90000	ug/kg	
208-96-8	Acenaphthylene	ND	90000	ug/kg	
120-12-7	Anthracene	ND	45000	ug/kg	
56-55-3	Benzo(a)anthracene	74200	45000	ug/kg	
50-32-8	Benzo(a)pyrene	72200	9000	ug/kg	
205-99-2	Benzo(b)fluoranthene	54400	9000	ug/kg	
191-24-2	Benzo(g,h,i)perylene	40600	9000	ug/kg	
207-08-9	Benzo(k)fluoranthene	38600	9000	ug/kg	
218-01-9	Chrysene	79600	45000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	8030	9000	ug/kg	J
206-44-0	Fluoranthene	97300	45000	ug/kg	
86-73-7	Fluorene	ND	45000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	47200	9000	ug/kg	
91-20-3	Naphthalene	ND	45000	ug/kg	
90-12-0	1-Methylnaphthalene	ND	45000	ug/kg	
91-57-6	2-Methylnaphthalene	ND	45000	ug/kg	
85-01-8	Phenanthrene	20800	45000	ug/kg	J
129-00-0	Pyrene	87800	45000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [a]		37-158%
92-94-4	p-Terphenyl	0% [a]		59-149%

(a) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707		
Lab Sample ID:	F10146-8	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	67.1
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008073.D	5	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	5000	ug/kg	
208-96-8	Acenaphthylene	ND	5000	ug/kg	
120-12-7	Anthracene	ND	2500	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2500	ug/kg	
50-32-8	Benzo(a)pyrene	ND	500	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	500	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	500	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	500	ug/kg	
218-01-9	Chrysene	ND	2500	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	500	ug/kg	
206-44-0	Fluoranthene	ND	2500	ug/kg	
86-73-7	Fluorene	ND	2500	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	500	ug/kg	
91-20-3	Naphthalene	ND	2500	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2500	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2500	ug/kg	
85-01-8	Phenanthrene	ND	2500	ug/kg	
129-00-0	Pyrene	ND	2500	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	94%		37-158%
92-94-4	p-Terphenyl	95%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707A		
Lab Sample ID:	F10146-7	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	68.4
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008072.D	5	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4900	ug/kg	
208-96-8	Acenaphthylene	ND	4900	ug/kg	
120-12-7	Anthracene	ND	2400	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2400	ug/kg	
50-32-8	Benzo(a)pyrene	ND	490	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	490	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	490	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	490	ug/kg	
218-01-9	Chrysene	ND	2400	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	490	ug/kg	
206-44-0	Fluoranthene	ND	2400	ug/kg	
86-73-7	Fluorene	ND	2400	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	490	ug/kg	
91-20-3	Naphthalene	ND	2400	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2400	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2400	ug/kg	
85-01-8	Phenanthrene	ND	2400	ug/kg	
129-00-0	Pyrene	ND	2400	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	99%		37-158%
92-94-4	p-Terphenyl	101%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708A		
Lab Sample ID:	F10146-3	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	71.9
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008067.D	4	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3700	ug/kg	
208-96-8	Acenaphthylene	ND	3700	ug/kg	
120-12-7	Anthracene	ND	1800	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1800	ug/kg	
50-32-8	Benzo(a)pyrene	ND	370	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	370	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	370	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	370	ug/kg	
218-01-9	Chrysene	ND	1800	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	370	ug/kg	
206-44-0	Fluoranthene	ND	1800	ug/kg	
86-73-7	Fluorene	ND	1800	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	370	ug/kg	
91-20-3	Naphthalene	ND	1800	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1800	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1800	ug/kg	
85-01-8	Phenanthrene	ND	1800	ug/kg	
129-00-0	Pyrene	ND	1800	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	101%		37-158%
92-94-4	p-Terphenyl	100%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719A		
Lab Sample ID:	F10146-1	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	71.0
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008063.D	5	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4700	ug/kg	
208-96-8	Acenaphthylene	ND	4700	ug/kg	
120-12-7	Anthracene	ND	2300	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2300	ug/kg	
50-32-8	Benzo(a)pyrene	292	470	ug/kg	J
205-99-2	Benzo(b)fluoranthene	368	470	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	ND	470	ug/kg	
207-08-9	Benzo(k)fluoranthene	152	470	ug/kg	J
218-01-9	Chrysene	ND	2300	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	470	ug/kg	
206-44-0	Fluoranthene	ND	2300	ug/kg	
86-73-7	Fluorene	ND	2300	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	305	470	ug/kg	J
91-20-3	Naphthalene	ND	2300	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2300	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2300	ug/kg	
85-01-8	Phenanthrene	ND	2300	ug/kg	
129-00-0	Pyrene	ND	2300	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	98%		37-158%
92-94-4	p-Terphenyl	97%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-739		
Lab Sample ID:	F10146-4	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	66.2
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008068.D	4	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4000	ug/kg	
208-96-8	Acenaphthylene	ND	4000	ug/kg	
120-12-7	Anthracene	ND	2000	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2000	ug/kg	
50-32-8	Benzo(a)pyrene	ND	400	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	400	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	400	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	400	ug/kg	
218-01-9	Chrysene	ND	2000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	400	ug/kg	
206-44-0	Fluoranthene	ND	2000	ug/kg	
86-73-7	Fluorene	ND	2000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	400	ug/kg	
91-20-3	Naphthalene	ND	2000	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2000	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2000	ug/kg	
85-01-8	Phenanthrene	ND	2000	ug/kg	
129-00-0	Pyrene	ND	2000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	100%		37-158%
92-94-4	p-Terphenyl	103%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

045

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-740		
Lab Sample ID:	F10146-5	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	77.6
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008069.D	5	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4300	ug/kg	
208-96-8	Acenaphthylene	ND	4300	ug/kg	
120-12-7	Anthracene	ND	2100	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2100	ug/kg	
50-32-8	Benzo(a)pyrene	ND	430	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	430	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	430	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	430	ug/kg	
218-01-9	Chrysene	ND	2100	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	430	ug/kg	
206-44-0	Fluoranthene	ND	2100	ug/kg	
86-73-7	Fluorene	ND	2100	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	430	ug/kg	
91-20-3	Naphthalene	ND	2100	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2100	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2100	ug/kg	
85-01-8	Phenanthrene	ND	2100	ug/kg	
129-00-0	Pyrene	ND	2100	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	86%		37-158%
92-94-4	p-Terphenyl	89%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-741		
Lab Sample ID:	F10146-6	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	69.2
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008071.D	2	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	1900	ug/kg	
208-96-8	Acenaphthylene	ND	1900	ug/kg	
120-12-7	Anthracene	ND	960	ug/kg	
56-55-3	Benzo(a)anthracene	ND	960	ug/kg	
50-32-8	Benzo(a)pyrene	ND	190	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	190	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	190	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	190	ug/kg	
218-01-9	Chrysene	ND	960	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	190	ug/kg	
206-44-0	Fluoranthene	ND	960	ug/kg	
86-73-7	Fluorene	ND	960	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	190	ug/kg	
91-20-3	Naphthalene	ND	960	ug/kg	
90-12-0	1-Methylnaphthalene	ND	960	ug/kg	
91-57-6	2-Methylnaphthalene	ND	960	ug/kg	
85-01-8	Phenanthrene	ND	960	ug/kg	
129-00-0	Pyrene	ND	960	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	94%		37-158%
92-94-4	p-Terphenyl	95%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP3		
Lab Sample ID:	F10146-9	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	75.6
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008074.D	5	06/29/01	MRE	06/28/01	OP3397	GAA336
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4400	ug/kg	
208-96-8	Acenaphthylene	ND	4400	ug/kg	
120-12-7	Anthracene	ND	2200	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2200	ug/kg	
50-32-8	Benzo(a)pyrene	282	440	ug/kg	J
205-99-2	Benzo(b)fluoranthene	424	440	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	ND	440	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	440	ug/kg	
218-01-9	Chrysene	ND	2200	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	440	ug/kg	
206-44-0	Fluoranthene	ND	2200	ug/kg	
86-73-7	Fluorene	ND	2200	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	313	440	ug/kg	J
91-20-3	Naphthalene	ND	2200	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2200	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2200	ug/kg	
85-01-8	Phenanthrene	ND	2200	ug/kg	
129-00-0	Pyrene	ND	2200	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	99%		37-158%
92-94-4	p-Terphenyl	94%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**AUGUST 3, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – LEAD, CEC & TOC**
CTO-039 NAS CECIL FIELD
SAMPLE DELIVERY GROUP (SDG) – F10146

SAMPLES: 9/Soils/

CEF-015-SS-001	CEF-015-SS-707	CEF-015-SS-707A
CEF-015-SS-708A	CEF-015-SS-719A	CEF-015-SS-739
CEF-015-SS-740	CEF-015-SS-741	CEF-015-SS-DUP3

Overview

The sample set for CTO 039, NAS Cecil Field, SDG F10146, consists of nine (9) soil environmental samples. One field duplicate pair (CEF-015-SS-DUP3 / CEF-015-SS-719A) is included in this SDG.

All samples except CEF-015-SS-DUP3 were analyzed for lead, cation exchange capacity (CEC) and total organic carbon (TOC). Sample CEF-015-SS-DUP3 was analyzed for lead only. The samples were collected by TetraTech NUS from June 23-25, 2001 and analyzed by Accutest Laboratory under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Lead analyses were conducted using SW 846 method 6010B. CEC analyses were conducted using SW 846 method 9081. TOC analyses were conducted using the Army Corps of Engineering's test method 81M.

Lead analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

These data were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Recoveries
• Laboratory Blank Analyses
* • Field Duplicate Results
* • Detection Limits

* - All quality control criteria were met for this parameter.

Laboratory Blank Analyses

The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Lead	2.2 µg/L	1.1 mg/kg

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. No qualification of results was necessary because all reported results were greater than the action level.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Erin M Faust

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A
QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
N01 = Internal Standard Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-~~0~~7 01			CEF-015-SS-707			CEF-015-SS-707A			CEF-015-SS-708A		
SAMPLE DATE:	06/23/01			06/25/01			06/25/01			06/23/01		
LABORATORY ID:	F10146-2			F10146-8			F10146-7			F10146-3		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	74.2 %			67.1 %			67.1 %			68.4 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	419			3080			672			894		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-719A			CEF-015-SS-739			CEF-015-SS-740			CEF-015-SS-741		
SAMPLE DATE:	06/23/01			06/24/01			06/24/01			06/24/01		
LABORATORY ID:	F10146-1			F10146-4			F10146-5			F10146-6		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	71.0 %			66.2 %			77.6 %			69.2 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	109			11.4			9.3			7.8		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-DUP3			
SAMPLE DATE:	06/23/01	/ /	/ /	/ /
LABORATORY ID:	F10146-9			
QC_TYPE:	NORMAL			
% SOLIDS:	4.0 %	100.0 %	100.0 %	100.0 %
UNITS:	MG/KG			
FIELD DUPLICATE OF:	CEF-015-SS-719A			

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	86.6											

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-001	CEF-015-SS-707	CEF-015-SS-707A	CEF-015-SS-708A
SAMPLE DATE:	06/23/01	06/25/01	06/25/01	06/23/01
LABORATORY ID:	F10146-2	F10146-8	F10146-7	F10146-3
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	74.2 %	67.1 %	67.1 %	68.4 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	5350			7820			9610			7830		
TOTAL ORGANIC CARBON(MG/KG)	63300			121000			119000			98600		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10146

SAMPLE NUMBER:	CEF-015-SS-719A			CEF-015-SS-739			CEF-015-SS-740			CEF-015-SS-741		
SAMPLE DATE:	06/23/01			06/24/01			06/24/01			06/24/01		
LABORATORY ID:	F10146-1			F10146-4			F10146-5			F10146-6		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	71.0 %			66.2 %			77.6 %			69.2 %		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	9840			5440			5810			6610		
TOTAL ORGANIC CARBON(MG/KG)	80500			59700			55000			71500		

APPENDIX B
RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-001 = SS-701		
Lab Sample ID:	F10146-2	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	74.2
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	419	12	0.15	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707		
Lab Sample ID:	F10146-8	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	67.1
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	3080	15	0.18	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707A		
Lab Sample ID:	F10146-7	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	68.4
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	672	14	0.16	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708A		
Lab Sample ID:	F10146-3	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	71.9
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	894	13	0.15	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719A		
Lab Sample ID:	F10146-1	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	71.0
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	109	14	0.16	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-739		
Lab Sample ID:	F10146-4	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	66.2
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	11.4 B	16	0.18	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-740		
Lab Sample ID:	F10146-5	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	77.6
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed	By	Method
Lead	9.3 B	13	0.16	mg/kg	1	06/27/01	07/02/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-741		
Lab Sample ID:	F10146-6	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	69.2
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	7.8 B	14	0.16	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP3		
Lab Sample ID:	F10146-9	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	75.6
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	86.6	13	0.15	mg/kg	1	06/27/01	07/02/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-001 (= SS-701)		
Lab Sample ID:	F10146-2	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5350	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 23.3 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-001 = SS-701		
Lab Sample ID:	F10146-2	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	74.2
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Total Organic Carbon	63300	1300	mg/kg	1	06/30/01	LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707		
Lab Sample ID:	F10146-8	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	7820	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 34 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707		
Lab Sample ID:	F10146-8	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	67.1
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	121000	1500	mg/kg	1	07/02/01 VL	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707A		
Lab Sample ID:	F10146-7	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	9610	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 41.8 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-707A		
Lab Sample ID:	F10146-7	**Date Sampled:**	06/25/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	68.4
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	119000	1500	mg/kg	1	06/30/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708A		
Lab Sample ID:	F10146-3	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	7830	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 34 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708A		
Lab Sample ID:	F10146-3	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	71.9
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	98600	1400	mg/kg	1	06/30/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719A		
Lab Sample ID:	F10146-1	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	9840	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 42.8 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719A		
Lab Sample ID:	F10146-1	**Date Sampled:**	06/23/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	71.0
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	80500	1400	mg/kg	1	06/30/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-739		
Lab Sample ID:	F10146-4	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5440	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 23.7 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-739		
Lab Sample ID:	F10146-4	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	66.2
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	59700	1500	mg/kg	1	06/30/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-740		
Lab Sample ID:	F10146-5	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5810	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 25.3 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-740		
Lab Sample ID:	F10146-5	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	77.6
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	55000	1300	mg/kg	1	06/30/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-741		
Lab Sample ID:	F10146-6	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/28/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	6610	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 29.2 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-741		
Lab Sample ID:	F10146-6	**Date Sampled:**	06/24/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	69.2
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Total Organic Carbon	71500	1400	mg/kg	1	06/30/01	LCH	CORP ENG 81 M

RL = Reporting Limit

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**M. SPERANZA**	**DATE:**	**AUGUST 3, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – LEAD, CEC & TOC**
CTO-039 NAS CECIL FIELD
SAMPLE DELIVERY GROUP (SDG) – F10200

SAMPLES: 8/Soils/

CEF-015-SS-703	CEF-015-SS-704	CEF-015-SS-706
CEF-015-SS-708	CEF-015-SS-709	CEF-015-SS-717
CEF-015-SS-719	CEF-015-SS-724B	

Overview

The sample set for CTO 039, NAS Cecil Field, SDG F10200, consists of eight (8) soil environmental samples.

All samples except CEF-015-SS-724B were analyzed for lead, cation exchange capacity (CEC) and total organic carbon (TOC). Sample CEF-015-SS-724B was analyzed for lead only. The samples were collected by TetraTech NUS from June 26-27, 2001 and analyzed by Accutest Laboratory under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Lead analyses were conducted using SW 846 method 6010B. CEC analyses were conducted using SW 846 method 9081. TOC analyses were conducted using the Army Corps of Engineering's test method 81M.

Lead analyses were conducted using Inductively Coupled Plasma (ICP) methodologies.

These data were evaluated based on the following parameters:

* • Data Completeness
* • Holding Times
* • Calibration Recoveries
• Laboratory Blank Analyses
* • Detection Limits

* - All quality control criteria were met for this parameter.

Laboratory Blank Analyses

The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Lead[1]	0.26 mg/kg	1.3 mg/kg

[1] Maximum contamination present in a solid preparation blank.

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. No qualification of results was necessary because all reported results were greater than the action level.

Notes

The Contract Required Detection Limit (CRDL) percent recovery for lead was > 120% quality control limit. No validation action was taken, as per functional guidance.

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", February 1994 and the NFESC document entitled "Navy IRCDQM" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Erin M Faust

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

TetraTech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A
QUALIFIED ANALYTICAL RESULTS

Qualifier Codes:

A = Lab Blank Contamination
B = Field Blank Contamination
C = Calibration (i.e., % RSDs, %Ds, ICVs, CCVs, RPDs, RRFs, etc.) Noncompliance
D = MS/MSD Noncompliance
E = LCS/LCSD Noncompliance
F = Lab Duplicate Imprecision
G = Field Duplicate Imprecision
H = Holding Time Exceedance
I = ICP Serial Dilution Noncompliance
J = GFAA PDS - GFAA MSA's $r < 0.995$
K = ICP Interference - include ICSAB % R's
L = Instrument Calibration Range Exceedance
M = Sample Preservation
N = Internal Standard Noncompliance
N01 = Internal Standard Noncompliance Dioxins
N02 = Recovery Standard Noncompliance Dioxins
N03 = Clean-up Standard Noncompliance Dioxins
O = Poor Instrument Performance (i.e., base-time drifting)
P = Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
Q = Other problems (can encompass a number of issues)
R = Surrogates Recovery Noncompliance
S = Pesticide/PCB Resolution
T = % Breakdown Noncompliance for DDT and Endrin
U = Pest/PCD% between columns for positive results
V = Non-linear calibrations, tuning $r < 0.995$ (correlation coefficient)
W = EMPC result
X = Signal to noise response drop
Y = Percent solids <30%
Z = Uncertainty at 2 sigma deviation is less than sample activity

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-703			CEF-015-SS-704			CEF-015-SS-706			CEF-015-SS-708		
SAMPLE DATE:	06/27/01			06/26/01			06/27/01			06/26/01		
LABORATORY ID:	F10200-7			F10200-4			F10200-6			F10200-2		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	79.4 %			81.2 %			81.7 %			59.6 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	1400			3380			5470			2200		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-709			CEF-015-SS-717			CEF-015-SS-719			CEF-015-SS-724B		
SAMPLE DATE:	06/26/01			06/27/01			06/26/01			06/27/01		
LABORATORY ID:	F10200-3			F10200-5			F10200-1			F10200-8		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	83.4 %			84.1 %			77.0 %			81.3 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	709			120			66.3			31.0		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-703			CEF-015-SS-704			CEF-015-SS-706			CEF-015-SS-708		
SAMPLE DATE:	06/27/01			06/26/01			06/27/01			06/26/01		
LABORATORY ID:	F10200-7			F10200-4			F10200-6			F10200-2		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	79.4 %			81.2 %			81.7 %			59.6 %		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	5010			5840			4730			8950		
TOTAL ORGANIC CARBON(MG/KG)	40700			53700			25300			93000		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10200

SAMPLE NUMBER:	CEF-015-SS-709	CEF-015-SS-717	CEF-015-SS-719	/ /
SAMPLE DATE:	06/26/01	06/27/01	06/26/01	
LABORATORY ID:	F10200-3	F10200-5	F10200-1	
QC_TYPE:	NORMAL	NORMAL	NORMAL	
% SOLIDS:	83.4 %	84.1 %	77.0 %	100.0 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	5360			5310			4190					
TOTAL ORGANIC CARBON(MG/KG)	30400			32900			37100					

APPENDIX B
RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-703		
Lab Sample ID:	F10200-7	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	79.4
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	1400	12	0.14	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-704		
Lab Sample ID:	F10200-4	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	81.2
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	3380	11	0.13	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-706		
Lab Sample ID:	F10200-6	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	81.7
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	5470	11	0.13	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708		
Lab Sample ID:	F10200-2	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	59.6
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed	By	Method
Lead	2200	14	0.16	mg/kg	1	07/03/01	07/06/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-709		
Lab Sample ID:	F10200-3	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	83.4
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	709	12	0.14	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-717		
Lab Sample ID:	F10200-5	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	84.1
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	120	7.8	0.091	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719		
Lab Sample ID:	F10200-1	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	77.0
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	66.3	8.5	0.099	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-724B		
Lab Sample ID:	F10200-8	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	81.3
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	31.0	9.1	0.11	mg/kg	1	07/03/01	07/06/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-703		
Lab Sample ID:	F10200-7	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5010	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 21.8 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-703		
Lab Sample ID:	F10200-7	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	79.4
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	40700	1200	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-704		
Lab Sample ID:	F10200-4	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5840	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 25.4 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-704		
Lab Sample ID:	F10200-4	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	81.2
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	53700	1200	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-706		
Lab Sample ID:	F10200-6	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	4730	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 20.6 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-706		
Lab Sample ID:	F10200-6	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	81.7
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	25300	1200	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708		
Lab Sample ID:	F10200-2	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	8950	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 38.9 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-708		
Lab Sample ID:	F10200-2	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	59.6
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	93000	1700	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-709		
Lab Sample ID:	F10200-3	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5360	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 23.3 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-709		
Lab Sample ID:	F10200-3	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	83.4
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Total Organic Carbon	30400	1200	mg/kg	1	07/05/01	LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-717		
Lab Sample ID:	F10200-5	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5310	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 23.1 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-717		
Lab Sample ID:	F10200-5	**Date Sampled:**	06/27/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	84.1
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	32900	1200	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719		
Lab Sample ID:	F10200-1	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	4190	120	mg/kg	5	07/12/01 JA	SW846 9081

(a) 18.2 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-719		
Lab Sample ID:	F10200-1	**Date Sampled:**	06/26/01
Matrix:	SO - Soil	**Date Received:**	06/29/01
		Percent Solids:	77.0
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	37100	1300	mg/kg	1	07/05/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**MR. M. SPERANZA**	**DATE:**	**AUGUST 7, 2001**
FROM:	**ANGELA SCHEETZ**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC AND INORGANIC DATA VALIDATION- /PAH/LEAD/TOC/CEC**
CTO 039, NAS CECIL FIELD
SDG F10089

SAMPLES: 7/Soil

CEF-015-SS-721	CEF-015-SS-722	CEF-015-SS-724
CEF-015-SS-732	CEF-015-SS-733	CEF-015-SS-734
CEF-015-SS-737		

OVERVIEW

The sample set for CTO 039, NAS Cecil Field, SDG F10089 consists of seven (7) soil environmental samples. The samples were analyzed for polynuclear aromatic hydrocarbons (PAHs), lead, total organic carbon (TOC), and cation exchange capacity (CEC). No sample duplicates were included in this SDG.

The samples were collected by TetraTech NUS on June 19 and 20, 2001 and analyzed by Accutest. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. PAHs were conducted using SW-846 Methods 8310. Lead analyses were conducted using SW 846 6010B. CEC analyses were conducted using SW 846 method 9081. TOC analyses were conducted using method CORP ENG 81 M.

Lead analyses were conducted using Inductively Coupled Plasma (ICP) methodologies. The data contained in this SDG were validated with regard to the following parameters:

* • Data completeness
* • Holding times
* • Initial and continuing calibration
• Laboratory method and field quality control blank results
* • Detection Limits

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A.

Polynuclear aromatic hydrocarbons

No qualifications were made for this fraction.

Lead

The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Lead	1.9 μg/L	0.95 mg/kg

An action level of 5X the maximum concentration was used to evaluate the sample data for blank contamination. Sample aliquot, percent solids and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. No qualification of results was necessary because all reported results were greater than the action level.

TOC & CEC

No qualifications were made to these fractions.

Notes

Dilution factors were used in the PAH fraction for the following samples:

CEF-015-SS-721	40X	CEF-015-SS-722	4X
CEF-015-SS-724	4X	CEF-015-SS-732	4X
CEF-015-SS-733	10X	CEF-015-SS-734	80X
CEF-015-SS-737	4X		

A dilution factor of 5X was used in the CEC analysis for all samples. No qualifications were made on this basis.

EXECUTIVE SUMMARY

Laboratory Performance Issues: None.

Other Factors Affecting Data Quality: Dilution factors were used in the PAH and CEC fractions.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (10/99), the NFESC guidelines (September, 1999), and the National Functional Guidelines for Inorganic Review (February, 1994). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS

Angela Scheetz
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-721			CEF-015-SS-722			CEF-015-SS-724			CEF-015-SS-732		
SAMPLE DATE:	06/19/01			06/20/01			06/20/01			06/20/01		
LABORATORY ID:	F10089-1			F10089-5			F10089-6			F10089-4		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	76.3 %			71.3 %			73.5 %			77.5 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	17000	U		1900	U		1800	U		1700	U	
2-METHYLNAPHTHALENE	17000	U		1900	U		1800	U		1700	U	
ACENAPHTHENE	35000	U		3700	U		3600	U		3400	U	
ACENAPHTHYLENE	35000	U		3700	U		3600	U		3400	U	
ANTHRACENE	17000	U		1900	U		1800	U		1700	U	
BENZO(A)ANTHRACENE	36500			1900	U		1800	U		863	J	P
BENZO(A)PYRENE	43300			370	U		460			576		
BENZO(B)FLUORANTHENE	31400			370	U		629			489		
BENZO(G,H,I)PERYLENE	29800			370	U		390			432		
BENZO(K)FLUORANTHENE	19500			370	U		214	J	P	271	J	P
CHRYSENE	43100			1900	U		1800	U		566	J	P
DIBENZO(A,H)ANTHRACENE	3000	J	P	370	U		360	U		340	U	
FLUORANTHENE	70500			1900	U		1800	U		783	J	P
FLUORENE	17000	U		1900	U		1800	U		1700	U	
INDENO(1,2,3-CD)PYRENE	30700			370	U		468			577		
NAPHTHALENE	17000	U		1900	U		1800	U		1700	U	
PHENANTHRENE	26800			1900	U		1800	U		1700	U	
PYRENE	61100			1900	U		1800	U		846	J	P

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-733			CEF-015-SS-734			CEF-015-SS-737					
SAMPLE DATE:	06/19/01			06/19/01			06/20/01			/ /		
LABORATORY ID:	F10089-3			F10089-2			F10089-7					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	81.5 %			80.3 %			70.8 %			100.0 %		
UNITS:	UG/KG			UG/KG			UG/KG					
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	4100	U		33000	U		1900	U				
2-METHYLNAPHTHALENE	4100	U		33000	U		1900	U				
ACENAPHTHENE	8200	U		66000	U		3800	U				
ACENAPHTHYLENE	8200	U		66000	U		3800	U				
ANTHRACENE	4100	U		33000	U		1900	U				
BENZO(A)ANTHRACENE	8520			59900			1900	U				
BENZO(A)PYRENE	10000			71300			739					
BENZO(B)FLUORANTHENE	7090			49200			696					
BENZO(G,H,I)PERYLENE	6880			44400			578					
BENZO(K)FLUORANTHENE	4510			29800			366	J	P			
CHRYSENE	9680			71600			1900	U				
DIBENZO(A,H)ANTHRACENE	927			3650	J	P	380	U				
FLUORANTHENE	15600			113000			972	J	P			
FLUORENE	4100	U		33000	U		1900	U				
INDENO(1,2,3-CD)PYRENE	6820			47100			638					
NAPHTHALENE	4100	U		33000	U		1900	U				
PHENANTHRENE	6290			35200			1900	U				
PYRENE	13400			104000			969	J	P			

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-721			CEF-015-SS-722			CEF-015-SS-724			CEF-015-SS-732		
SAMPLE DATE:	06/19/01			06/20/01			06/20/01			06/20/01		
LABORATORY ID:	F10089-1			F10089-5			F10089-6			F10089-4		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	76.3 %			71.3 %			73.5 %			77.5 %		
UNITS:	MG/KG			MG/KG			MG/KG			MG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	102			23.4			48.5			214		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-733	CEF-015-SS-734	CEF-015-SS-737	
SAMPLE DATE:	06/19/01	06/19/01	06/20/01	/ /
LABORATORY ID:	F10089-3	F10089-2	F10089-7	
QC_TYPE:	NORMAL	NORMAL	NORMAL	
% SOLIDS:	81.5 %	80.3 %	70.8 %	100.0 %
UNITS:	MG/KG	MG/KG	MG/KG	
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	336			73.0			45.8					

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-721	CEF-015-SS-722	CEF-015-SS-724	CEF-015-SS-732
SAMPLE DATE:	06/19/01	06/20/01	06/20/01	06/20/01
LABORATORY ID:	F10089-1	F10089-5	F10089-6	F10089-4
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	76.3 %	71.3 %	73.5 %	77.5 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	5470			6800			4970			4590		
TOTAL ORGANIC CARBON(MG/KG)	58600			68600			49200			53600		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10089

SAMPLE NUMBER:	CEF-015-SS-733	CEF-015-SS-734	CEF-015-SS-737	
SAMPLE DATE:	06/19/01	06/19/01	06/20/01	/ /
LABORATORY ID:	F10089-3	F10089-2	F10089-7	
QC_TYPE:	NORMAL	NORMAL	NORMAL	
% SOLIDS:	81.5 %	80.3 %	70.8 %	100.0 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	7130			6140			6580					
TOTAL ORGANIC CARBON(MG/KG)	43000			48500			42100					

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-721		
Lab Sample ID:	F10089-1	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	76.3
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008146.D	40	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	35000	ug/kg	
208-96-8	Acenaphthylene	ND	35000	ug/kg	
120-12-7	Anthracene	ND	17000	ug/kg	
56-55-3	Benzo(a)anthracene	36500	17000	ug/kg	
50-32-8	Benzo(a)pyrene	43300	3500	ug/kg	
205-99-2	Benzo(b)fluoranthene	31400	3500	ug/kg	
191-24-2	Benzo(g,h,i)perylene	29800	3500	ug/kg	
207-08-9	Benzo(k)fluoranthene	19500	3500	ug/kg	
218-01-9	Chrysene	43100	17000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	3000	3500	ug/kg	J
206-44-0	Fluoranthene	70500	17000	ug/kg	
86-73-7	Fluorene	ND	17000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	30700	3500	ug/kg	
91-20-3	Naphthalene	ND	17000	ug/kg	
90-12-0	1-Methylnaphthalene	ND	17000	ug/kg	
91-57-6	2-Methylnaphthalene	ND	17000	ug/kg	
85-01-8	Phenanthrene	26800	17000	ug/kg	
129-00-0	Pyrene	61100	17000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [b]		37-158%
92-94-4	p-Terphenyl	0% [b]		59-149%

(a) All hits confirmed by spectral match using a diode array detector.
(b) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-722		
Lab Sample ID:	F10089-5	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	71.3
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008150.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3700	ug/kg	
208-96-8	Acenaphthylene	ND	3700	ug/kg	
120-12-7	Anthracene	ND	1900	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1900	ug/kg	
50-32-8	Benzo(a)pyrene	ND	370	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	370	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	370	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	370	ug/kg	
218-01-9	Chrysene	ND	1900	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	370	ug/kg	
206-44-0	Fluoranthene	ND	1900	ug/kg	
86-73-7	Fluorene	ND	1900	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	370	ug/kg	
91-20-3	Naphthalene	ND	1900	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1900	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1900	ug/kg	
85-01-8	Phenanthrene	ND	1900	ug/kg	
129-00-0	Pyrene	ND	1900	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	88%		37-158%
92-94-4	p-Terphenyl	93%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-724		
Lab Sample ID:	F10089-6	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	73.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008151.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3600	ug/kg	
208-96-8	Acenaphthylene	ND	3600	ug/kg	
120-12-7	Anthracene	ND	1800	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1800	ug/kg	
50-32-8	Benzo(a)pyrene	460	360	ug/kg	
205-99-2	Benzo(b)fluoranthene	629	360	ug/kg	
191-24-2	Benzo(g,h,i)perylene	390	360	ug/kg	
207-08-9	Benzo(k)fluoranthene	214	360	ug/kg	J
218-01-9	Chrysene	ND	1800	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	360	ug/kg	
206-44-0	Fluoranthene	ND	1800	ug/kg	
86-73-7	Fluorene	ND	1800	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	468	360	ug/kg	
91-20-3	Naphthalene	ND	1800	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1800	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1800	ug/kg	
85-01-8	Phenanthrene	ND	1800	ug/kg	
129-00-0	Pyrene	ND	1800	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	99%		37-158%
92-94-4	p-Terphenyl	102%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-732		
Lab Sample ID:	F10089-4	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	77.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008149.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3400	ug/kg	
208-96-8	Acenaphthylene	ND	3400	ug/kg	
120-12-7	Anthracene	ND	1700	ug/kg	
56-55-3	Benzo(a)anthracene	863	1700	ug/kg	J
50-32-8	Benzo(a)pyrene	576	340	ug/kg	
205-99-2	Benzo(b)fluoranthene	489	340	ug/kg	
191-24-2	Benzo(g,h,i)perylene	432	340	ug/kg	
207-08-9	Benzo(k)fluoranthene	271	340	ug/kg	J
218-01-9	Chrysene	566	1700	ug/kg	J
53-70-3	Dibenzo(a,h)anthracene	ND	340	ug/kg	
206-44-0	Fluoranthene	783	1700	ug/kg	J
86-73-7	Fluorene	ND	1700	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	577	340	ug/kg	
91-20-3	Naphthalene	ND	1700	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1700	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1700	ug/kg	
85-01-8	Phenanthrene	ND	1700	ug/kg	
129-00-0	Pyrene	846	1700	ug/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	84%		37-158%
92-94-4	p-Terphenyl	88%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-733		
Lab Sample ID:	F10089-3	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	81.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008148.D	10	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	8200	ug/kg	
208-96-8	Acenaphthylene	ND	8200	ug/kg	
120-12-7	Anthracene	ND	4100	ug/kg	
56-55-3	Benzo(a)anthracene	8520	4100	ug/kg	
50-32-8	Benzo(a)pyrene	10000	820	ug/kg	
205-99-2	Benzo(b)fluoranthene	7090	820	ug/kg	
191-24-2	Benzo(g,h,i)perylene	6880	820	ug/kg	
207-08-9	Benzo(k)fluoranthene	4510	820	ug/kg	
218-01-9	Chrysene	9680	4100	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	927	820	ug/kg	
206-44-0	Fluoranthene	15600	4100	ug/kg	
86-73-7	Fluorene	ND	4100	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	6820	820	ug/kg	
91-20-3	Naphthalene	ND	4100	ug/kg	
90-12-0	1-Methylnaphthalene	ND	4100	ug/kg	
91-57-6	2-Methylnaphthalene	ND	4100	ug/kg	
85-01-8	Phenanthrene	6290	4100	ug/kg	
129-00-0	Pyrene	13400	4100	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	118%		37-158%
92-94-4	p-Terphenyl	186% [b]		59-149%

(a) All hits confirmed by spectral match using a diode array detector.
(b) Outside control limits due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-734		
Lab Sample ID:	F10089-2	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	80.3
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008147.D	80	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	66000	ug/kg	
208-96-8	Acenaphthylene	ND	66000	ug/kg	
120-12-7	Anthracene	ND	33000	ug/kg	
56-55-3	Benzo(a)anthracene	59900	33000	ug/kg	
50-32-8	Benzo(a)pyrene	71300	6600	ug/kg	
205-99-2	Benzo(b)fluoranthene	49200	6600	ug/kg	
191-24-2	Benzo(g,h,i)perylene	44400	6600	ug/kg	
207-08-9	Benzo(k)fluoranthene	29800	6600	ug/kg	
218-01-9	Chrysene	71600	33000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	3650	6600	ug/kg	J
206-44-0	Fluoranthene	113000	33000	ug/kg	
86-73-7	Fluorene	ND	33000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	47100	6600	ug/kg	
91-20-3	Naphthalene	ND	33000	ug/kg	
90-12-0	1-Methylnaphthalene	ND	33000	ug/kg	
91-57-6	2-Methylnaphthalene	ND	33000	ug/kg	
85-01-8	Phenanthrene	35200	33000	ug/kg	
129-00-0	Pyrene	104000	33000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [b]		37-158%
92-94-4	p-Terphenyl	0% [b]		59-149%

(a) All hits confirmed by spectral match using a diode array detector.
(b) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-737		
Lab Sample ID:	F10089-7	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	70.8
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008152.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3800	ug/kg	
208-96-8	Acenaphthylene	ND	3800	ug/kg	
120-12-7	Anthracene	ND	1900	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1900	ug/kg	
50-32-8	Benzo(a)pyrene	739	380	ug/kg	
205-99-2	Benzo(b)fluoranthene	696	380	ug/kg	
191-24-2	Benzo(g,h,i)perylene	578	380	ug/kg	
207-08-9	Benzo(k)fluoranthene	366	380	ug/kg	J
218-01-9	Chrysene	ND	1900	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	380	ug/kg	
206-44-0	Fluoranthene	972	1900	ug/kg	J
86-73-7	Fluorene	ND	1900	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	638	380	ug/kg	
91-20-3	Naphthalene	ND	1900	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1900	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1900	ug/kg	
85-01-8	Phenanthrene	ND	1900	ug/kg	
129-00-0	Pyrene	969	1900	ug/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	86%		37-158%
92-94-4	p-Terphenyl	95%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-721		
Lab Sample ID:	F10089-1	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	76.3
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	102	14	0.16	mg/kg	1	06/21/01	06/25/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-722		
Lab Sample ID:	F10089-5	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	71.3
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	23.4	13	0.16	mg/kg	1	06/21/01	06/25/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-724		
Lab Sample ID:	F10089-6	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	73.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	48.5	13	0.16	mg/kg	1	06/21/01	06/25/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-732		
Lab Sample ID:	F10089-4	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	77.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	214	13	0.15	mg/kg	1	06/21/01	06/25/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-733		
Lab Sample ID:	F10089-3	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	81.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	336	12	0.14	mg/kg	1	06/21/01	06/25/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-734		
Lab Sample ID:	F10089-2	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	80.3
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	73.0	12	0.15	mg/kg	1	06/21/01	06/25/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-737		
Lab Sample ID:	F10089-7	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	70.8
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	45.8	15	0.17	mg/kg	1	06/21/01	06/25/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-721		
Lab Sample ID:	F10089-1	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	76.3
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	5470	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	5470	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	76.3		%	1	06/25/01	LJR	EPA 160.3 M
Total Organic Carbon	58600	1300	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 23.8 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-722		
Lab Sample ID:	F10089-5	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	71.3
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	6800	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	6800	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	71.3		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	68600	1400	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 29.2 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-724		
Lab Sample ID:	F10089-6	**Date Sampled:**	06/20/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	73.5
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	4970	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	4970	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	73.5		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	49200	1400	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 21.6 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-732	**Date Sampled:**	06/20/01
Lab Sample ID:	F10089-4	**Date Received:**	06/21/01
Matrix:	SO - Soil	**Percent Solids:**	77.5
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	4590	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	4590	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	77.5		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	53600	1300	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 20 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-733	**Date Sampled:**	06/19/01
Lab Sample ID:	F10089-3	**Date Received:**	06/21/01
Matrix:	SO - Soil	**Percent Solids:**	81.5
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	7130	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	7130	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	81.5		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	43000	1200	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 31 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-734		
Lab Sample ID:	F10089-2	**Date Sampled:**	06/19/01
Matrix:	SO - Soil	**Date Received:**	06/21/01
		Percent Solids:	80.3
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	6140	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	6140	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	80.3		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	48500	1200	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 26.7 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-737	**Date Sampled:**	06/20/01
Lab Sample ID:	F10089-7	**Date Received:**	06/21/01
Matrix:	SO - Soil	**Percent Solids:**	70.8
Project:	Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By		Method
Cation Exchange Capacity [a]	6580	120	mg/kg	5	07/13/01	ATX	SW846 9081
Cation Exchange Capacity	6580	120	mg/kg	5	07/13/01	ATX	SW846 9081
Solids, Percent	70.8		%	1	06/25/01	LIR	EPA 160.3 M
Total Organic Carbon	42100	1400	mg/kg	1	06/26/01	ANJ	CORP ENG 81 M

(a) 28.6 meq/100g

RL = Reporting Limit

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**MR. M. SPERANZA**	**DATE:**	**AUGUST 7, 2001**
FROM:	**ANGELA SCHEETZ**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC AND INORGANIC DATA VALIDATION- /PAH/LEAD/TOC/CEC**
CTO 039, NAS CECIL FIELD
SDG F10128

SAMPLES: 7/Soil

CEF-015-SS-726A	CEF-015-SS-727A	CEF-015-SS-728A
CEF-015-SS-735A	CEF-015-SS-736A	CEF-015-SS-DUP1
CEF-015-SS-DUP2		

OVERVIEW

The sample set for CTO 039, NAS Cecil Field, SDG F10128 consists of seven (7) soil environmental samples. All samples were analyzed for polynuclear aromatic hydrocarbons (PAHs), and lead. All samples except, CEF-015-SS-DUP1 and CEF-015-SS-DUP2 were analyzed for total organic carbon (TOC) and cation exchange capacity (CEC). Two sample duplicate pairs were included in this SDG, CEF-015-SS-DUP1 / CEF-015-SS-735A and CEF-015-SS-DUP2 / CEF-015-SS-727A.

The samples were collected by TetraTech NUS on June 21 and 22, 2001 and analyzed by Accutest. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. PAHs were conducted using SW-846 Methods 8310. Lead analyses were conducted using SW 846 6010B. CEC analyses were conducted using SW 846 method 9081. TOC analyses were conducted using method CORP ENG 81 M.

Lead analyses were conducted using Inductively Coupled Plasma (ICP) methodologies. The data contained in this SDG were validated with regard to the following parameters:

*	•	Data completeness
*	•	Holding times
*	•	Initial and continuing calibration
	•	Laboratory method and field quality control blank results
*	•	Detection Limits
*	•	Field duplicate results

The symbol (*) indicates that all quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A.

Polynuclear aromatic hydrocarbons

No qualifications were made for this fraction.

Lead

The following contaminants were detected in the laboratory method/preparation blanks at the following

The field duplicate summary is prese fractions.

EXECUTIVE SUMMARY

Laboratory Performance Issues: ted in the PAH fraction because of the following dilution factors:

Other Factors Affecting Data Qu X

X	CEF-015-SS-727A	4X
X	CEF-015-SS-735A	4X
X	CEF-015-SS-DUP1	4X
X		

the CEC analysis for all samples. No qualifications were made on thi

ented in Appendix C.

None.

lity: Dilution factors were used in the PAH and CEC fractions.

TO: **M. SPERANZA – PAGE**
DATE: **AUGUST 7, 2001**

maximum concentrations:

Analyte
Lead

An action level of 5X the r
contamination. Sample a
consideration when eval
qualified as nondetected.

2

TOC & CEC

No qualifications were made to the

Notes	Maximum Concentration	Action Level
Elevated reporting limits were repo	1.8 µg/L	0.90 mg/kg

CEF-015-SS-726A 8
CEF-015-SS-728A 5
CEF-015-SS-736A 4
CEF-015-SS-DUP2 4

maximum concentration was used to evaluate the sample data for blan
liquot, percent solids and dilution factors, if applicable, were taken int
uating for blank contamination. Results below the action level wer

A dilution factor of 5X was used in

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (10/99), the NFESC guidelines (September, 1999), and the National Functional Guidelines for Inorganic Review (February, 1994). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

Angela Scheetz

Tetra Tech NUS

Angela Scheetz
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

APPENDIX A

QUALIFIED ANALYTICAL RESULTS

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-726A			CEF-015-SS-727A			CEF-015-SS-728A			CEF-015-SS-735A		
SAMPLE DATE:	06/21/01			06/22/01			06/21/01			06/21/01		
LABORATORY ID:	F10128-3			F10128-4			F10128-1			F10128-2		
QC_TYPE:	NORMAL			NORMAL			NORMAL			NORMAL		
% SOLIDS:	84.8 %			84.6 %			77.5 %			81.4 %		
UNITS:	UG/KG			UG/KG			UG/KG			UG/KG		
FIELD DUPLICATE OF:												
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	31000	U		1600	U		2200	U		1600	U	
2-METHYLNAPHTHALENE	31000	U		1600	U		2200	U		1600	U	
ACENAPHTHENE	63000	U		3200	U		4300	U		3300	U	
ACENAPHTHYLENE	63000	U		3200	U		4300	U		3300	U	
ANTHRACENE	23700	J	P	1600	U		2200	U		1600	U	
BENZO(A)ANTHRACENE	111000			1440	J	P	4560			1600	U	
BENZO(A)PYRENE	116000			1610			5500			291	J	P
BENZO(B)FLUORANTHENE	83300			1250			4150			327	J	P
BENZO(G,H,I)PERYLENE	63300			1190			3890			280	J	P
BENZO(K)FLUORANTHENE	56000			768			2560			330	U	
CHRYSENE	116000			1610			5130			1600	U	
DIBENZO(A,H)ANTHRACENE	9220			167	J	P	497			330	U	
FLUORANTHENE	211000			2660			8790			1600	U	
FLUORENE	31000	U		1600	U		2200	U		1600	U	
INDENO(1,2,3-CD)PYRENE	65400			1260			4050			360		
NAPHTHALENE	31000	U		1600	U		2200	U		1600	U	
PHENANTHRENE	87600			1220	J	P	3590			1600	U	
PYRENE	179000			2380			7620			1600	U	

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-736A			CEF-015-SS-DUP1			CEF-015-SS-DUP2					
SAMPLE DATE:	06/22/01			06/21/01			06/22/01			/ /		
LABORATORY ID:	F10128-5			F10128-6			F10128-7					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	63.5 %			88.9 %			87.5 %			100.0 %		
UNITS:	UG/KG			UG/KG			UG/KG					
FIELD DUPLICATE OF:				CEF-015-SS-735A			CEF-015-SS-727A					
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
POLYNUCLEAR AROMATIC HYDROCARBONS												
1-METHYLNAPHTHALENE	2100	U		1500	U		1500	U				
2-METHYLNAPHTHALENE	2100	U		1500	U		1500	U				
ACENAPHTHENE	4200	U		3000	U		3000	U				
ACENAPHTHYLENE	4200	U		3000	U		3000	U				
ANTHRACENE	2100	U		1500	U		1500	U				
BENZO(A)ANTHRACENE	2100	U		1500	U		1570					
BENZO(A)PYRENE	420	U		298	J	P	1810					
BENZO(B)FLUORANTHENE	420	U		276	J	P	1430					
BENZO(G,H,I)PERYLENE	420	U		211	J	P	1460					
BENZO(K)FLUORANTHENE	420	U		152	J	P	878					
CHRYSENE	2100	U		1500	U		1770					
DIBENZO(A,H)ANTHRACENE	420	U		300	U		180	J	P			
FLUORANTHENE	2100	U		1500	U		2870					
FLUORENE	2100	U		1500	U		1500	U				
INDENO(1,2,3-CD)PYRENE	420	U		270	J	P	1430					
NAPHTHALENE	2100	U		1500	U		1500	U				
PHENANTHRENE	2100	U		1500	U		1260	J	P			
PYRENE	2100	U		1500	U		2580					

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-726A	CEF-015-SS-727A	CEF-015-SS-728A	CEF-015-SS-735A
SAMPLE DATE:	06/21/01	06/22/01	06/21/01	06/21/01
LABORATORY ID:	F10128-3	F10128-4	F10128-1	F10128-2
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	84.8 %	84.6 %	77.5 %	81.4 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	5540			3580			5530			5480		
TOTAL ORGANIC CARBON(MG/KG)	28000			31300			54100			53900		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-736A			
SAMPLE DATE:	06/22/01	/ /	/ /	/ /
LABORATORY ID:	F10128-5			
QC_TYPE:	NORMAL			
% SOLIDS:	63.5 %	100.0 %	100.0 %	100.0 %
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
MISCELLANEOUS PARAMETERS												
CATION EXCHANGE CAPACITY(MG/KG)	10200											
TOTAL ORGANIC CARBON(MG/KG)	137000											

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-726A	CEF-015-SS-727A	CEF-015-SS-728A	CEF-015-SS-735A
SAMPLE DATE:	06/21/01	06/22/01	06/21/01	06/21/01
LABORATORY ID:	F10128-3	F10128-4	F10128-1	F10128-2
QC_TYPE:	NORMAL	NORMAL	NORMAL	NORMAL
% SOLIDS:	84.8 %	84.6 %	77.5 %	81.4 %
UNITS:	MG/KG	MG/KG	MG/KG	MG/KG
FIELD DUPLICATE OF:				

	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	532			276			84.8			40.5		

CTO039-NAS CECIL FIELD
SOIL DATA
Accutest, NJ
SDG: F10128

SAMPLE NUMBER:	CEF-015-SS-736A			CEF-015-SS-DUP1			CEF-015-SS-DUP2					
SAMPLE DATE:	06/22/01			06/21/01			06/22/01			/ /		
LABORATORY ID:	F10128-5			F10128-6			F10128-7					
QC_TYPE:	NORMAL			NORMAL			NORMAL					
% SOLIDS:	63.5 %			88.9 %			87.5 %			100.0 %		
UNITS:	MG/KG			MG/KG			MG/KG					
FIELD DUPLICATE OF:				CEF-015-SS-735A			CEF-015-SS-727A					
	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE	RESULT	QUAL	CODE
INORGANICS												
LEAD	0.73	U	A	40.7			290					

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-726A		
Lab Sample ID:	F10128-3	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	84.8
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008156.D	80	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	63000	ug/kg	
208-96-8	Acenaphthylene	ND	63000	ug/kg	
120-12-7	Anthracene	23700	31000	ug/kg	J
56-55-3	Benzo(a)anthracene	111000	31000	ug/kg	
50-32-8	Benzo(a)pyrene	116000	6300	ug/kg	
205-99-2	Benzo(b)fluoranthene	83300	6300	ug/kg	
191-24-2	Benzo(g,h,i)perylene	63300	6300	ug/kg	
207-08-9	Benzo(k)fluoranthene	56000	6300	ug/kg	
218-01-9	Chrysene	116000	31000	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	9220	6300	ug/kg	
206-44-0	Fluoranthene	211000	31000	ug/kg	
86-73-7	Fluorene	ND	31000	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	65400	6300	ug/kg	
91-20-3	Naphthalene	ND	31000	ug/kg	
90-12-0	1-Methylnaphthalene	ND	31000	ug/kg	
91-57-6	2-Methylnaphthalene	ND	31000	ug/kg	
85-01-8	Phenanthrene	87600	31000	ug/kg	
129-00-0	Pyrene	179000	31000	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	0% [b]		37-158%
92-94-4	p-Terphenyl	0% [b]		59-149%

(a) All hits confirmed by spectral match using a diode array detector.
(b) Outside control limits due to dilution.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-727A		
Lab Sample ID:	F10128-4	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	84.6
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008157.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3200	ug/kg	
208-96-8	Acenaphthylene	ND	3200	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	1440	1600	ug/kg	J
50-32-8	Benzo(a)pyrene	1610	320	ug/kg	
205-99-2	Benzo(b)fluoranthene	1250	320	ug/kg	
191-24-2	Benzo(g,h,i)perylene	1190	320	ug/kg	
207-08-9	Benzo(k)fluoranthene	768	320	ug/kg	
218-01-9	Chrysene	1610	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	167	320	ug/kg	J
206-44-0	Fluoranthene	2660	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	1260	320	ug/kg	
91-20-3	Naphthalene	ND	1600	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	1220	1600	ug/kg	J
129-00-0	Pyrene	2380	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	90%		37-158%
92-94-4	p-Terphenyl	103%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-728A		
Lab Sample ID:	F10128-1	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	77.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008154.D	5	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4300	ug/kg	
208-96-8	Acenaphthylene	ND	4300	ug/kg	
120-12-7	Anthracene	ND	2200	ug/kg	
56-55-3	Benzo(a)anthracene	4560	2200	ug/kg	
50-32-8	Benzo(a)pyrene	5500	430	ug/kg	
205-99-2	Benzo(b)fluoranthene	4150	430	ug/kg	
191-24-2	Benzo(g,h,i)perylene	3890	430	ug/kg	
207-08-9	Benzo(k)fluoranthene	2560	430	ug/kg	
218-01-9	Chrysene	5130	2200	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	497	430	ug/kg	
206-44-0	Fluoranthene	8790	2200	ug/kg	
86-73-7	Fluorene	ND	2200	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	4050	430	ug/kg	
91-20-3	Naphthalene	ND	2200	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2200	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2200	ug/kg	
85-01-8	Phenanthrene	3590	2200	ug/kg	
129-00-0	Pyrene	7620	2200	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	81%		37-158%
92-94-4	p-Terphenyl	119%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-735A		
Lab Sample ID:	F10128-2	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	81.4
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008155.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3300	ug/kg	
208-96-8	Acenaphthylene	ND	3300	ug/kg	
120-12-7	Anthracene	ND	1600	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1600	ug/kg	
50-32-8	Benzo(a)pyrene	291	330	ug/kg	J
205-99-2	Benzo(b)fluoranthene	327	330	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	280	330	ug/kg	J
207-08-9	Benzo(k)fluoranthene	ND	330	ug/kg	
218-01-9	Chrysene	ND	1600	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	330	ug/kg	
206-44-0	Fluoranthene	ND	1600	ug/kg	
86-73-7	Fluorene	ND	1600	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	360	330	ug/kg	
91-20-3	Naphthalene	ND	1600	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1600	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1600	ug/kg	
85-01-8	Phenanthrene	ND	1600	ug/kg	
129-00-0	Pyrene	ND	1600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	104%		37-158%
92-94-4	p-Terphenyl	106%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-736A		
Lab Sample ID:	F10128-5	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	63.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008158.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	4200	ug/kg	
208-96-8	Acenaphthylene	ND	4200	ug/kg	
120-12-7	Anthracene	ND	2100	ug/kg	
56-55-3	Benzo(a)anthracene	ND	2100	ug/kg	
50-32-8	Benzo(a)pyrene	ND	420	ug/kg	
205-99-2	Benzo(b)fluoranthene	ND	420	ug/kg	
191-24-2	Benzo(g,h,i)perylene	ND	420	ug/kg	
207-08-9	Benzo(k)fluoranthene	ND	420	ug/kg	
218-01-9	Chrysene	ND	2100	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	420	ug/kg	
206-44-0	Fluoranthene	ND	2100	ug/kg	
86-73-7	Fluorene	ND	2100	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	ND	420	ug/kg	
91-20-3	Naphthalene	ND	2100	ug/kg	
90-12-0	1-Methylnaphthalene	ND	2100	ug/kg	
91-57-6	2-Methylnaphthalene	ND	2100	ug/kg	
85-01-8	Phenanthrene	ND	2100	ug/kg	
129-00-0	Pyrene	ND	2100	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	84%		37-158%
92-94-4	p-Terphenyl	93%		59-149%

(a) Dilution required due to matrix interference.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP1		
Lab Sample ID:	F10128-6	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	88.9
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008159.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3000	ug/kg	
208-96-8	Acenaphthylene	ND	3000	ug/kg	
120-12-7	Anthracene	ND	1500	ug/kg	
56-55-3	Benzo(a)anthracene	ND	1500	ug/kg	
50-32-8	Benzo(a)pyrene	298	300	ug/kg	J
205-99-2	Benzo(b)fluoranthene	276	300	ug/kg	J
191-24-2	Benzo(g,h,i)perylene	211	300	ug/kg	J
207-08-9	Benzo(k)fluoranthene	152	300	ug/kg	J
218-01-9	Chrysene	ND	1500	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	ND	300	ug/kg	
206-44-0	Fluoranthene	ND	1500	ug/kg	
86-73-7	Fluorene	ND	1500	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	270	300	ug/kg	J
91-20-3	Naphthalene	ND	1500	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1500	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1500	ug/kg	
85-01-8	Phenanthrene	ND	1500	ug/kg	
129-00-0	Pyrene	ND	1500	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	102%		37-158%
92-94-4	p-Terphenyl	112%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP2		
Lab Sample ID:	F10128-7	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
Method:	EPA 8310 SW846 3550B	**Percent Solids:**	87.5
Project:	Cecil Field-Site 15		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	AA008160.D	4	07/04/01	MRE	06/29/01	OP3411	GAA341
Run #2							

Polynuclear Aromatic Hydrocarbons

CAS No.	Compound	Result	RL	Units	Q
83-32-9	Acenaphthene	ND	3000	ug/kg	
208-96-8	Acenaphthylene	ND	3000	ug/kg	
120-12-7	Anthracene	ND	1500	ug/kg	
56-55-3	Benzo(a)anthracene	1570	1500	ug/kg	
50-32-8	Benzo(a)pyrene	1810	300	ug/kg	
205-99-2	Benzo(b)fluoranthene	1430	300	ug/kg	
191-24-2	Benzo(g,h,i)perylene	1460	300	ug/kg	
207-08-9	Benzo(k)fluoranthene	878	300	ug/kg	
218-01-9	Chrysene	1770	1500	ug/kg	
53-70-3	Dibenzo(a,h)anthracene	180	300	ug/kg	J
206-44-0	Fluoranthene	2870	1500	ug/kg	
86-73-7	Fluorene	ND	1500	ug/kg	
193-39-5	Indeno(1,2,3-cd)pyrene	1430	300	ug/kg	
91-20-3	Naphthalene	ND	1500	ug/kg	
90-12-0	1-Methylnaphthalene	ND	1500	ug/kg	
91-57-6	2-Methylnaphthalene	ND	1500	ug/kg	
85-01-8	Phenanthrene	1260	1500	ug/kg	J
129-00-0	Pyrene	2580	1500	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	122%		37-158%
92-94-4	p-Terphenyl	137%		59-149%

(a) All hits confirmed by spectral match using a diode array detector.

ND = Not detected
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-726A		
Lab Sample ID:	F10128-3	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	84.8
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	532	12	0.14	mg/kg	1	06/27/01	06/28/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-727A		
Lab Sample ID:	F10128-4	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	84.6
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	276	12	0.14	mg/kg	1	06/27/01	07/02/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-728A		
Lab Sample ID:	F10128-1	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	77.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	84.8	12	0.15	mg/kg	1	06/27/01	06/28/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID: CEF-015-SS-735A
Lab Sample ID: F10128-2
Matrix: SO - Soil
Project: Cecil Field-Site 15

Date Sampled: 06/21/01
Date Received: 06/25/01
Percent Solids: 81.4

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	40.5	12	0.14	mg/kg	1	06/27/01	06/28/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-736A		
Lab Sample ID:	F10128-5	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	63.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By	Method
Lead	0.73	0.16	0.0018	mg/kg	1	06/27/01	07/02/01 JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP1		
Lab Sample ID:	F10128-6	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	88.9
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed By		Method
Lead	40.7	11	0.13	mg/kg	1	06/27/01	07/02/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-DUP2		
Lab Sample ID:	F10128-7	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	87.5
Project:	Cecil Field-Site 15		

Metals Analysis

Analyte	Result	RL	IDL	Units	DF	Prep	Analyzed	By	Method
Lead	290	11	0.13	mg/kg	1	06/27/01	07/02/01	JK	SW846 6010B

RL = Reporting Limit
IDL = Instrument Detection Limit

U = Indicates a result < IDL
B = Indicates a result >= IDL but < RL

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-726A		
Lab Sample ID:	F10128-3	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	84.8
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	28000	1200	mg/kg	1	06/28/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-727A		
Lab Sample ID:	F10128-4	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	84.6
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	31300	1200	mg/kg	1	06/27/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-728A		
Lab Sample ID:	F10128-1	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	77.5
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	54100	1300	mg/kg	1	06/27/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-735A		
Lab Sample ID:	F10128-2	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	81.4
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	53900	1200	mg/kg	1	06/27/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-736A		
Lab Sample ID:	F10128-5	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/25/01
		Percent Solids:	63.5
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Total Organic Carbon	137000	1600	mg/kg	1	06/27/01 LCH	CORP ENG 81 M

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-726A		
Lab Sample ID:	F10128-3	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5540	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 24.1 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-727A		
Lab Sample ID:	F10128-4	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	3580	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 15.6 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-728A		
Lab Sample ID:	F10128-1	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5530	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 24.1 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-735A		
Lab Sample ID:	F10128-2	**Date Sampled:**	06/21/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	5480	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 23.8 meq/100g

RL = Reporting Limit

Accutest Laboratories

Report of Analysis

Client Sample ID:	CEF-015-SS-736A		
Lab Sample ID:	F10128-5	**Date Sampled:**	06/22/01
Matrix:	SO - Soil	**Date Received:**	06/26/01
		Percent Solids:	n/a
Project:	TETRSCAI: Cecil Field-Site 15		

General Chemistry

Analyte	Result	RL	Units	DF	Analyzed By	Method
Cation Exchange Capacity [a]	10200	120	mg/kg	5	07/13/01 JA	SW846 9081

(a) 44.8 meq/100g

RL = Reporting Limit

B-3

SOIL GRAIN SIZE ANALYSIS RESULTS

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 14

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 14

Sample Location: CEF-015-SS-~~001~~ 701

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-23-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	89.0
No.100	34.0
No.200	1.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 26

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 26

Sample Location: CEF-015-SS-703

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 7-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.0
No.100	39.0
No.200	4.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 20

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 20

Sample Location: CEF-015-SS-~~726~~ 704

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 7-18-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.0
No.100	38.0
No.200	2.0

Reviewed By: Sam Davis

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 27

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 27

Sample Location: CEF-015-SS-706

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 7-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	96.0
No.100	46.0
No.200	7.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 19

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 19

Sample Location: CEF-015-SS-707

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 7-18-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	88.0
No.100	32.5
No.200	1.50

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 18

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 18

Sample Location: CEF-015-SS-707 A

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 7-16-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	87.0
No.100	32.0
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 22

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 22

Sample Location: CEF-015-SS-708

Soil Description: Dark gray silty sand with trace of roots

Date Sampled: 7-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	90.0
No.100	37.0
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 13

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 13

Sample Location: CEF-015-SS-708 A

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 6-23-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	75.0
No.100	35.0
No.200	10.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 23

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 23

Sample Location: CEF-015-SS-709

Soil Description: Gray fine sand with trace of roots

Date Sampled: 7-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	82.0
No.100	46.0
No.200	8.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 25

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 25

Sample Location: CEF-015-SS-717

Soil Description: Gray fine sand with trace of roots

Date Sampled: 7-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	95.0
No.100	42.0
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 21

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 21

Sample Location: CEF-015-SS-719

Soil Description: Gray fine sand with trace of roots

Date Sampled: 7-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.0
No.100	39.0
No.200	2.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 15

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 15

Sample Location: CEF-015-SS-719 A

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 6-23-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	89.0
No.100	35.0
No.200	4.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 01

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 1

Sample Location: CEF-015-SS-721

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	93.0
No.100	38.0
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 06
Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 6

Sample Location: CEF-015-SS-722

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.0
No.100	37.0
No.200	2.0

Reviewed By: Sai [illegible]

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 07
Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 7

Sample Location: CEF-015-SS-724

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	91.0
No.100	35.0
No.200	2.0

Reviewed By: Sai [illegible]

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 08
Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 8

Sample Location: CEF-015-SS-726 A

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-21-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	92.5
No.100	36.2
No.200	3.1

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 12

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 12

Sample Location: CEF-015-SS-727 A

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-22-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	95.3
No.100	39.5
No.200	2.8

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 10
Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 10

Sample Location: CEF-015-SS-728 A

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-21-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.0
No.100	41.0
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 05

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 5

Sample Location: CEF-015-SS-732

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 6-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	85.0
No.100	36.0
No.200	6.0

Reviewed By: Sam Dorsey

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 02

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 2

Sample Location: CEF-015-SS-733

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	94.5
No.100	37.5
No.200	2.50

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 03

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 3

Sample Location: CEF-015-SS-734

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-19-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	94.0
No.60	86.0
No.100	37.0
No.200	2.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 09
Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 9

Sample Location: CEF-015-SS-735 A

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 6-21-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	95.0
No.100	40.5
No.200	3.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 11

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 11

Sample Location: CEF-015-SS-736 A

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 6-22-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	77.0
No.100	19.0
No.200	1.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 04

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 4

Sample Location: CEF-015-SS-737

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	90.0
No.100	34.1
No.200	1.50

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 24

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 24

Sample Location: CEF-015-SS-739

Soil Description: Light gray fine sand with trace of roots

Date Sampled: 7-20-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	88.0
No.100	34.8
No.200	1.70

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 16

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 16

Sample Location: CEF-015-SS-740

Soil Description: Gray fine sand with trace of roots

Date Sampled: 6-24-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	91.0
No.100	41.0
No.200	2.0

Reviewed By: _____

Civil Services, Inc.

P.O.BOX 8185, JACKSONVILLE, FLORIDA 32239/(904)641-1834

LABORATORY SOIL TEST RESULT

Client: Tetra Tech Nus. Inc. Report No: 17

Project: Laboratory Services - Cecil Field CSI Project No: 9363-01

Project Location: Jacksonville, Florida

****

Sample No: 17

Sample Location: CEF-015-SS-741

Soil Description: Dark gray fine sand with trace of roots

Date Sampled: 6-24-01

****

TEST RESULTS

Sieve Size	% Passing
No.4	100
No.10	100
No.60	84.0
No.100	36.0
No.200	2.0

Reviewed By: _____

APPENDIX C

TOXICITY TEST REPORT

TOXICITY OF SOIL SAMPLES COLLECTED AT NAVAL AIR STATION CECIL FIELD

Springborn Laboratories

SUMMARY REPORT

TOXICITY OF SOIL SAMPLES COLLECTED AT NAVAL AIR STATION CECIL FIELD

Submitted to:

Tetra Tech NUS, Inc.
900 Trail Ridge Road
Aiken, South Carolina 29803

SLI Report No.: 13764.6100

Study Director: Debra Teixeira

Prepared by:

Springborn Laboratories, Inc.
790 Main Street
Wareham, Massachusetts 02571-1075

30 July 2001

TABLE OF CONTENTS

Page

LIST OF TABLES 3
SIGNATURES AND APPROVALS 5
EXECUTIVE SUMMARY 6
CONCLUSION 6
REFERENCES 35
BENCH DATA 36

LIST OF TABLES

Page

Table 1. Summary of the 14-day survival of earthworms (*Eisenia fetida*) exposed to soil samples collected at Naval Air Station Cecil Field. 7

TABLE 2. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 721 8

TABLE 3. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 734 9

TABLE 4. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 733 10

TABLE 5. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 732 11

TABLE 6. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 722 12

TABLE 7. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 737 13

TABLE 8. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 728A 14

TABLE 9. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 735A 15

TABLE 10. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 726A 16

TABLE 11. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 736A 17

TABLE 12. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 727A 18

TABLE 13. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 741 19

TABLE 14. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 708A 20

TABLE 15. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 001 21

TABLE 16. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 719A 22

TABLE 17. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 739 23

TABLE 18. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 708 24

TABLE 19. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 719 25

TABLE 20. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 704 26

TABLE 21. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 717 27

TABLE 22. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 703 28

TABLE 23. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 724B 29
TABLE 24. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 709 30
TABLE 25. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 740 31
TABLE 26. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 707 32
TABLE 27. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 707A 33
TABLE 28. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 706 34

SIGNATURES AND APPROVALS

SUBMITTED BY:

Springborn laboratories, Inc.
790 Main Street
Wareham, Massachusetts 02571-1075

Debra Teixeira
Study Director

7/30/01
Date

Susan M. Hamel
Technical Report Writer

7/30/01
Date

Ronald C. Biever
Manager,
Environmental Toxicology

7-30-01
Date

EXECUTIVE SUMMARY

Springborn Laboratories was contracted to define the toxicity of 27 soil samples to the earthworm, *Eisenia fetida*. Twenty-eight samples were collected between 19 and 27 June 2001 from Site 15 at Naval Air Station Cecil Field, Jacksonville, Florida. All samples were collected by personnel from Tetra Tech NUS, Inc. The objective of the study was to determine the survival of earthworms in the soil samples after 14 days. The procedures used in this study were based on methodologies in the ASTM E-1676-97 Guidelines for Bioassessment of Soil Samples.

Samples 721, 734, 733, 732, 722, 724, 737, 728A, 735A and 726A were received at Springborn on 25 June 2001. Sample 724 was not tested due to excessive water and was recollected. Samples 736A, 727A, 741, 708A, 001, 719A and 739 were received at Springborn on 26 June 2001. Samples 708, 719, 704, 717, 703, 724B, 709, 740, 707, 707A and 706 were received at Springborn on 29 June 2001. Upon receipt, the soil samples were refrigerated at approximately 4°C until use. The 14-day exposures were initiated in two groups beginning on 29 June and 2 July 2001 and terminated on 13 and 16 July 2001.

Table 1 summarizes the day 14 percent survival for each sample received. Tables 2 to 29 present more detailed information on a per sample basis relative to sample receipt and test dates, testing conditions and percent survival data.

Survival of earthworms exposed to all but two soil samples, 703 and 706, was 100% on day 14. Mean survival in the laboratory controls was also 100% after 14 days.

CONCLUSION

Based on the survival rates of earthworms exposed to soil samples collected from Naval Air Station Cecil Field, little acute toxicity was observed. A significant reduction in survival was observed in two of the soil samples tested from this site. Samples 703 and 706 were highly toxic to earthworms, where a survival of 0% was recorded among earthworms exposed for 14 days.

Table 1. Summary of the 14-day survival of earthworms (*Eisenia fetida*) exposed to soil samples collected at Naval Air Station Cecil Field.

Sample Identification	Day 14 Mean Survival[a] (%)
Control 1	100
Control 2	100
Control 3	100
721	100
734	100[b]
733	100[c]
732	100
722	100[b]
737	100[b]
728A	100[c]
735A	100[b]
726A	100[c]
736A	100[b]
727A	100
741	100[b]
708A	100[b]
001	100[b]
719A	100
739	100
708	100
719	100
704	100[b]
717	100[b]
703	0
724B	100[b]
709	100[b]
740	100[b]
707	100[b]
707A	100[b]
706	0

[a] Mean survival of four replicate vessels, 10 earthworms per replicate.
[b] All earthworms were observed to be lethargic.
[c] Several earthworms were observed to be lethargic

TABLE 2. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 721

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	721
COLLECTION DATE:	19 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.7 to 4.3 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 721
	14-Day Mean Survival (%)
Earthworm	100

TABLE 3. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 734

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	734
COLLECTION DATE:	19 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.4 to 3.9 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 734
	14-Day Mean Survival (%)
Earthworm	100

TABLE 4. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 733

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	733
COLLECTION DATE:	19 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 4.1 to 4.2 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 733
	14-Day Mean Survival (%)
Earthworm	100

TABLE 5. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 732

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	732
COLLECTION DATE:	20 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.7 to 3.9 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	**Sample ID: 732**
	14-Day Mean Survival (%)
Earthworm	100

TABLE 6. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 722

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	722
COLLECTION DATE:	20 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.5 to 3.9 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 722
	14-Day Mean Survival (%)
Earthworm	100

TABLE 7. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 737

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	737
COLLECTION DATE:	20 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH: 3.4 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 737
	14-Day Mean Survival (%)
Earthworm	100

TABLE 8. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 728A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	728A
COLLECTION DATE:	21 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 4.0 to 4.2 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 728A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 9. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 735A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	735A
COLLECTION DATE:	21 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.3 to 4.1 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 735A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 10. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 726A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	726A
COLLECTION DATE:	21 June 2001
DATE RECEIVED:	25 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 4.9 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (10 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 726A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 11. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 736A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	736A
COLLECTION DATE:	22 June 2001
DATE RECEIVED:	26 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.3 to 3.5 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 736A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 12. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 727A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	727A
COLLECTION DATE:	22 June 2001
DATE RECEIVED:	26 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.6 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 727A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 13. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 741

STUDY NUMBER: 13764.6100

SAMPLE I.D.: 741

COLLECTION DATE: 24 June 2001

DATE RECEIVED: 26 June 2001

STORAGE CONDITIONS: refrigerated (approximately 4°C)

EXPERIMENTAL DATES: 29 June to 13 July 2001

TEST ORGANISM: earthworm (*Eisenia fetida*)

SAMPLE CHARACTERIZATION: soil

TEST CONDITIONS: temperature: 21°C
pH range: 3.2 to 3.4
light intensity: 70 to 80 footcandles

TEST VESSELS: 500 mL glass jars

SAMPLE SIZE: 200 g (dry weight)

NUMBER EXPOSED: 10 earthworms per vessel, four vessels per sample (8 control vessels)

LAB CONTROL MEDIUM: artificial soil

LAB CONTROL RESPONSE: 14-day mean survival: 100%

Test Organism	Sample ID: 741
	14-Day Mean Survival (%)
Earthworm	100

TABLE 14. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 708A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	708A
COLLECTION DATE:	23 June 2001
DATE RECEIVED:	26 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.2 to 3.6 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 708A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 15. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 001

STUDY NUMBER: 13764.6100

SAMPLE I.D.: 001

COLLECTION DATE: 23 June 2001

DATE RECEIVED: 26 June 2001

STORAGE CONDITIONS: refrigerated (approximately 4°C)

EXPERIMENTAL DATES: 29 June to 13 July 2001

TEST ORGANISM: earthworm (*Eisenia fetida*)

SAMPLE CHARACTERIZATION: soil

TEST CONDITIONS:
temperature: 21°C
pH range: 3.3 to 3.6
light intensity: 70 to 80 footcandles

TEST VESSELS: 500 mL glass jars

SAMPLE SIZE: 200 g (dry weight)

NUMBER EXPOSED: 10 earthworms per vessel, four vessels per sample (8 control vessels)

LAB CONTROL MEDIUM: artificial soil

LAB CONTROL RESPONSE: 14-day mean survival: 100%

Test Organism	Sample ID: 001
	14-Day Mean Survival (%)
Earthworm	100

TABLE 16. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 719A

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	719A
COLLECTION DATE:	23 June 2001
DATE RECEIVED:	26 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 4.0 to 4.4 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 719A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 17. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 739

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	739
COLLECTION DATE:	24 June 2001
DATE RECEIVED:	26 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	29 June to 13 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.2 to 3.5 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (8 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 739
	14-Day Mean Survival (%)
Earthworm	100

TABLE 18. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 708

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	708
COLLECTION DATE:	26 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.4 to 3.9 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	**Sample ID: 708**
	14-Day Mean Survival (%)
Earthworm	100

TABLE 19. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 719

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	719
COLLECTION DATE:	26 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 2.7 to 6.4 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 719
	14-Day Mean Survival (%)
Earthworm	100

TABLE 20. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 704

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	704
COLLECTION DATE:	26 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.0 to 3.6 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 704
	14-Day Mean Survival (%)
Earthworm	100

TABLE 21. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 717

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	717
COLLECTION DATE:	27 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.0 to 3.7 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 717
	14-Day Mean Survival (%)
Earthworm	100

TABLE 22. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 703

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	703
COLLECTION DATE:	27 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.0 to 3.5 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 703
	14-Day Mean Survival (%)
Earthworm	0

TABLE 23. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 724B

STUDY NUMBER: 13764.6100

SAMPLE I.D.: 724B

COLLECTION DATE: 27 June 2001

DATE RECEIVED: 29 June 2001

STORAGE CONDITIONS: refrigerated (approximately 4°C)

EXPERIMENTAL DATES: 2 to 16 July 2001

TEST ORGANISM: earthworm (*Eisenia fetida*)

SAMPLE CHARACTERIZATION: soil

TEST CONDITIONS:
temperature: 21°C
pH range: 3.0 to 3.6
light intensity: 70 to 80 footcandles

TEST VESSELS: 500 mL glass jars

SAMPLE SIZE: 200 g (dry weight)

NUMBER EXPOSED: 10 earthworms per vessel, four vessels per sample (4 control vessels)

LAB CONTROL MEDIUM: artificial soil

LAB CONTROL RESPONSE: 14-day mean survival: 100%

Test Organism	Sample ID: 724B
	14-Day Mean Survival (%)
Earthworm	100

TABLE 24. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 709

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	709
COLLECTION DATE:	26 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.0 to 3.2 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 709
	14-Day Mean Survival (%)
Earthworm	100

TABLE 25. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 740

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	740
COLLECTION DATE:	24 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.0 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 740
	14-Day Mean Survival (%)
Earthworm	100

TABLE 26. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 707

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	707
COLLECTION DATE:	25 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 2.7 to 3.0 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 707
	14-Day Mean Survival (%)
Earthworm	100

TABLE 27. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 707A

STUDY NUMBER: 13764.6100

SAMPLE I.D.: 707A

COLLECTION DATE: 25 June 2001

DATE RECEIVED: 29 June 2001

STORAGE CONDITIONS: refrigerated (approximately 4°C)

EXPERIMENTAL DATES: 2 to 16 July 2001

TEST ORGANISM: earthworm (*Eisenia fetida*)

SAMPLE CHARACTERIZATION: soil

TEST CONDITIONS:
temperature: 21°C
pH range: 2.9 to 3.0
light intensity: 70 to 80 footcandles

TEST VESSELS: 500 mL glass jars

SAMPLE SIZE: 200 g (dry weight)

NUMBER EXPOSED: 10 earthworms per vessel, four vessels per sample (4 control vessels)

LAB CONTROL MEDIUM: artificial soil

LAB CONTROL RESPONSE: 14-day mean survival: 100%

Test Organism	Sample ID: 707A
	14-Day Mean Survival (%)
Earthworm	100

TABLE 28. 14-DAY EARTHWORM SCREENING TOXICITY TEST WITH SAMPLE 706

STUDY NUMBER:	13764.6100
SAMPLE I.D.:	706
COLLECTION DATE:	27 June 2001
DATE RECEIVED:	29 June 2001
STORAGE CONDITIONS:	refrigerated (approximately 4°C)
EXPERIMENTAL DATES:	2 to 16 July 2001
TEST ORGANISM:	earthworm (*Eisenia fetida*)
SAMPLE CHARACTERIZATION:	soil
TEST CONDITIONS:	temperature: 21°C pH range: 3.5 to 4.0 light intensity: 70 to 80 footcandles
TEST VESSELS:	500 mL glass jars
SAMPLE SIZE:	200 g (dry weight)
NUMBER EXPOSED:	10 earthworms per vessel, four vessels per sample (4 control vessels)
LAB CONTROL MEDIUM:	artificial soil
LAB CONTROL RESPONSE:	14-day mean survival: 100%

Test Organism	Sample ID: 706
	14-Day Mean Survival (%)
Earthworm	0

REFERENCES

ASTM, 1999. Conducting Laboratory Soil Toxicity or Bioaccumulation Tests with the Lumbricid Earthworm *Eisenia fetida*. ASTM E 1676-91. Adopted 10 May 1997.

U.S. EPA. 1989. Protocols for the Short Term Toxicity Screening of Hazardous Waste Sites EPA 600/3-88/029.

BENCH DATA

Study Number: 13764.6100
Sponsor: Tetra Tech
Test Substance: Waste Site Soils
Test Type: 14 Day Earthworm Acute
Study Director: Debra Teixeira

13764.6100

TEST METHOD SOLID - ASTM E-1676-97

14-Day Earthworm Subacute Toxicity Test to Meet ASTM E-1676-97 Guidelines for Bioassessment of Soil Sample.

1.0 OBJECTIVE

The objective of this study will be to determine the toxicity of a soil sample to earthworms (*Eisenia fetida*) during a 14-day exposure. Earthworms will be exposed to either 100% soil sample (screening test) or a range of soil concentrations (test soil sample mixed with artificial soil, or a reference soil; expressed as a percentage weight/weight). Assessment of mortality will be performed on test day 14 (test termination) to estimate the lethal concentration to 50% of the test organisms (LC50). The test medium will be monitored at test initiation and termination for pH, percent moisture and temperature. The methods described generally meet the standard procedures described for short-term toxicity screening of hazardous waste site soil (Greene, et. al. 1989) and ASTM E-1676-97.

2.0 MATERIALS AND METHODS

2.1 Test System

2.1.1 Species

Earthworms (*Eisenia fetida*) will be either cultured at Springborn Laboratories or obtained from an outside supplier and acclimated to laboratory conditions for at least two weeks prior to testing. The source of the test system will be identified in the raw data and final report. Species verification will be conducted using Reynolds (1977) taxonomic key, or provided by the supplier. The maintenance medium will be a mixture of peat, composted cattle manure and Bed-A-Beast™. Earthworms used for testing will be isolated from the culture and acclimated in artificial soil for approximately 24 to 48 hours prior to testing. During culturing, earthworms will be fed composted cattle manure and may also be fed certified organic cornmeal. Earthworms will not be fed during the test. Adult earthworms at least two months old (with clitellum), with a minimum wet weight of approximately 300 mg, will be used for testing.

2.1.2 Justification of Test System

Earthworms have demonstrated sensitivity to chemical challenges which, combined with their importance to the terrestrial ecosystem, support the use of this organism to evaluate the acute toxicity of chemical substances to soil fauna (Gilman and Vardanis, 1974; Karnak and Hamelink, 1982; Neuhauser and Callahan, 1990; Roberts and Dorough, 1984).

2.2 Physical System:

2.2.1 Soil

A minimum of 1 kilogram of soil is required for a screening test, and 6 kg of soil is needed for a test with dilutions. Solid samples will be stored at approximately 4°C. The test is generally initiated within three days of receipt, but storage will not exceed 14-days from receipt. The exposure in a screening test will consist of 100% soil sample and a negative control. In a test with dilutions, five test concentrations (i.e., 100, 50, 25, 13 and 6.3% soil sample) will be prepared, as well as a control. The appropriate proportions of soil sample will be blended with artificial soil (see section 2.2.2) or reference soil using a mechanical mixer. The negative control is prepared with 100% artificial soil which will be useful to evaluate survival of the test species in a standard medium.

2.2.2 Artificial Soil Medium

The medium utilized for dilution of the soil sample may consist of reference soil or the following components on a weight basis:

70 % Industrial sand (≥50% of particles are 50 to 100 µm)
20 % Kaolin clay
10 % Sphagnum peat (finely ground)
$CaCO_3$ or phosphoric acid to adjust pH to 6.0 ± 0.5 if necessary

The dry ingredients will be thoroughly mixed in a suitable mixer. A measured quantity of deionized water will be added during mixing to yield approximately 75% water holding capacity. Moisture content will be determined by drying a pre-weighed sample at approximately 105 °C and reweighing, or on a moisture analyzer.

2.2.3 Test Vessels

Four, 500-mL polypropylene or four, 1-L glass beakers will be used as test vessels. The vessels will be covered with a perforated lids that allow air exchange. Test vessels will be cleaned following standard laboratory procedures to removed contaminants prior to use.

2.3 Test Procedures

2.3.1 Test Concentrations

A screening test is conducted with 100% test soil sample and a negative control. For a test with dilutions, the test sample will be mixed with artificial soil or a reference soil in a mechanical mixer to produce five concentrations (i.e., 100, 50, 25, 13 and 6.3%). For example, the 50% sample will contain 50% soil sample and 50% artificial soil or reference soil on a per weight basis. Four replicates per concentration will be prepared for either a screening test or one with dilutions. Each replicate contains 200 g of soil (dry weight). The negative control consist of 100% artificial soil.

2.3.2 Test Initiation

Twenty-four to forty-eight hours prior to test initiation, earthworms will be isolated from the culture and placed in an acclimation vessel containing artificial soil. This procedure allows the earthworms sufficient time to eliminate the culture medium and take up artificial soil so the medium within the earthworms will be equivalent at test initiation and termination. To initiate the test, the earthworms will be removed from the acclimation vessel and placed in an empty isolation vessel. Ten mature earthworms will be impartially selected from the isolation vessel. The earthworms (n=10) will be randomly assigned to a replicate test vessel using a computer-generated random number table. This procedure will be repeated until ten earthworms are selected for each replicate test vessel. Earthworm burrowing and/or avoidance behavior will be recorded for each replicate.

2.3.3 Sample Preparation

One day prior to initiation, test soil will be hydrated and mixed well. Soil will be separated into replicate vessels and placed into the test chamber or waterbath for overnight equilibration. Soil samples will be hydrated to approximately 75% of its water holding capacity or 25 to 35% moisture.

2.3.4 Environmental Conditions

Testing and acclimation of earthworms will be conducted at 20 ± 2 °C. Light will be provided continuously with an intensity at the soil surface of about 400-800 lux (37 - 74 footcandles) and will be measured at initiation and day 14 (termination).

2.3.5 Monitoring of Test System

On day 14, earthworm mortality and health assessments will be performed. Soil moisture content, pH and temperature will be measured in one replicate vessel per sample or control(s) at the initiation and termination, day 14. Mortality will be assessed on day 14 by emptying the test medium onto a tray, sorting the earthworms from the medium and testing their reaction to a mechanical stimulus at the anterior end. Mortality will be defined as a lack of visible movement after gentle mechanical stimulation is applied. The general health of the earthworms will be assessed and recorded (for example, by observing color changes, lethargy, softness, lesions and/or the presence of cocoons).

2.3.6 Acceptability Criteria

The percent mortality among the negative control organisms (100% artificial soil) must not exceed 10 percent at the end of the test.

3.0 CALCULATIONS

Test data will be presented in tabular form which includes observation period, number of organisms per replicate, health assessments and mortality. Data will be summarized in the form of a mean and standard deviation for control(s) and exposure replicate measurements.

For a screening test, a t-Test will be used to determine if the test data is significantly different ($p \leq 0.05$) from the negative control or reference soil site data.

Mortality data from a multi-concentration test will be subjected to Dunnett's Test (Dunnett, 1955, 1964) to determine the No-Observed-Effect Concentration (NOEC). Dunnett's Test will be preceded by a Shapiro-Wilks' and Bartlett's test which test for normality and homogeneity of the data set. Mean values will be transformed using arcsine square root procedure, if possible. If either Shapiro-Wilks' or Bartlett's tests continue to fail after these conversions, Dunn's Test, a non-parametric procedure, will be used to establish the NOEC. All comparisons will be made at 95% level of certainty ($P \leq 0.05$) except Shapiro Wilks' and Bartlett's Tests, where 99% level of certainty will be applied ($P \leq 0.01$).

The 14 day mortality data will be used to estimate a median lethal concentration (LC50) and its 95% confidence interval. The LC50 is the estimated nominal concentration of the test sample that produces death in 50% of the test population at the stated exposure time. A computer program estimates the LC50 values using one of three statistical methods: probit analysis, moving average angle analysis or non-linear interpolation. The method selected is determined by the data (e.g., presence or absence of 100% mortality, number of partial responses etc.). An LC50 value can not be calculated if the data derived is insufficient according to any of the three statistical methods. The probit method provides values of slope, including 95% confidence intervals, as well as appropriate statistical tests to evaluate goodness-of-fit. If less than a 50% response is observed in the 100% solid sample, the LC50 is empirically estimated to be >100% soil.

4.0 RECORDS TO BE MAINTAINED

Records to be maintained will include, but will not be limited to, correspondence and other documents relating to the interpretation and evaluation of data as well as all raw data and documentation generated as a result of the study.

5.0 REPORTING

The raw data and the final report will be reviewed by the Study Director. The test results will be presented in an outline format on a per sample basis.

6.0 REFERENCES

ASTM, 1999. Conducting Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm *Eisenia Fetida*. ASTM E 1676-91. Adopted 10 May 1997.

Dunnett, C.W. 1955. *A Multiple Comparison Procedure for Comparing Several Treatments with Control. J. Amer. Stat. Assoc.* 50: 1096-1121.

Dunnett, C.W. 1964. New Tables for Multiple Comparisons with a Control. *Biometrics* 20: 482-291.

Gilman, A. and A. Vardanis. 1974. Carbofuran: Comparative toxicity and metabolism in the worms *Lumbricus terrestris* and *Eisenia foetida*. *S.J. Agric. Food Chem.* 22: 625-6218.

Greene, J.C., C.L. Bartels, W.J. Warren-Hicks, B.R. Parkhurst, G.L. Linder, S.A. Peterson and W.E. Miller. 1989. Protocols for the Short Term Toxicity Screening of Hazardous Waste Sites. EPA 600/3-88/029.

Karnak, R. E. and J. L. Hamelink. 1982. A standardized method for determining the acute toxicity of chemicals to earthworms. *Ecotoxicol. Environ. Safety* 6: 216-221.

Neuhauser, E.F. and C.A. Callahan. 1990. Growth and reproduction of the earthworm *Eisenia foetida* exposed to sublethal concentrations of organic chemicals. *Soil Biol. Biochem.* 22: pp. 175 - 179.

Roberts, B.L. and H.W. Dorough. 1984. Relative toxicities of chemicals to the earthworm *Eisenia foetida*. *Environ. Toxicol. Chem.* 3: 67-78.

Reynolds, J.W. 1977. The Earthworms (Lumricidae and Sparganophilidae) of Ontario. Royal Ontario Museum, Ontario, Canada. 141 pp.

TETRA TECH NUS, INC. CHAIN OF CUSTODY NUMBER PAGE 1 OF 1

PROJECT NO: Cent Field	SITE NAME: Site 15	PROJECT MANAGER AND PHONE NUMBER: Mike Whitten 803-649-7963	LABORATORY NAME AND CONTACT: Springborn Laboratories
SAMPLERS (SIGNATURE): M L Whitten		FIELD OPERATIONS LEADER AND PHONE NUMBER:	ADDRESS: 790 Main Street
		CARRIER/WAYBILL NUMBER: FEDEX	CITY, STATE: Wareham MA 02571-1075

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ~~☐ 7 day~~ ☐ 14 day

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: Metals, Cadmium, Toxicity								COMMENTS
						CONTAINER TYPE PLASTIC (P) or GLASS (G)								
						PRESERVATIVE USED	none							
6/19/01	1005	CEF-015-SS-721	S	C	1	✓								Cool to 4°C.
6-19-01	1230	CEF-015-SS-734	S	C	1	✓								
6-19-01	1515	CEF-015-SS-733	S	C	1	✓								All samples
6/20/01	0930	CEF-015-SS-732	S	C	1	✓								were at
	1045	CEF-015-SS-722	S	C	1	✓								~~5°C~~ 5°C
	1215	CEF-015-SS-724 *	S	C	1	✓								on reciept
	1320	CEF-015-SS-737	S	C	1	✓								AEP 6/25/01
6/21/01	0923	CEF-015-SS-728A	S	C	1	✓								
	1205	CEF-015-SS-735A	S	C	1	✓								
	1510	CEF-015-SS-726A	S	C	1	✓								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: M.L. Whitten	6/21/01	1730	1. RECEIVED BY: Delivered to FedEx		
2. RELINQUISHED BY: FedEx	6/25/01	1230	2. RECEIVED BY: Springborn	6/25/01	1230
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

* Sample discarded excessive water, sample to be recollected. 6/21/01

3/99
FORM NO. TtNUS-001

15164.6MN

6

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO:	SITE NAME:	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT:
CECIL FIELD	SITE 15	MIKE WHITTEN 803-649-7963	Springborn Labs - Arthur Putt
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS 790 Main Street
M L Whitten		CARRIER/WAYBILL NUMBER FedEx	CITY, STATE Wareham, MA 02571-1075

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): P
PRESERVATIVE USED: ice cool to 4°C

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: 14-day earthworm toxicity								COMMENTS
6/22	1150	CEF-015-SS-736A	Soil	C		✓								Cool to 4°C
6/22	0920	CEF-015-SS-727A	Soil	C		✓								received @ 5°C 6/26
~~6/25~~	~~0920~~	MLW 707A												
6/24	1220	CEF-015-SS-741	Soil	C		✓								
~~6/24~~	~~1013~~	740												MLW
6/23	1245	CEF-015-SS-708A	Soil	C		✓								
6/23	1030	CEF-015-SS-001	Soil	C		✓								
6/23	0830	CEF-015-SS-719A	Soil	C		✓								
6/24	0745	CEF-015-SS-739	Soil	C		✓								
~~6/25~~	~~1215~~	MLW 707												MLW

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY M. L. Whitten	6/25/01	1830	1. RECEIVED BY Delivered to FedEx		
2. RELINQUISHED BY			2. RECEIVED BY Nelson Sullivan	6/26/01	1120
3. RELINQUISHED BY			3. RECEIVED BY		

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

13764.6100

Study Number: 13764.6100 Page:

ARTIFICIAL SOIL PREPARATION 3.0 Kg

TOTAL AMOUNT OF SOIL (DRY WEIGHT) NEEDED: 3.0 Kg (Controls)
Test Soil

Dry Components	Theoretical[a] Dry Weight (g)	%[b] Moisture	Ambient Dry[c] Weight (g)	Net Weight (g)
Coarse Sand: 35% Wedron Silica Co.	1050	0.3	1053	1053
Fine Sand: 35% Wedron Silica Co.	1050	0.3	1053	1053
Kaolin Clay: 20% Engelhard Corp.	600	1.0	606	606
Peat Moss: 10% Magic Products, Inc.	300	10.1	334	334

a/(1 - b(as decimal)) = c Approved by:

Balance Used: Mettler PE6 F50070		
Mixer Used Hobart A200 1742668	Start Time: 1045	End Time: 1055
pH meter: LAMOTTE 46116-5551	Initial pH: 6.4	Adjusted pH: N/A
pH adjusted with calcium carbonate/phosphoric acid (circle one) amount used: N/A		
Date/Initials: EKP 6/27/01		

COMMENTS:
Moistened with 900 ml DI Water. EKP 6/27/01

9 13764.6100

test soil

M	105 C	60 m	
1:00	57 C		12.43g
0.3%M	99.7%S		
2:00	104 C		12.33g
1.1%M	98.9%S		
3:00	103 C		12.28g
1.5%M	98.5%S		
4:00	104 C		12.25g
1.8%M	98.2%S		
5:00	106 C		12.24g
1.8%M	98.2%S		
6:00	105 C		12.24g
1.8%M	98.2%S		
7:00	106 C		12.23g
1.9%M	98.1%S		
8:00	106 C		12.23g
1.9%M	98.1%S		
9:00	105 C		12.23g
1.9%M	98.1%S		
10:00	105 C		12.23g
1.9%M	98.1%S		
11:00	105 C		12.23g
1.9%M	98.1%S		
12:00	106 C		12.23g
1.9%M	98.1%S		
13:00	106 C		12.23g
1.9%M	98.1%S		
14:00	106 C		12.23g
1.9%M	98.1%S		

ERP 6/27/01

ARTIFICIAL SOIL PREPARATION

TOTAL AMOUNT OF SOIL (DRY WEIGHT) NEEDED: 1.0 Kg

Acclimation Soil

Dry Components	Theoretical[a] Dry Weight (g)	%[b] Moisture	Ambient Dry[c] Weight (g)	Net Weight (g)
Coarse Sand: 35% Wedron Silica Co.	2450	0.3	2457	2457
Fine Sand: 35% Wedron Silica Co.	2450	0.3	2457	2457
Kaolin Clay: 20% Engelhard Corp.	1400	1.0	~~1401~~ 1414 ①	1414
Peat Moss: 10% Magic Products, Inc.	700	10.1	779	779

a/(1 - b(as decimal)) = c

Approved by: [illegible] 6/19/01

Balance Used: Mettler PE6 F50070		
Mixer Used Hobart A200 1742668	Start Time: 1130	End Time: 1140
pH meter: LAMOTTE 46116-5551	Initial pH: 6.8 ②	Adjusted pH: N/A
pH adjusted with calcium carbonate/phosphoric acid (circle one) amount used: N/A		
Date/Initials: EKP 6/20/01		

COMMENTS:

Moistened with 2000mL DI water. EKP 6/19/01
bringing % moisture from 2.2 to 28. EKP 6/19/01

2 batches were made and combined 6/20/01
② pH dropped to 6.4 when combined with other batch of Acclimation Soil. EKP 6/20/01

① c.e. ekp 6/19/01

11

13164.6100

Clay EKP 6/18/01

N 105 C 60 m

1:00	93 C	3.13g
1.0%M	99.0%S	
2:00	107 C	3.13g
1.0%M	99.0%S	
3:00	103 C	3.13g
1.0%M	99.0%S	
4:00	103 C	3.13g
1.0%M	99.0%S	
5:00	106 C	3.13g
1.0%M	99.0%S	
6:00	105 C	3.13g
1.0%M	99.0%S	
7:00	105 C	3.13g
1.0%M	99.0%S	
8:00	106 C	3.13g
1.0%M	99.0%S	
9:00	106 C	3.13g
1.0%M	99.0%S	

Coarse Sand EKP 6/18/01

1:00	85 C	3.54g
0.3%M	99.7%S	
2:00	106 C	3.54g
0.3%M	99.7%S	
3:00	102 C	3.54g
0.3%M	99.7%S	
4:00	105 C	3.54g
0.3%M	99.7%S	
5:00	106 C	3.54g
0.3%M	99.7%S	
6:00	105 C	3.54g
0.3%M	99.7%S	
7:00	106 C	3.54g
0.3%M	99.7%S	
8:00	106 C	3.54g
0.3%M	99.7%S	
9:00	105 C	3.54g
0.3%M	99.7%S	
10:00	106 C	3.54g
0.3%M	99.7%S	
11:00	105 C	3.54g
0.3%M	99.7%S	
12:00	105 C	3.54g
0.3%M	99.7%S	
13:00	106 C	3.54g
0.3%M	99.7%S	
14:00	106 C	3.54g
0.3%M	99.7%S	

N 105 C 60 m

1:00	57 C	5.04g
0.4%M	99.6%S	
2:00	103 C	4.96g
2.0%M	98.0%S	
3:00	104 C	4.95g
2.2%M	97.8%S	
4:00	103 C	4.95g
2.2%M	97.8%S	
5:00	107 C	4.95g
2.2%M	97.8%S	
6:00	105 C	4.95g
2.2%M	97.8%S	
7:00	105 C	4.95g
2.2%M	97.8%S	
8:00	107 C	4.95g
2.2%M	97.8%S	
9:00	106 C	4.95g
2.2%M	97.8%S	
10:00	105 C	4.95g
2.2%M	97.8%S	

Acclimation Soil EKP 6/19/01

Peat EKP 6/18/01

N 105 C 60 m

1:00	101 C	3.60g
2.2%M	97.8%S	
2:00	106 C	3.52g
4.3%M	95.7%S	
3:00	102 C	3.47g
5.7%M	94.3%S	
4:00	106 C	3.42g
7.1%M	92.9%S	
5:00	106 C	3.39g
7.9%M	92.1%S	
6:00	105 C	3.36g
8.7%M	91.3%S	
7:00	106 C	3.34g
9.2%M	90.8%S	
8:00	106 C	3.33g
9.5%M	90.5%S	
9:00	106 C	3.32g
9.8%M	90.2%S	
10:00	106 C	3.32g
9.8%M	90.2%S	
11:00	106 C	3.31g
10.1%M	89.9%S	
12:00	106 C	3.31g
10.1%M	89.9%S	
13:00	106 C	3.31g
10.1%M	89.9%S	
14:00	106 C	3.31g
10.1%M	89.9%S	
15:00	106 C	3.31g
10.1%M	89.9%S	

Fine Sand EKP 6/18/01

N 105 C 60 m

1:00	102 C	3.61g
0.3%M	99.7%S	
2:00	107 C	3.61g
0.3%M	99.7%S	
3:00	102 C	3.61g
0.3%M	99.7%S	
4:00	104 C	3.61g
0.3%M	99.7%S	
5:00	106 C	3.61g
0.3%M	99.7%S	
6:00	105 C	3.61g
0.3%M	99.7%S	
7:00	105 C	3.61g
0.3%M	99.7%S	
8:00	105 C	3.61g
0.3%M	99.7%S	
9:00	105 C	3.61g
0.3%M	99.7%S	
10:00	105 C	3.61g
0.3%M	99.7%S	
11:00	105 C	3.61g
0.3%M	99.7%S	
12:00	105 C	3.61g
0.3%M	99.7%S	

Study Number: 13764.6100

ARTIFICIAL SOIL PREPARATION

TOTAL AMOUNT OF SOIL (DRY WEIGHT) NEEDED: 7.0kg

Acclimation Soil

Dry Components	Theoretical [a] Dry Weight (g)	% [b] Moisture	Ambient Dry [c] Weight (g)	Net Weight (g)
Coarse Sand: 35% Wedron Silica Co.	2450	0.3	2457	2457
Fine Sand: 35% Wedron Silica Co.	2450	0.3	2457	2457
Kaolin Clay: 20% Engelhard Corp.	1400	1.0	1414	1414
Peat Moss: 10% Magic Products, Inc.	700	10.1	779	779

a/(1 - b(as decimal)) = c

Approved by:

Balance Used: Mettler PE6 F50070		
Mixer Used Hobart A200 1742668	Start Time: 1102	End Time: 1112
pH meter: LAMOTTE 46116 - 5551	Initial pH: 6.4	Adjusted pH: N/A
pH adjusted with calcium carbonate/phosphoric acid (circle one) amount used: N/A		
Date/Initials: EWP 6/20/01		

COMMENTS:
Moistened with 1900ml DI Water. EWP 6/20/01
2 batches were made and combined EWP 6/20/01

13

13764.6100

acclimation soil

N 105 C 60 m

1:00	56 C	4.18g
0.5%M	99.5%S	
2:00	104 C	4.13g
1.7%M	98.3%S	
3:00	103 C	4.12g
1.9%M	98.1%S	
4:00	104 C	4.12g
1.9%M	98.1%S	
5:00	106 C	4.12g
1.9%M	98.1%S	
6:00	105 C	4.12g
1.9%M	98.1%S	
7:00	105 C	4.12g
1.9%M	98.1%S	
8:00	105 C	4.12g
1.9%M	98.1%S	
9:00	106 C	4.12g
1.9%M	98.1%S	

EAP 6/20/01

13764.6100

Clay

EKP 6/18/01

N 105 C 60 m		
1:00	93 C	3.13g
1.0%M	99.0%S	
2:00	107 C	3.13g
1.0%M	99.0%S	
3:00	103 C	3.13g
1.0%M	99.0%S	
4:00	103 C	3.13g
1.0%M	99.0%S	
5:00	106 C	3.13g
1.0%M	99.0%S	
6:00	105 C	3.13g
1.0%M	99.0%S	
7:00	105 C	3.13g
1.0%M	99.0%S	
8:00	106 C	3.13g
1.0%M	99.0%S	
9:00	106 C	3.13g
1.0%M	99.0%S	

Coarse Sand

EKP 6/18/01

1:00	85 C	3.54g
0.3%M	99.7%S	
2:00	106 C	3.54g
0.3%M	99.7%S	
3:00	102 C	3.54g
0.3%M	99.7%S	
4:00	105 C	3.54g
0.3%M	99.7%S	
5:00	106 C	3.54g
0.3%M	99.7%S	
6:00	105 C	3.54g
0.3%M	99.7%S	
7:00	106 C	3.54g
0.3%M	99.7%S	
8:00	106 C	3.54g
0.3%M	99.7%S	
9:00	105 C	3.54g
0.3%M	99.7%S	
10:00	106 C	3.54g
0.3%M	99.7%S	
11:00	105 C	3.54g
0.3%M	99.7%S	
12:00	105 C	3.54g
0.3%M	99.7%S	
13:00	106 C	3.54g
0.3%M	99.7%S	
14:00	106 C	3.54g
0.3%M	99.7%S	

N 105 C 60 m		
1:00	57 C	5.04g
0.4%M	99.6%S	
2:00	103 C	4.96g
2.0%M	98.0%S	
3:00	104 C	4.95g
2.2%M	97.8%S	
4:00	103 C	4.95g
2.2%M	97.8%S	
5:00	107 C	4.95g
2.2%M	97.8%S	
6:00	105 C	4.95g
2.2%M	97.8%S	
7:00	105 C	4.95g
2.2%M	97.8%S	
8:00	107 C	4.95g
2.2%M	97.8%S	
9:00	106 C	4.95g
2.2%M	97.8%S	
10:00	105 C	4.95g
2.2%M	97.8%S	

Acclimation Soil
EKP 6/19/01

Peat

EKP 6/18/01

N 105 C 60 m		
1:00	101 C	3.60g
2.2%M	97.8%S	
2:00	106 C	3.52g
4.3%M	95.7%S	
3:00	102 C	3.47g
5.7%M	94.3%S	
4:00	106 C	3.42g
7.1%M	92.9%S	
5:00	106 C	3.39g
7.9%M	92.1%S	
6:00	105 C	3.36g
8.7%M	91.3%S	
7:00	106 C	3.34g
9.2%M	90.8%S	
8:00	106 C	3.33g
9.5%M	90.5%S	
9:00	106 C	3.32g
9.8%M	90.2%S	
10:00	106 C	3.32g
9.8%M	90.2%S	
11:00	106 C	3.31g
10.1%M	89.9%S	
12:00	106 C	3.31g
10.1%M	89.9%S	
13:00	106 C	3.31g
10.1%M	89.9%S	
14:00	106 C	3.31g
10.1%M	89.9%S	
15:00	106 C	3.31g
10.1%M	89.9%S	

Fine Sand

EKP 6/18/01

N 105 C 60 m		
1:00	102 C	3.61g
0.3%M	99.7%S	
2:00	107 C	3.61g
0.3%M	99.7%S	
3:00	102 C	3.61g
0.3%M	99.7%S	
4:00	104 C	3.61g
0.3%M	99.7%S	
5:00	106 C	3.61g
0.3%M	99.7%S	
6:00	105 C	3.61g
0.3%M	99.7%S	
7:00	105 C	3.61g
0.3%M	99.7%S	
8:00	105 C	3.61g
0.3%M	99.7%S	
9:00	105 C	3.61g
0.3%M	99.7%S	
10:00	105 C	3.61g
0.3%M	99.7%S	
11:00	105 C	3.61g
0.3%M	99.7%S	
12:00	105 C	3.61g
0.3%M	99.7%S	

STUDY NUMBER: 13764-6100

MONITORING OF TEST SYSTEM

HEALTH ASSESSMENT DAY - 0

	Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Date/Initials
	Control - 1	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
	Control - 2	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#1	721	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#2	734	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#3	733	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#4	732	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#5	722	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#7	737	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#8	728 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#9	735 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#10	726 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#11	736 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#12	727 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#13	741	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#14	708 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#15	001	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#16	719 A	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#17	739	10 H - B	10 H - B	10 H - B	10 H - B	6/29/01 LCB
#						/ /

H = Healthy L = Lethargic D = Dead M = Missing
C = Cocoons LE = Lesions S = Segmental constriction
B = Burrowed

STUDY NUMBER: 13764.6100

PAGE: 16

MONITORING OF TEST SYSTEM

HEALTH ASSESSMENT DAY - 14

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Date/Initials
Control - 1	10 H	10 H	10 H	10 H	DJ 7/13/01
Control - 2	10 H	10 H	10 H	10 H	DJ 7/13/01
721	10 H	10 H	10 H	10 H	7/13/01 LCB
734	10 ~~H~~ ① L	10 L	10 L	10 L	7/13/01 LCB
733	10 H	4 L 6 H	4 L 6 H	5 L 5 H	7/13/01 LCB
732	10 H	10 H	10 H	10 H	7/13/01 LCB
722	10 L	10 L	10 L	10 L	7/13/01 LCB
737	10 L	10 L	10 L	10 L	7/13/01 LCB
728A	8 L / 2 H	6 L / 4 H	4 L / 6 H	3 L / 7 H	7/13/01 LCB
735A	10 L	10 L	10 L	10 L	7/13/01 DJ
726A	10 L	10 L	10 L	9 L, 1 H	7/13/01 DJ
736A	10 L	10 L	10 L	10 L	7/13/01 LCB
727A	10 H	10 H	10 H	10 H	7/13/01 LCB
741	10 L	10 L	10 L	10 L	7/13/01 LCB
708A	10 L	10 L	10 L	10 L	7/13/01 LCB
001	10 L	10 L	10 L	10 L	7/13/01 LCB
719A	10 H	10 H	10 H	10 H	7/13/01 LCB
739	10 H	10 H	10 H	10 H	7/13/01 LCB
			DJ		
			7/13/01 DJ		

① 1 C LCB 7/13/01

H = Healthy L = Lethargic D = Dead M = Missing
C = Cocoons LE = Lesions S = Segmental constriction

Study Number: 13764-6100

TEST DAY - 0

pH and Temperature

Sample ID	Rep	ph	temperature °C
		Date/Initials 6/29/01 DJ	Date/Initials DJ 6/29/01
721	1	3.7	21
734	1	3.4	21
733	1	4.1	21
732	1	3.7	21
722	1	3.5	21
~~724~~		(1)	21
737	1	3.4	21
728A	1	4.0	21
735A	1	3.3	21
726A	1	4.9	21
736A	1	3.5	21
727A	1	3.6	21
741	1	3.4	21
708A	1	3.6	21
001	1	3.6	21
719A	1	4.4	21
739	1	3.5	21
Control 142	1	6.4	21
~~708~~	1	3.4	21
719	1	3.1	21 (2)
704	1	3.0	21

pH meter Used: LaMotte 46116-5551 Thermometer #: 857

(1) Sample not used sample uncollected.

Springborn Laboratories, Inc.

DJ 7/2/01

ph & temperature HW

(2) recorded on wrong sheet 7/2/01

Study Number: 13764.6100

TEST DAY - 14

pH and Temperature

Sample ID	Rep	ph	temperature °C
		Date/Initials 7/13/01 LCB	Date/Initials 7/16/01 PD
Control -1	1	6.5	21
Control - 2	1	6.5	21
721	1	4.3	21
734	1	3.9	21
733	1	4.2	21
732	1	3.9	21
722	1	3.9	21
737	1	3.4	21
728A	1	4.2	21
735A	1	4.1	21
726A	1	4.9	21
736A	1	3.3	21
727A	1	3.6	21
741	1	3.2	21
708A	1	3.2	21
001	1	3.3	21
719A	1	4.0	21
739	1	3.2	21
		NA 7/16/01 PD	

pH meter Used: LaMotte 46116-5551 Thermometer #: ~~859~~ ① 897

① 1e LCB 7/16/01

Study Number: 1364-6100

Set #1 received 6/26/01

PERCENT MOISTURE DETERMINATION Day -1

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
735A	1.2415	6.7512	5.4597	5.7928	18
728A	1.3111	6.1487	4.8376	5.0021	24
734	1.2862	6.3020	5.0158	5.4044	18
722	1.3042	8.0968	6.7924	6.4038	25
732	1.3074	8.2772	6.9698	5.7578	36
721	1.2683	6.9580	5.6897	5.8321	20
733	1.2792	6.6605	5.3813	5.6188	19
737	1.3105	7.7143	6.4038	6.2239	23
726A	(1) ~~1.2907~~ 1.2865	6.8794	5.5889	5.6092	23
Control	(1) ~~1.2905~~ 1.2866	6.3466	5.0618	6.3258	0.41
			NA		
			7/6/01		

(1) ie

Balance Used (wet weight): Fisher B027883 Date/Initials: 6/26/01

Balance Used (dry weight): Fisher B027883 Date/Initials: 6/27/01

Oven #3 Lab-Line Imperial III therm. 726 @ 105°C

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: _____ Date: 6/27/01

Study Number: 13764-6100

20

Set 2 Received 6/26/01 26 7/10/01 DJ

PERCENT MOISTURE DETERMINATION

Day -1

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
727 A	1.2670	8.4872	7.2202	7.5817	13
719 A	1.2822	5.1418	3.8596	3.9534	31
736 A	1.2825	5.0447	3.7642	3.6989	36
708 A	1.2830	6.5614	5.2784	5.1880	24
739	1.2910	6.5445	5.2535	4.4271	31
741	1.2813	7.6809	6.3996	5.4230	35
001	1.2522	7.5453	6.2931	6.1970	21
			NA 7/10/01 DJ		

Balance Used (wet weight): Ashen B02783 Date/Initials: DJ 6/27/01

Balance Used (dry weight): Ashen B02783 Date/Initials: DJ 6/28/01

oven #3 lab Line Imperial II therm. 726 @ 105°C

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: DJ Date: 6/28/01

Study Number: 13764-6102

21

PERCENT MOISTURE DETERMINATION Samples on Day 0

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
735A	2.2600	10.4658	8.2058	7.9326	31
728A	2.2422	8.1782	5.9360	6.3090	31
734	2.2539	12.2313	9.9774	9.5836	27
722	2.2534	8.0345	5.7811	6.2038	32
732	2.2328	7.3679	5.1351	5.3045	40
721	2.2635	12.7492	10.4857	9.5258	31
733	2.2931	8.7583	6.4652	7.6205	18
737	2.2596	7.4643	5.2047	5.0456	46
726A	2.2809	9.1132	6.8323	7.1778	28
727A	2.2712	8.9204	6.6492	7.6960	18
719A	2.2658	10.1630	7.8972	7.1746	38
736A	2.2511	8.1640	5.9129	5.8126	40
708A	2.2468	8.7376	6.4908	6.7716	30
739	2.2553	8.0436	5.7883	6.4396	28
741	2.5770	10.3646	7.7876	7.5330	36
001	2.2793	8.3420	6.0627	6.3226	33
Controls	~~2.2922~~ 2.2583	10.5321	8.2738	8.5550	24

in 4/28/01 DJ

Balance Used (wet weight): Fisher 6027883 Date/Initials: 6/28/01 DJ

Balance Used (dry weight): Fisher 5127883 Date/Initials: 6/29/01 DJ

Oven #3 lab line Imperial II Therm-726 @ 105°C

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: DJ Date: 6/30/01

Study Number: 13764-6000

PERCENT MOISTURE DETERMINATION Day 14

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
Control 1	2.2347	7.5762	5.3415	6.3473	23
Control 2	2.2480	7.8461	5.5981	6.5785	23
721	2.2650	6.9986	4.7336	5.6073	29
734	2.2829	7.1209	4.8380	5.8953	25
733	2.2665	6.2794	4.0129	5.1738	28
732	2.2437	6.8702	4.6265	5.0117	46
722	2.2356	7.6248	5.3892	5.9176	32
737	2.2556	(1) ~~7~~ 6.3310	4.0754	5.2957	25
728A	2.2783	7.6511	5.3728	5.7964	35
735A	2.2818	7.5636	5.2818	5.8640	32
726A	2.2637	5.5552	3.2915	4.5283	31
736A	2.2620	6.0027	3.7407	4.5148	40
727A	2.2649	7.4629	5.1980	6.2538	23
741	2.2641	6.4784	4.2143	5.1658	31
708A	2.2815	6.7223	4.4408	5.3616	31
001	2.2480	7.6314	5.3836	5.8441	33

Balance Used (wet weight): Fisher B027883 Date/Initials: 7/13/01 LCB

Balance Used (dry weight): Fisher B027883 Date/Initials: 7/14/01 95

OVEN #3 LAB-LINE IMPERIAL II Therm. # ~~726~~ (2) 744 @ 105°C

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: [illegible] Date: 7/16/01

SPRINGBORN LABORATORIES, INC. Percent moisture

(1) ie LCB 7/13/01

(2) replace thermometer #726 - mercury separated 7/13/01 LCB

Study Number: 13764-6100

PERCENT MOISTURE DETERMINATION Day 14

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
719A	2.2732	6.4100	4.1368	4.9249	36
739	2.2824	6.4790	4.1966	5.3919	24

Balance Used (wet weight): Fisher B027883 Date/Initials: 7/13/01 LCB

Balance Used (dry weight): Fisher B027883 Date/Initials: 7/14/01 95

Oven used: LAB-LINE IMPERIAL II therm # ~~726~~ ① 744

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: [signature] Date: 7/16/01

① replace thermometer # 726 - mercury separated 7/13/01 LCB

Study Number: 13764-6100

Light Intensity (footcandles/lux)

		Footcandles	Lux	Footcandles	Lux	
Day 0	Front	80	860	110	1200	Meter Used: Traceable
	Back	70	750	100	1200	Date/ID: EXP 6/28/01
Day 7	Front					Meter Used:
	Back					Date/ID:
Day 14	Front	70	750	70	750	Meter Used: Traceable
	Back	70	750	70	750	Date/ID: 7/12/01 [illegible]
Day 28	Front					Meter Used:
	Back					Date/ID:
Day 42	Front					Meter Used:
	Back					Date/ID:
Day 56	Front					Meter Used:
	Back					Date/ID:

Set 1

	Foot Candles	LUX	
Day 0 - 7/2/01	70	750	Traceable 7/2/01 [illegible]
Front & Back	70	750	
Day 14 - 7/16/01	70	750	Traceable 7/16/01 [illegible]
Front & Back	80	860	

Set 2

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE 1 OF 1

PROJECT NO: CECIL FIELD	SITE NAME: SITE 15	PROJECT MANAGER AND PHONE NUMBER: MIKE WHITTEN 803-649-7963	LABORATORY NAME AND CONTACT: Springborn Labs - Arthur Pitt
SAMPLERS (SIGNATURE): M L Whitten		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS: 790 Main Street
		CARRIER/WAYBILL NUMBER: FedEx	CITY, STATE: Wareham, MA 02571-1075

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): P
PRESERVATIVE USED: ice

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: 14 day earthworm toxicity test								COMMENTS
6/26	1020	CEF-015-SS-708	SOIL	C	1	✓								Cool to 4°C
6/26	0756	CEF-015-SS-719	SOIL	C	1	✓								"
6/26	1605	CEF-015-SS-704	SOIL	C	1	✓								"
6/27	0845	CEF-015-SS-717	SOIL	C	1	✓								"
~~6/~~		~~CEF-015-SS~~	~~SOIL~~											~~MLW~~
														received at 4°C

1. RELINQUISHED BY: M.L. Whitten	DATE: 6/28/01	TIME: 1130	1. RECEIVED BY: Delivered to FedEx	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY: Arthur R. Shearer	DATE: 6/29/01	TIME: 1230

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

137G4.6100

8

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE ___ OF ___

PROJECT NO: CECIL FIELD	SITE NAME: SITE 15	PROJECT MANAGER AND PHONE NUMBER: MIKE WHITTEN 803-649-7963	LABORATORY NAME AND CONTACT: Springborn Labs - Arthur Pott
SAMPLERS (SIGNATURE): M L Whitten		FIELD OPERATIONS LEADER AND PHONE NUMBER	ADDRESS: 790 Main Street
		CARRIER/WAYBILL NUMBER: Fed Ex	CITY, STATE: Wareham, MA 02571-1075

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G): P
PRESERVATIVE USED: ice

DATE YEAR 2001	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS: 14-day earthworm toxicity test								COMMENTS
6/27	1450	CEF-015-SS-703	SOIL	C	1	✓								Cool to 4°C
6/27	1710	CEF-015-SS-724B	SOIL	C	1	✓								
6/26	1354	CEF-015-SS-709	SOIL	C	1	✓								
6/24	1013	CEF-015-SS-740	SOIL	C	1	✓								
6/25	1215	CEF-015-SS-707	SOIL	C	1	✓								
6/25	0920	CEF-015-SS-707A	SOIL	C	1	✓								
6/27	1200	CEF-015-SS-706	SOIL	C	1	✓								
														received at 4°C

1. RELINQUISHED BY: M.L. Whitten	DATE: 6/28/01	TIME: 1130	1. RECEIVED BY: Delivered to Fed Ex	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY: Arthur R. Thomas	DATE: 6/29/01	TIME: 1230

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

3/99
FORM NO. TtNUS-001

13764.6/00

26

STUDY NUMBER: 13764.6100 PAGE: 27

MONITORING OF TEST SYSTEM

HEALTH ASSESSMENT DAY - 0

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Date/Initials
Neg Control-3	10 H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
708	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
719	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
704	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
717	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
703	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
724B	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
709	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
740	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
707	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
707A	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
706	10H-B	10H-B	10 H-B	10 H-B	7/2/01 DJ
			N/A 7/2/01 DJ		

H = Healthy L = Lethargic D = Dead M = Missing
C = Cocoons LE = Lesions S = Segmental constriction
B = Burrowed

STUDY NUMBER: 13764.6100

MONITORING OF TEST SYSTEM

HEALTH ASSESSMENT DAY - 14

Sample ID	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Date/Initials
Neg Control-3	10H	10H	10H	10H	7/16/01 LCB
708	10 H	10 H	10 H	10 H	7/16/01 LCB
719	10 H	10 H	10 H	10 H	7/16/01 LCB
704	10 L	10 L	10 L	10 L	7/16/01 LCB
717	10L	10L	10L	10L	7/16/01 LCB
703 ①	10D	10D	10D	10D	7/16/01 LCB
734B	10 L	10 L	10 L	10 L	7/16/01 LCB
709	10 L	10 L	10 L	10 L	7/16/01 LCB
740	10 L	10 L	10 L	10 L	7/16/01 LCB
707	10 L	10 L	10 L	10 L	7/16/01 LCB
707A	10 L	10 L	10 L	10 L	7/16/01 LCB
706	10D	10D	10D	10D	7/16/01 LCB
		NA	7/16/01		

H = Healthy L = Lethargic D = Dead M = Missing
C = Cocoons LE = Lesions S = Segmental constriction

SPRINGBORN LABORATORIES, INC.

OBSERVATIONS

① sample moldy on surface LCB 7/16/01

Study Number: 13764.6100

TEST DAY - 0

pH and Temperature

Sample ID	Rep	ph	temperature °C
		Date/Initials 7/2/01	Date/Initials 7/2/01
Neg Control-3	1	6.8	21
708	1	3.4	21
719	1	3.1	21
704	1	3.0	21
717	1	3.0	21
703	1	3.0	21
724.5	1	3.0	21
709	1	3.0	21
740	1	3.0	21
707	1	3.0	21
707A	1	3.0	21
706	1	3.5	21
		NA 7/2/01 PJ	

pH meter Used: Lemotte 46116-5551

Thermometer #:

Study Number: 13764.6100

TEST DAY - 14

pH and Temperature

Sample ID	Rep	ph	temperature °C
		Date/Initials 7/16/01 LCB	Date/Initials 7/16/01 LCB
Neg Control-3	1	6.4	21
708	1	3.9	21
719	1	3.7	21
704	1	3.6	21
717	1	3.7	21
703	1	3.5	21
724B	1	3.6	21
709	1	3.2	21
740	1	3.0	21
707	1	2.7	21
707A	1	2.9	21
706	1	4.0	21
		NA 7/16/01	

pH meter Used: LaMotte 46116-5551

Thermometer #: ~~857~~ 897

Springborn Laboratories, Inc.

ph & temperature HW

Date 7/16/01 LCB

Study Number: 13764.6100

PERCENT MOISTURE DETERMINATION

Day -1

Set #3 Received 6/29/01 DJ

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
708	2.2608	9.7823	7.5215	6.3178	46
719	2.2588	7.0584	4.7996	6.1793	① 27/8
704	2.2745	8.0299	5.7554	6.8475	21
717	2.2635	7.1451	6.2920	6.2920	18
703	2.2587	8.4877	6.9883	6.9833	24
724B	2.2567	7.8862	6.9387	6.9387	17
709	2.2580	8.9196	7.6765	7.6765	18
740	2.2417	8.8415	7.2626	7.2624	24
707	2.2473	7.3415	5.6171	5.6171	34
707A	2.2647	7.5097	5.6494	5.6494	36
706	2.2530	10.8930	9.3391	9.3391	18
			NA		
			7/2/01 DJ		

@ 6/29/01 DJ

Balance Used (wet weight): Fisher B027853 Date/Initials: 6/29/01 DJ

Balance Used (dry weight): Fisher B027853 Date/Initials: DJ 6/30/01 DJ

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: DJ Date: 6/30/01

Study Number: 13764.6100

PERCENT MOISTURE DETERMINATION Day-0

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
708	2.2566	9.0389	6.7823	6.0661	44
719	2.2718	9.5842	7.3174	7.7427	25
704	2.2715	10.5241	8.2526	8.4823	25
717	2.2548	10.3829	8.1281	8.6616	21
703	2.2722	9.7474	7.4752	8.0482	23
724B	2.2727	13.7260	11.4533	11.0857	23
709	2.2514	11.9922	9.7408	9.4957	26
740	2.2728	9.6368	7.3640	7.9674	23
707	2.2537	9.9682	7.7145	7.2931	35
707A	2.2733	9.1578	6.8845	6.7029	36
706	2.2566	13.3163	11.0577	10.9883	21
Control 3	2.2605	13.6972	11.4367	10.9926	24
			NA 7/3/01		

Oven #3 Lab Line Imperial II Therm. 726 @ 105°C

Balance Used (wet weight): [illegible] Date/Initials: 7/2/01

Balance Used (dry weight): [illegible] Date/Initials: 7/3/01

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: [illegible] Date: 7/3/01

PERCENT MOISTURE DETERMINATION Day 14

Sample	Tare Weight (g)[a]	Gross Wet Weight (g)[b]	Net Wet Weight (g)	Gross Dry Weight (g)[c]	% Moisture
Neg Control - 3	2.2518	6.1361	3.8843	5.1584	25
708	2.2741	5.6092	3.3351	4.1481	44
719	2.2474	5.0662	2.8188	4.3691	25
704	2.2678	5.0969	2.8291	4.3738	26
717	2.2712	5.9520	3.6808	5.1987	20
703	2.2612	6.3090	4.0478	5.3125	25
724B	2.2702	6.5726	4.3024	5.5987	23
709	2.2480	6.3968	4.1488	5.3984	24
740	2.2622	6.4999	4.2377	5.5238	23
707	2.2656	5.7368	3.4712	4.6381	32
707A	2.2737	5.0701	2.7964	4.0534	36
706	2.2686	5.7789	3.5103	5.1017	19
			MA		
			DJ		
			7/16/01		

Balance Used (wet weight): Fisher Scientific B027883 Date/Initials: 7/16/01 LCB

Balance Used (dry weight): Fisher Scientific B027883 Date/Initials: 7/17/01 LCB

Oven II 3 has Fine Imperial II therm. II 744 @ 105°

percent moisture = ((b - c) / (b - a)) x 100

Percent Moisture calculated by: DJ Date: 7/17/01 DJ

13764-6100
Tetra Tech

Sample	Gross Wet Wt (g)	Tare Wt (g)	Net Wt. (g)	Final Wt (g)	Moisture Fraction	Wet Soil = 200 g dry	WHC Initial Wt (g)	Final Wt (g)	WHC mL/100g	75% WCH	Volume water in 200 g Soil (mL)	Additional water/200 grams (mL)
Control	6.3466	1.2848	5.0618	6.3258	0.004	200.83	131	183	52	78	1	77
735A	6.7512	1.2915	5.4597	5.7928	0.176	242.58	134	187	53	66	35	30
728A	6.1487	1.3111	4.8376	5.0021	0.237	262.13	134	183	49	56	47	9
734	6.302	1.2862	5.0158	5.4044	0.179	243.59	132	168	36	44	36	9
722	8.0968	1.3042	6.7926	6.4038	0.249	266.40	135	176	41	46	50	-4
732	8.2772	1.3074	6.9698	5.7578	0.361	313.22	133	171	38	36	72	-36
721	6.958	1.2683	5.6897	5.8321	0.198	249.34	134	188	54	65	40	25
733	6.6605	1.2792	5.3813	5.6188	0.194	248.01	134	181	47	57	39	18
737	7.7143	1.3105	6.4038	6.2239	0.233	260.67	136	182	46	53	47	6
726A	6.8794	1.2905	5.5889	5.6092	0.227	258.82	133	186	53	61	45	16
727A	8.4872	1.267	7.2202	7.5817	0.125	228.68	133	169	36	47	25	22
719A	5.1418	1.2822	3.8596	3.9534	0.308	288.98	134	206	72	75	62	13
736A	5.0467	1.2825	3.7642	3.6989	0.358	311.55	133	205	72	69	72	-2
708A	6.5614	1.283	5.2784	5.1880	0.260	270.34	133	196	63	70	52	18
739	6.5445	1.291	5.2535	4.9271	0.308	288.96	135	183	48	50	62	-12
741	7.6809	1.2813	6.3996	5.4230	0.353	309.03	132	180	48	47	71	-24
"001"	7.5453	1.2522	6.2931	6.1970	0.214	254.53	135	182	47	55	43	13

10/29/01 34

13764-6100
Tetra Tech

Sample	Gross Wet Wt (g)	Tare Wt (g)	Net Wt. (g)	Final Wt (g)	Moisture Fraction	Wet Soil = 200 g dry	WHC Initial Wt (g)	Final Wt (g)	WHC mL/100g	75% WCH	Volume water in 200 g Soil (mL)	Additional water/200 grams (mL)
708	9.7823	2.2608	7.5215	6.3178	0.461	370.79	133	164	31	25	92	-67
719	7.0584	2.2588	4.7996	6.1793	0.183	244.85	136	184	48	59	37	22
704	8.0299	2.2745	5.7554	6.8475	0.205	251.71	136	183	47	56	41	15
717	7.1451	2.2635	4.8816	6.2920	0.175	242.35	136	173	37	46	35	11
703	8.4877	2.2587	6.2290	6.9833	0.242	263.68	132	174	42	48	48	-1
724B	7.8862	2.2567	5.6295	6.9387	0.168	240.47	133	174	41	51	34	17
709	8.9196	2.258	6.6616	7.6765	0.187	245.88	135	183	48	59	37	21
740	8.8415	2.2417	6.5998	7.2626	0.239	262.89	133	168	35	40	48	-8
707	7.3415	2.2473	5.0942	5.6171	0.339	302.34	134	190	56	56	68	-12
707A	7.5097	2.2647	5.2450	5.6494	0.355	309.92	134	194	60	58	71	-13
706	10.8930	2.2530	8.6400	9.3091	0.183	244.89	137	166	29	36	37	-1

7/4/01

137164-6100

36

Springborn Laboratories,Inc.

Weights for determining percent moisture and water holding capacity

Wet wt. Balance Used Mettler PE6 F50070 Init + Date EKP 6/26/01

Dry wt. Balance Used Mettler PE6 F50070 Init + Date EKP 6/26/01

Sample ID	Initial Wet weight (g) Gross	Tare	(Final) Dry weight (g) Gross	Tare
735A	1234	0	187	0
728A	1234	0	183	0
734	1232	0	168	0
722	1235	0	176	0
732	1233	0	171	0
721	1234	0 ~~234~~	188	0
733	1234	0	181	0
737	1236	0	182	0
724	1232	0		NA 6/29/01
726A	1233	0	186	0
Control	1231	0	183	0
741	132	0	180	0
736A	133	0	205	0
727A	133	0	169	0
739	135	0	183	0
001	135	0	182	0
719A	134	0	206	0
708A	133	0	196	0
708	133	0	164	0
704	136	0	184	0
719	136	0	183	0
717	136	0	173	0
703	132	0	174	0
729B	133	0	174	0
729	135	0	183	0
710	133	0	168	0
[illegible]	134	0	190	0
[illegible]A	134	0	194	0
[illegible]	137	0	166	0

EKP 6/26/01

37

13764.6100

Springborn Laboratories,Inc.

Weights for determining percent moisture and water holding capacity

Wet wt. Balance Used_____ Init + Date_____

Dry wt. Balance Used_____ Init + Date_____

Sample ID	Wet weight (g) Gross	Wet weight (g) Tare	Dry weight (g) Gross	Dry weight (g) Tare

edit 1/20/93

SPRINGBORN LABORATORIES, INC.

38

13764-6100

Month (year)	JUNE
Location	S11
Therm #	~~857~~ ① 858

DAY	MIN	MAX	INITIALS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29	20	22	ERP
30	21	22	ERP
31			

7/5/01

7/5/01

① 12 LCB 7/13/01

Month (year)	JULY
Location	S11
Therm #	~~857~~ ① 858

DAY	MIN	MAX	INITIALS
1	21	22	ERP
2	20	22	ERP
3	20	21	ERP
4	20	21	[illegible]
5	19	21	ERP
6	20	21	ERP
7	20	21	[illegible]
8	20	21	ERP
9	21	21	ERP
10	21	22	ERP
11	21	22	ERP
12	21	22	ERP
13	20	21	LCB
14	20	21	[illegible]
15	20	21	LCB
16	20	21	LCB
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

13764.6100

SPRINGBORN LABORATORIES, INC. Page No: 36

RECORD OF TEST ORGANISM RECEIPT

Date of Receipt: 3/21/01 (1)

Designated SLI Lot Number: ~~032101~~ 01A36

Species Name: red wiggler worms

Organisms Collected or Purchased: Collected Purchased (Circle One)

Description of Collection Location (or): N/A

Source of Purchase (Supplier Name, Address, Invoice No.): Merchants Bay, Mt. Laurel, NJ

Approximate Number of Organisms Collected or Received: ~2000

Life Stage of Organisms: adults

Estimated Age of Organisms (i.e. Hatch Date): N/A

Holding Vessel Identification Number: N/A

Water Quality of Original Water Source: Temp N/A °C Salinity N/A (ppt) Other N/A

Water Quality Upon Receipt: Temp N/A °C Salinity N/A (ppt) Other N/A

General Condition of Organisms: Good

Shipping Information (if available, e.g.,Carrier/Courier, Airbill No.): Invoice # 122

Data By: LCB Date: 4/17/01

RECORD OF TEST ORGANISM IDENTIFICATION

Species Name: red wiggler worms

Taxonomic Reference(s) Used: 12 (See Reverse For Bibliographic Info.)

Organisms Identified By: DJ

Date of Verification: 4/17/01

Comments/Notes:

Cir 5/9/01 DJ

ORG-REC1 rev. 1/3/00

Page 39 to 43 Copy of originals, originals located in culture log 2001. DJ

EARTHWORM CULTURE # 01A36 (SIGN AND DATE EACH ENTRY)

3/21/01 DJ

~2000 Earthworms added to culture bedding of 2 Blocks Bed-a-Beast w/ 3.79L Hot water - after 20 minutes pH 6.3 Lamotte 46116-5551 - 1kg lot 56991 Cattle manure & 1kg peat lot 011600 mixed together in Hobart 1742668 w/ 3L water DI Balance Mettler F50070 -

Added to Bricks and mixed by hand

pH - 6.5 lamotte 46116-5551

percent moisture = 71%

tare 1.2451g gross wet 5.5012g Net Wet 4.2561g

Gross dry - 2.4651g

$$\frac{(5.5012g - 2.4651g)}{(5.5012g - 1.2451g)} \times 100 = 71\%$$

balance = Fisher B027883 Oven - lab line Imperial II @ 105°C

thermometer #726

4/4/01 DJ

500g manure lot #56991 added to culture

4/25/01 DJ

500g manure lot 56991 added to culture

pH 6.5 lamotte 46116-5551 moisture = 72%

tare - 1.3482g G-Dry - 2.5947g

Gross wet - 5.8142g

Net wet - 4.4660g

$$\frac{(\overset{5.8142}{\cancel{5.8012g}} - 2.5947g)}{(5.8142g - 1.3482g)} \times 100 = 72\%$$

(in 4/25/01 DJ)

Balance - Fisher B027883

Oven lab line Imperial II @ 105°C thermometer #726

EARTHWORM CULTURE # 01A36 (SIGN AND DATE EACH ENTRY)

5/9/01 DJ

Culture Fed 500g Manure lot # 56991

5/23/01 DJ

Culture Fed 500g Manure lot # 56991

pH 6.5 Moisture = 66.1

Tare - 1.2961g Gross Wet - 5.7623 Net Wet 4.466z

Gross Dry - 2.8162

$$\frac{(5.7623 - 2.8162)}{5.7623 - 1.2961} \times 100 = 66$$

Oven - lab line Impuned II @ 105°C thermometer # 726

Balance - Fisher 5027833

13764.6100

EARTHWORM CULTURE # 01A36 (SIGN AND DATE EACH ENTRY)

SLI # 01A36

6/4/01 culture fed ≈ 100g moist manure

exp 6/4/01 pH = 6.0 LaMotte 46116-5551

6/17/01 EXP culture fed ≈ 250g moist manure lot 4-20-01

6/29/01 culture fed ≈ 250g moist manure Lot 42001 EXP

7/12/01 culture fed ≈ 250 g each moist manure Lot 42001 EXP

6/28/01 ~ 1000 adult worm removed for 13764-6100 placed in artificial soil.

6/28/01 ~ 1000 adult worm removed for 13764-6100 place in artificial soil

13764.6100

gborn Laboratories, Inc.

43

Temperature Monitoring

h (year) June 2001

Location: Weight Room

n # 869

Therm # 869

/	Min.	Max.	Initials
1	19	19	EKP
2	19	19	[illegible]
3	19	19	[illegible]
4	19	20	EKP
5	19	20	EKP
6	20	21	EKP
7	20	20	EKP
8	20	20	EKP
9	20	20	[illegible]
0	19	19	[illegible]
11	19	20	EKP
12	20	20	EKP
13	20	20	EKP
14	20	20	EKP
15	20	20	EKP
16	20	20	[illegible]
17	20	21	EKP
18	20	21	EKP
19	21	21	EKP
20	21	21	EKP
21	21	21	EKP
22	21	21	EKP
23	20	20	EKP
24	20	20	[illegible]
25	20	21	EKP
26	20	21	EKP
27	20	21	EKP
28	21	22	EKP
29	20	21	EKP
30	20	21	[illegible]
31			

July

Day	Min.	Max.	Initials
1	18	22	EKP
2	21	21	EKP
3	20	21	EKP
4	20	21	[illegible]
5	20	21	EKP
6	21	21	EKP
7	20	20	[illegible]
8	20	21	EKP
9	20	20	EKP
10	20	21	EKP
11	20	21	EKP
12	20	21	[illegible]
13	20	21	[illegible]
14	20	20	[illegible]
15	20	20	[illegible]
16	20	20	[illegible]
17	20	20	[illegible]
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Springborn Laboratories, Inc.

790 Main Street
Wareham, Massachusetts 02571-1075
Telephone: (508) 295-2550
Facsimile: (508) 295-8107

Springborn Laboratories, Inc.

640 North Elizabeth Street
Spencerville, Ohio 45887-0143
Telephone: (419) 647-4196
Facsimile: (419) 647-6560

Springborn Laboratories, Inc.

2900 Quakenbush Road
P.O. Box 620
Snow Camp, North Carolina 27349
Telephone: (336) 376-0141
Facsimile: (336) 376-0145

Springborn Laboratories (Europe) AG

Seestrasse 21
Horn, CH-9326, Switzerland
Telephone: (41) 71 844-6970
Facsimile: (41) 71 841-8630

APPENDIX D

INVERTEBRATE REPORT

SOIL INVERTEBRATE ASSAY
CECIL FIELD, JACKSONVILLE, FLORIDA

Wade Davidson
University of Florida
Department of Entomology and Nematology

Introduction

Soil invertebrates were sampled from 27 sites. Sites were categorized as either polycyclic aromatic hydrocarbon (PAH) contaminated, lead contaminated, or as a reference (non contaminated). All sites were forested with "high pine" vegetation typical of north Florida. At each site a 10' x 15' plot was established for sampling. Extracted specimens were identified and either preserved in 70% alcohol (PAH sites), or sent away for lead content analyses (Lead and reference sites). The scope of this report is to detail the methods used for soil invertebrate extraction and identification, and to present the data.

Soil Invertebrate Extraction

Soil invertebrates dwelling at the interface between mineral soil and leaf litter were focused on. The logic presented to the author for this bias was that these invertebrates were more likely to be resident to (therefore representative of) the site and not transient. Also, the mineral soil of north Florida has a very high sand content and does not support enough invertebrate activity to be of any use for this assay. Therefore, the surface leaf litter was removed from the plot. The "duff" layer was meticulously sorted by a team of investigators for soil invertebrates large enough to be a food item for birds or rodents (>5mm). Sorting was done with tweezers and gloved hands. Extracted specimens were placed in sample bags and stored in coolers in the field. At the end of each day, samples were placed in jars and either frozen (lead and reference sites) or covered in 70% alcohol (PAH sites).

Soil Invertebrate Identification

Invertebrates were identified to the most detailed taxon possible given the time and facilities the author had to work with. Insects, snails, and earthworms were identified to family. Identification of insects beyond the family level is difficult and requires the attention of specialists for each family. Identification of larva also requires attention from a larva specialist. Non-insect arthropods were identified to order. Identification of non-insect arthropods beyond the order taxon often requires dissection of mouthparts and/or specialists who work exclusively with a specific order or family of arthropod (i.e. spiders).

Functional Roles

The level of identification performed for this assay is detailed enough to categorize the specimens into functional roles. Following is a list of encountered organisms organized by their role in the food web.

Generalist Predators
All arachnids, all centipedes, Hemiptera: Reduviidae, Anthocoridae; Coleoptera: Carabidae, Cicindelidae; Mantodae: Mantidae.

Specialist Predators
Coleoptera: Cleridae (preys on other beetles), some Staphlyinds (prey varies with species).

Omnivores
Coleoptera: Staphylinidae, Melandryidae; Hymenoptera: Formicidae.

Herbivores
Coleoptera: Scarabidae; Orthoptera: Tettigonidae; Hemiptera: Miridae, Lygaeidae; Homoptera: Cicadidae; Gastropoda.

Detritivores
Coleoptera: Helodidae, Staphylindae, Silphidae, Elateridae; Diptera: Tabanidae (only as larva); Orthoptera: Gryllidae; Blatteria: Blatellidae; Annelida; Isopoda; Diplopoda.

ss 721

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			5		Scarab beetles
			Staphylindae			1		Rove beetles
			Silphidae			1		Carrion beetles
			Elateridae			3	larva	Click beetles
			unkown			2	larva	
		Lepidoptera	unkown			1	larva	
		Blattaria	Blatellidae			11		roaches
	Chilopoda	Scolopendromorpha				7		centipedes
	Arachnida	Araneida				12		spiders
		Opiolones				1		daddy longlegs
Annelida	Oligochaeta		Lumbricidae			1		earthworms

ss722

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae				2	Scarab beetles
			Elateridae				2 larva	Click beetles
		Orthoptera	Gryllidae				2	Field Crickets
		Hymenoptera	Formicidae				2	Ants
	Arachnida	Araneida					4 1 eggsack	Spiders
	Chilopoda	Scolopendromorpha					9	Centipedes
		Lithobiomorpha					1	Centipedes

ss724

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			2		Scarab beetles
			Elateridae			3	larva	Click beetles
			unknown			3		
		Hymenoptera	Formicidae			2		Ants
		Blattaria	Blatellidae			1		Roaches
	Arachnida	Araneida				2		Spiders
	Chilopoda	Scolopendromorpha				5		Centipedes
		Lithobiomorpha				2		Centipedes

ss726a

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetles
			Carabidae			1		Ground beetles
			Elateridae			1		click beetles
			Elateridae			1	larva	click beetles
			unknown			1		
			unknown			1		
			unknown			1		
		Diptera	Tabanidae			1	larva	Horse fly
		Lepidoptera	unknown			1	pupa	
			unknown			1	larva	
			unknown			1	larva	
		Hymenoptera	Formicidae			8		Ants
		Blattaria	Blatellidae			7		Roaches
	Arachnida	Araneida				8		Spiders
	Chilopoda	Scolopendromorpha				11		Centipedes
		Lithobiomorpha				1		Centipedes

ss727a

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			2		Scarab beetles
			Silphidae			1		Carrion beetles
			Elateridae			1	larva	Click beetles
		Hymenoptera	Formicidae			6		Ants
		Orthoptera	Gryllidae			1		Field Cricket
			Tettigonidae			1		Bush Katydid
	Arachnida	Araneida				2		Spiders
	Chilopoda	Scolopendromorpha				4		Centipedes
		Lithobiomorpha				4		Centipedes
Annelida	Oligochaeta		Lumbricidae			1		Earthworms

ss728a

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			5		Scarab beetles
			Carabidae			2		Ground beetles
			Staphylinidae			2		Rove beetles
			unknown			1	larva	
		Hemiptera	Anthocoridae			2		Pirate bug
		Blattaria	Blatellidae			6		Roaches
	Arachnida	Araneida				2		Spiders
		Opiolones				3		Daddy longlegs
	Chilopoda	Scolopendromorpha				26		Centipedes
		Lithobiomorpha				2		Centipedes
Annelida	Oligochaeta		Lumbricidae			3		Earthworms

ss732

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	unknown				1 larva	
		Hemiptera	Reduviidae				1	Assassin bug
		Hymenoptera	Formicidae				1	Ants
		Orthoptera	Gryllidae				1	Field Cricket
		Blattaria	Blatellidae				5	Roaches
	Crustacea	Isopoda					2	pill bugs
	Chilopoda	Scolopendromorpha					5	Centipedes
	Arachnida	Araneida					2	Spiders
Annelida	Oligochaeta		Lumbricidae				1	Earthworms

ss733

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Carabidae			3		Ground beetles
			Scarabaeidae			1		Scarab beetles
			Elateridae			2	larva	Click beetles
		Blattaria	Blatellidae			6		Roaches
		Diptera	unknown			1	larva	
		Lepidoptera	unknown			2	larva	
	Chilopoda	Scolopendromorpha				10		Centipedes
		Lithobiomorpha				5		Centipedes
	Diplopoda	unknown				2		Millipedes
	Arachnida	Araneida				4		Spiders
		Scorpiones				1		Scorpion

ss734

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetles
			Carabidae	Brachinus		1		Bombardier beetle
			Carabidae			3		Ground beetles
			Carabidae			1	larva	
			Elateridae			2	larva	
		Hemiptera	Anthocoridae			6		Pirate bugs
		Diptera	unknown			1	larva	
		Lepidoptera	unknown			1	larva	
		Hymenoptera	Formicidae			1		Ant
		Blattaria	Blatellidae			12		Roaches
	Arachnida	Araneida				5		Spiders
		Opiolones				3		Daddy longlegs
	Chilopoda	Scolopendromor				19		Centipedes
		Lithobiomorpha				11		Centipedes

ss735a

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			4		Scarab beetle
			Carabidae	Brachinus		1		Bombardier beetle
			Carabidae			1		Ground beetle
			Staphlynidae			1		Rove beetles
			Elateridae			2	larva	Click beetles
		Hemiptera	Anthocoridae			9		Pirate bugs
		Blattaria	Blatellidae			11		Roaches
	Arachnida	Araneida				6	1w/eggsack	Spiders
		Opiolones				3		Daddy longlegs
	Chilopoda	Scolopendromorpha				12		Centipedes
		Lithobiomorpha				3		Centipedes
Mollusca	Gastropoda		Vitrinidae			1		Vitrinid snail

ss736a

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Cleridae			1		Checkered beetle
			Cicindelidae			1		Tiger beetle
			Scarabaeidae			1		Scarab beetle
			Elateridae			1	larva	Click beetle
			unknown			2	larva	
		Orthoptera	Gryllidae			1		Field Cricket
		Blattaria	Blatellidae			9		Roaches
		Hymenoptera	Formicidae			1		Ant
		Lepidoptera	unknown			1	larva	Caterpillar
	Arachnida	Araneida				3		Spiders
	Chilopoda	Scolopendromorpha				22		Centipedes
		Lithobiomorpha				1		Centipedes

ss737

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Carabidae			2		Ground beetle
			Elateridae			10	larva	Click beetle
		Hemiptera	Anthocoridae			1		Pirate bugs
		Orthoptera	Gryllidae			1		Field cricket
		Hymenoptera	Formicidae			2		Ant
		Blattaria	Blatellidae			3		Roach
		Lepidoptera	unknown			1	pupa	cacoon
	Arachnida	Araneida				3		Spider
		Opiolones				4		Daddy longlegs
	Chilopoda	Scolopendromorpha				21		Centipedes
		Lithobiomorpha				7		Centipedes

CEF 015 SS-701

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			4		Scarab beetle
			Elateridae			4	larva	Click beetle
		Blattaria	Blatellidae			2		Roach
	Arachnida	Opiolones				1		Daddy longlegs
	Chilopoda	Scolopendromorpha				33		Centipede
		Lithobiomorpha				4		Centipede

CEF 015 SS-703

Phylum	Class	Order	Family	Genus	Species	Quantity	Common Name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			2	Scarab beetle
			unknown			1	unknown beetle grub
			unknown			1	unknown beetle grub
		Hemiptera	Anthocoridae			1	Pirate bug
			Lygaeidae			1	Seed bug
		Hymenoptera	Formicidae			1	Ant
	Arachnida	Araneida				4	Spider
	Chilopoda	Scolopendromorpha				12	Centipede
		Lithobiomorpha				10	Centipede

CEF 015 SS-704

Phylum	Class	Order	Family	Genus	Species	Quantity		Common Name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetle
			Elateridae			1	larva	Click beetle
		Hymenoptera	Formicidae			14		Ant
		Lepidoptera	unknown			1	larva	unknown caterpillar
		Blattaria	Blatellidae			2		Roach
	Arachnida	Araneida				3		Spider
	Chilopoda	Scolopendromorpha				10		Centipedes
		Lithobiomorpha				3		Centipedes

CEF 015 SS-706

Phylum	Class	Order	Family	Genus	Species	Quantity		Common Name
Arthropoda	Insecta	Coleoptera	Carabidae			1		Ground beetle
		Hymenoptera	Formicidae			1		Ant
		Orthoptera	Gryllidae			1		Field Cricket
		Blattaria	Blatellidae			2	ootheca	eggsack
	Arachnid	Araneida				4		Spider
		Araneida				1	eggsack	Spider
		Scorpiones				1		Scorpion
	Chilopod	Scolopendromorpha				2		Centipede
		Lithobiomorpha				5		Centipede

CEF 015 SS-707

Phylum	Class	Order	Family	Genus	Species	Quantity		Common Name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetle
			Silphidae			1		Carrion beetle
			Elateridae			3		Click beetle
			Elateridae			3	larva	Click beetle
			Carabidae	Brachinus		3		Ground beetle
			unknown			4	larva	unknown beetle grub
		Orthoptera	Gryllidae			2		Field cricket
		Blattaria	Blatellidae			5	1 ootheca	Roach
		Lepidoptera	unknown			1	larva	unknown caterpillar
		Hemiptera	Anthocoridae			4		Pirate bug
		Hymenoptera	Formicidae			10		Ant
	Arachnida	Araneida				5		Spider
		Opiolones				1		Daddy longlegs
		Scorpiones				1		Scorpion
	Chilopoda	Scolopendromorpha				43		Centipede
		Lithobiomorpha				3		Centipede

CEF 015 SS-707A

Phylum	Class	Order	Family	Genus	Species	Quantity	
Arthropoda	Insecta	Coleoptera	Hydrophilidae			1	!unusual!
			Scarabaeidae			7	
			Carabidae			1	
			Elateridae			1	larva
			unknown			2	larva
			unknown			1	larva
		Diptera	unknown			1	larva
		Hymenoptera	Formicidae			2	
		Blattaria	Blatellidae			4	2 oothec
	Arachnida	Araneida				4	
	Chilopoda	Scolopendromorpha				20	
		Lithobiomorpha				10	

Common Name
Water Scavenger beetle (terrestrial species-no natatorial legs)
Scarab beetle
Ground beetle
Click beetle grub
unknown beetle grub #1
unknown beetle grub #2
unknown fly maggot
Ant
Roach
Spider
Centipede
Centipede

CEF 015 SS-708

Phylum	Class	Order	Family	Genus	Species	Quantity	Common Name
Arhtropoda	Insecta	Coleoptera	Scarabaeidae			1	Scarab beetle
			Carabidae	Brachinus		2	Bombardier beetle
			Staphylinidae			1	Rove beetle
		Hemiptera	Miridae			2	Leaf bug
		Hymenoptera	Formicidae			3	Ant
		Orthoptera	Gryllidae			3	Field cricket
		Blattaria	Blatellidae			9	Roach
	Arachnida	Araneida				4	Spider
	Chilopoda	Scolopendromorpha				6	Centipede
		Lithobiomorpha				21	Centipede

CEF 015 SS-708A

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			3		Scarab beetle
			Elateridae			1	larva	Click beetle
		Blattaria	Blatellidae			3		Roach
	Chilopoda	Scolopendromorha				9		Centipede
		Lithobiomorpha				4		Centipede

CEF 015 SS-709

Phylum	Class	Order	Family	Genus	Species	Quantity		Common Name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			4		Scarab beetle
			Elateridae			2	larva	Click beetle
			unknown			1	larva	
			unknown			1	larva	
			unknown			1	larva	
		Orthoptera	Gryllidae			3		Field cricket
		Blattaria	Blatellidae			3		Roach
		Hemiptera	Anthocoridae			1		Pirate bug
		Hymenoptera	Formicidae			1		Ant
	Arachnida	Araneida				2		Spider
	Chilopoda	Scolopendromorpha				18		Centipede
		Lithobiomorpha				5		Centipede

CEF 015 SS-717

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Helodidae			1		Marsh beetle
			Elateridae			1		Click beetle
			Elateridae			1		Click beetle
			Cicindelidae			1		Tiger beetle
			Scarabaeidae			4		Scarab beetle
		Hemiptera	Reduviidae			1		Assassin bug
			Anthocoridae			1		Pirate bug
		Blattaria	Blatellidae			3		Roach
			Blatellidae			1	ootheca	egg sack
		Hymenoptera	Formicidae			3		Ant
		Lepidoptera	unknown			1	pupa	cacoon
	Arachnida	Araneida				6		Spider
	Chilopoda	Scolopendromorpha				6		Centipede
		Lithobiomorpha				11		Centipede

CEF 015 SS-719

Phylum	Class	Order	Family	Genus	Species	Quantity		Common Name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			3		Scarab beetle
			Elateridae			5	larva	Click beetle
			unknown			1	larva	
		Hymenoptera	Formicidae			2		Ant
		Orthoptera	Gryllidae			1		Field cricket
	Arachnida	Araneida				2		Spider
	Chilopoda	Scolopendromorpha				23		Centipeded
		Lithobiomorpha				1		Centipeded

CEF 015 SS-719A

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			3		Scarab beetle
			Elateridae			1	larva	Click beetle
			unknown			1	larva	
			unknown			1	larva	
		Hymenoptera	Formicidae			2		Ant
		Homoptera	Cicadidae			1	larva	Cicada
		Hemiptera	Anthocoridae			1		Pirate bug
	Arachnida	Araneida				1		Spider
	Chilopoda	Scolopendromorpha				7		Centipede

CEF 015 SS-739

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetle
			Elateridae			1		Click beetle
			Elateridae			1	larva	Click beetle
		Orthoptera	Gryllidae			1		Field cricket
		Blattaria	Blatellidae			1		Roach
		Hymenoptera	Formicidae	Solenopsis		1		Fire ant
		Mantodea	Mantidae			1		Mantis
	Chilopoda	Scolopendromorpha				18		Centipede
		Lithobiomorpha				21		Centipede

CEF 025 SS-740

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Scarabaeidae			1		Scarab beetle
			Melandryidae			1		False Darkling beetle
			Elateridae			5	larva	Click beetle
		Hymenoptera	Formicidae			2		Ant
		Blattaria	Blatellidae			3		Roach
	Arachnida	Araneida				1		Spider
	Chilopoda	Scolopendromorpha				13		Centipede
		Lithobiomorpha				2		Centipede

CEF 015 SS-741

Phylum	Class	Order	Family	Genus	Species	Quantity		common name
Arthropoda	Insecta	Coleoptera	Carabidae			2		Ground beetle
			Elateridae			3		Click beetle
			Elateridae			14	larva	Click beetle
			unknown			1	larva	
		Diptera	unknown			1	larva	Fly larva
		Blattaria	Blatellidae			4		Roach
		Hymenoptera	Formicidae			1		Ant
	Arachnida	Araneida				3		Spider
		Opiolones				2		Daddy longlegs
	Chilopoda	Scolopendromorpha				23		Centipede

APPENDIX E

HABITAT NOTES

DESCRIPTIONS OF SAMPLING PLOTS
(from field notes of M.L. Whitten, Tetra Tech NUS, Inc)

SS-701 6/23/01
understory: 0.2 gallberry, greenbrier, laurel oak
midstory: none
overstory: 0.5 red maple, laurel oak, slash pine, longleaf pine
duff: 1½ to 2 inches

SS-703 6/27/01
understory: 0.2 gallberry, yellow jessamine
midstory: none
overstory: 0.3 slash pine, laurel oak
duff: 3 to 5 inches, mostly 3 inches
Duff in plot is composed of more thickly intertwined small roots than at previous plots; extremely difficult to separate.

SS-704 6/26/01
understory: 0.5 laurel oak, St. John's wort, red maple, yellow jessamine, grasses
midstory: none
overstory: 0.4 slash pine
duff: ½ to 2 inches, mostly 1 to 1½ inches

SS-706 6/27/01
understory: none
midstory: none
overstory: 0.3 slash pine
duff: ½ to 1½ inches, mostly 1 inch
Plot is in area of sparse understory. Soil is light gray sand streaked with dark gray sand, resulting in a "splotchy" appearance.

SS-707 6/25/01
understory: 0.3 gallberry, greenbrier
midstory: 0.2 red maple, water oak
overstory: 0.5 water oak, slash pine
duff: 3 inches

SS-707A 6/25/01
understory: 0.2 gallberry, greenbrier
midstory: 0.2 *Ilex* sp.
overstory: 0.4 slash pine
duff: 2¾ to 3½ inches; mostly 3 inches
Large Ilex (4-5 inch dbh; 12 ft high) 3 feet east of plot provides partial shade in plot.

SS-708 6/25/01
understory: none
midstory: 0.1 bald cypress, slash pine
overstory: 0.4 bald cypress, slash pine, red maple
duff: 2 inches
Soil is darker (more organic) than in previous plots. The plot is located approximately 100 feet from edge of former cypress pond. Although the soil and vegetation is unlike that at any other plot, this location was selected because of expected high lead concentrations.

SS-708A 6/23/01
understory: 0.2 gallberry, wax myrtle, blueberry, greenbrier, yaupon holly
midstory: none
overstory: 0.3 slash pine
duff: 1½ inches
sparse tree cover to south; much of plot in direct sun for most of the day.

SS-709 6/25/01
understory: 0.2 gallberry, greenbrier, slash pine, laurel oak
midstory: none
overstory: 0.3 slash pine
duff: 1½ to 2½ inches (mostly 1½ inches)
numerous slash pines south of the plot provide partial shade for most of the day.

SS-717 6/27/01
understory: 0.2 gallberry, saw palmetto, grasses, red root
midstory: none
overstory: 0.4 slash pine
duff: 1½ inches

SS-719 6/25/01
understory: 0.1 gallberry, St. John's wort, greenbrier, lichens
midstory: 0.1 slash pine, wax myrtle
overstory: 0.4 slash pine, laurel oak
duff: 1½ inches

SS-719A 6/23/01
understory: 0.3 poison ivy, gallberry, wax myrtle, yellow jessamine
midstory: 0.1 wax myrtle
overstory: 0.3 slash pine
duff: ¾ to 3 inches (3 inches beneath mature slash pine, ¾ inch otherwise)

SS-721 6/19/01
understory: 0.3 yellow jessamine
midstory: none
overstory: 0.3 slash pine
duff: ¾ to 1 inch

SS-722 6/20/01
understory: 0.2 gallberry, St. John's wort, *Lyonia* sp., greenbrier
midstory: 0.1 gallberry
overstory: 0.3 slash pine
duff: ½ inch

SS-724 6/27/01
understory: 0.2 gallberry, wild grape, wax myrtle
midstory: none
overstory: 0.1 slash pine
duff: 1½ to 2 inches
plot is at the edge of treeline; shaded by adjacent pines during mornings, in direct sun during afternoons

SS-726A 6/21/01
understory: 0.1 wax myrtle, greenbrier, blackberry
midstory: none
overstory: 0.4 slash pine, wax myrtle
duff: 1 to 1½ inches
large wax myrtle immediately southeast of plot and nearby slash pines provide shade over ½ of plot. numerous clay pigeon fragments in soil, a few specimens of spent ammunition in soil

SS-727A 6/22/01
understory: 0.2 yellow jessamine, grasses, dog fennel, laurel oak, gallberry
midstory: none
overstory: 0.3 slash pine
duff: ¼ to 1 inch
plot is in partial shade for most of the day due to sweet gum trees immediately south of the plot and to overstory of slash pines

SS-728A 6/21/01
understory: 0.3 Virginia creeper, poison ivy, St. John's wort, grassses
midstory: none
overstory: 0.5 slash pine
duff: 1 inch
plot is in partial shade for most of the day due to sweet gum trees immediately south o fthe plot and to overstory of slash pines

SS-732 6/20/01
understory: 0.8 bracken fern
midstory: 0.1 red maple, bracken fern, slash pine
overstory: 0.4 slash pine
duff: ¾ to 1 inch

SS-733 6/19/01
understory: 0.2 laurel oak, greenbrier, American beauty berry, wild grape, poison ivy, yellow jessamine
midstory: 0.1 greenbrier
overstory: 0.3 laurel oak
duff: ½ to 1½ inches

SS-734 6/19/01
understory: 0.4 yellow jessamine, greenbrier, wild grape, red maple, poison ivy
midstory: 0.1 water oak, gallberry
overstory: 0.6 laurel oak, slash pine
duff: 2½ inches beneath the laurel oak, ½ to 1 inch elsewhere

SS-735A 6/21/01
understory: 0.3 greenbrier, yellow jessamine, blackberry, laurel oak
midstory: 0.1 wild grape, Blueberry
overstory: 0.2 slash pine, longleaf pine, laurel oak
duff: 1 to 2 inches; mostly 1½ to 2 inches

SS-736A 6/22/01
understory: 0.4 gallberry, laurel oak, St. John's wort, grasses
midstory: none
overstory: 0.4 slash pine
duff: 2½ to 3 inches

SS-737 6/20/01
understory: 0.1 wild grape, greenbrier
midstory: none
overstory: 0.8 laurel oak, slash pine
duff: 3 to 3½ inches (mostly 3½ inches)
plot is in partial shade most of the day due to 3 nearby laurel oaks

SS-739 (reference location) 6/24/01
understory: 0.5 gallberry, blueberry
midstory: none
overstory: 0.4 laurel oak, slash pine
duff: 1½ to 2½ inches

SS-740 (reference location) 6/24/01
understory: 0.4 gallberry, greenbrier, grasses
midstory: none
overstory: 0.5 laurel oak, slash pine
duff: 1 to 2½ inches (mostly 2 inches)

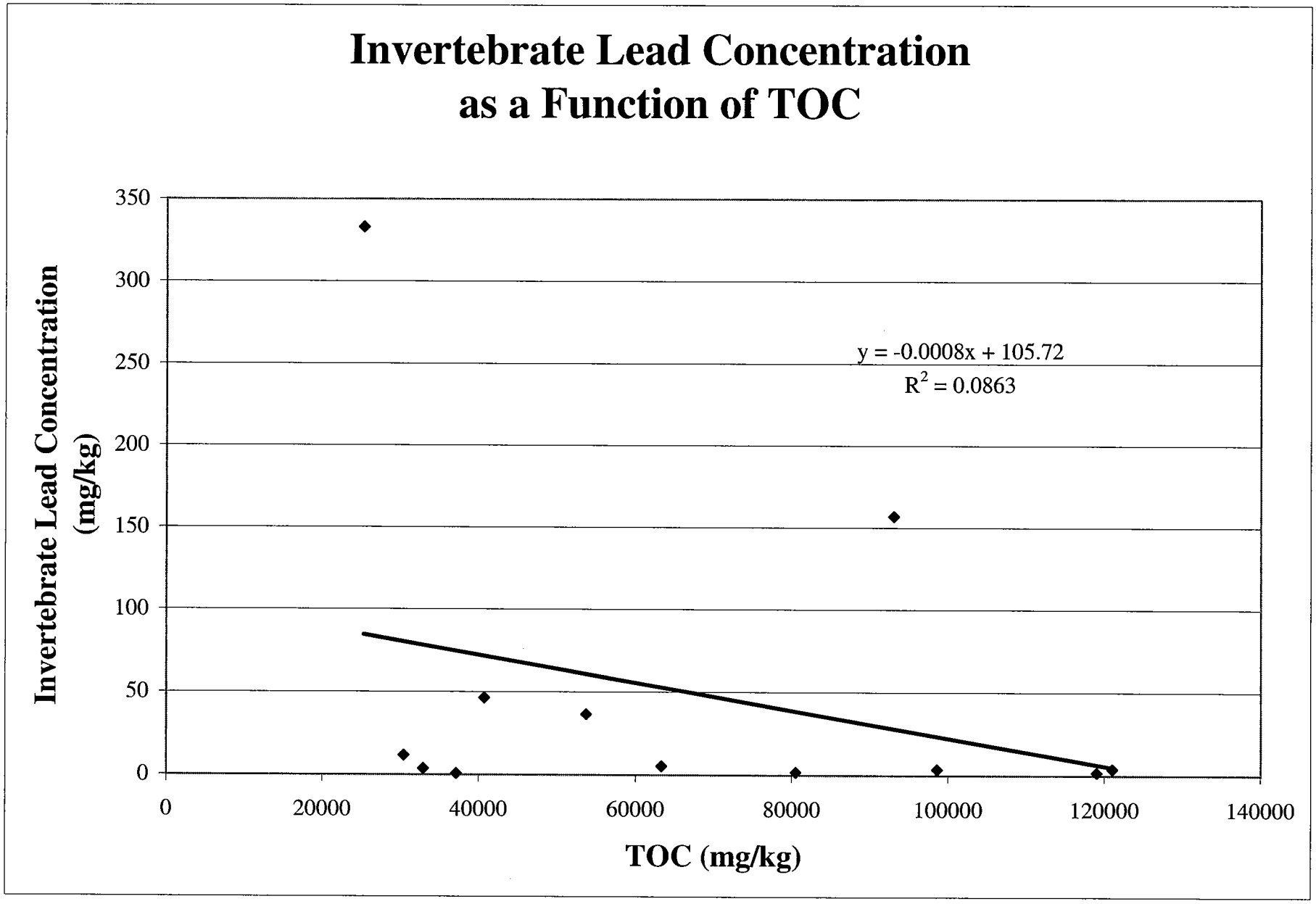
SS-741 (reference location) 6/24/01
understory: 0.1 gallberry, water oak
midstory: none
overstory: 0.7 water oak, slash pine
duff: 2 to 3½ inches (mostly 2 to 2½ inches)
much of plot is beneath the canopy of large water oak; thus in partial shade most of the day

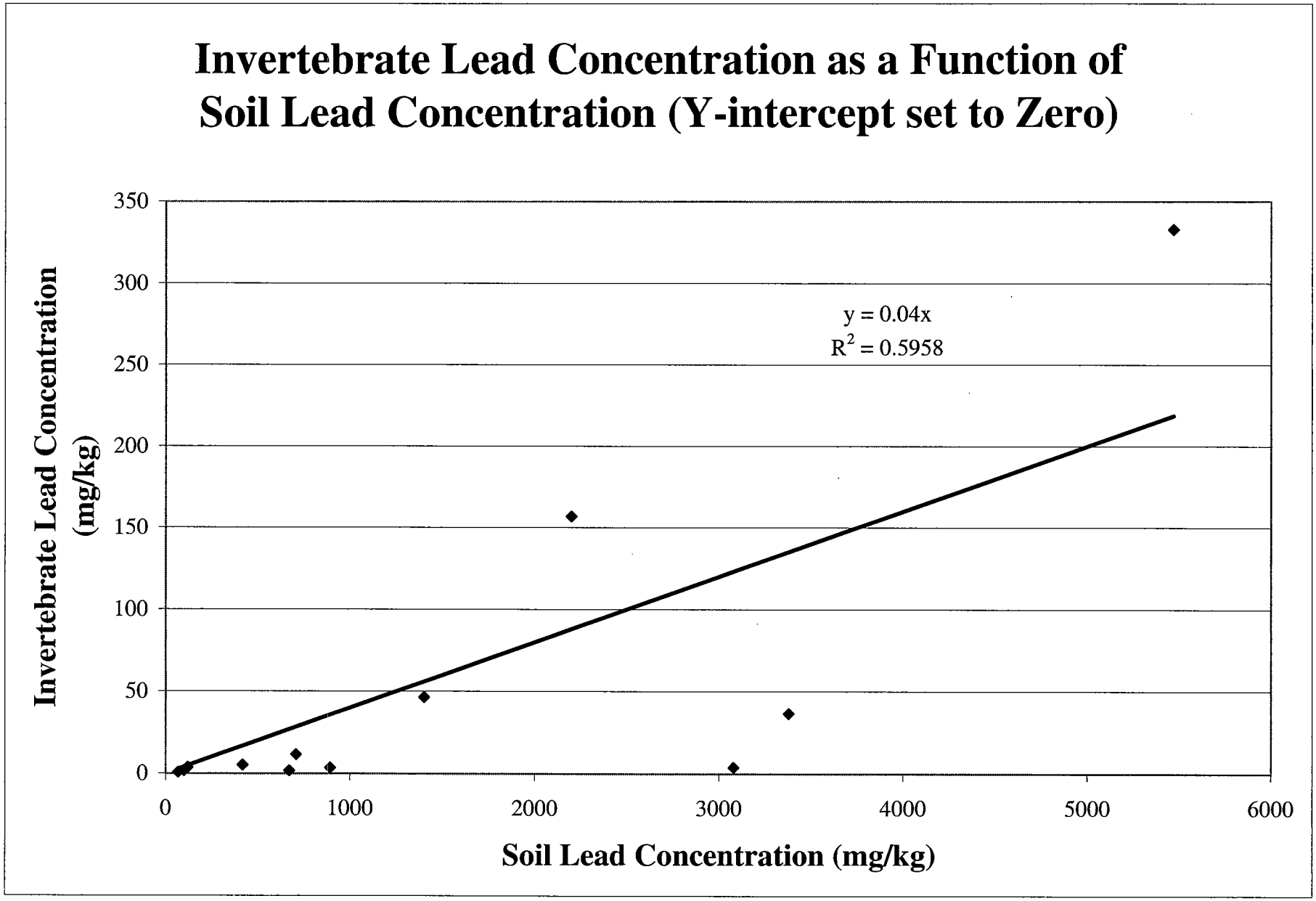
Species names

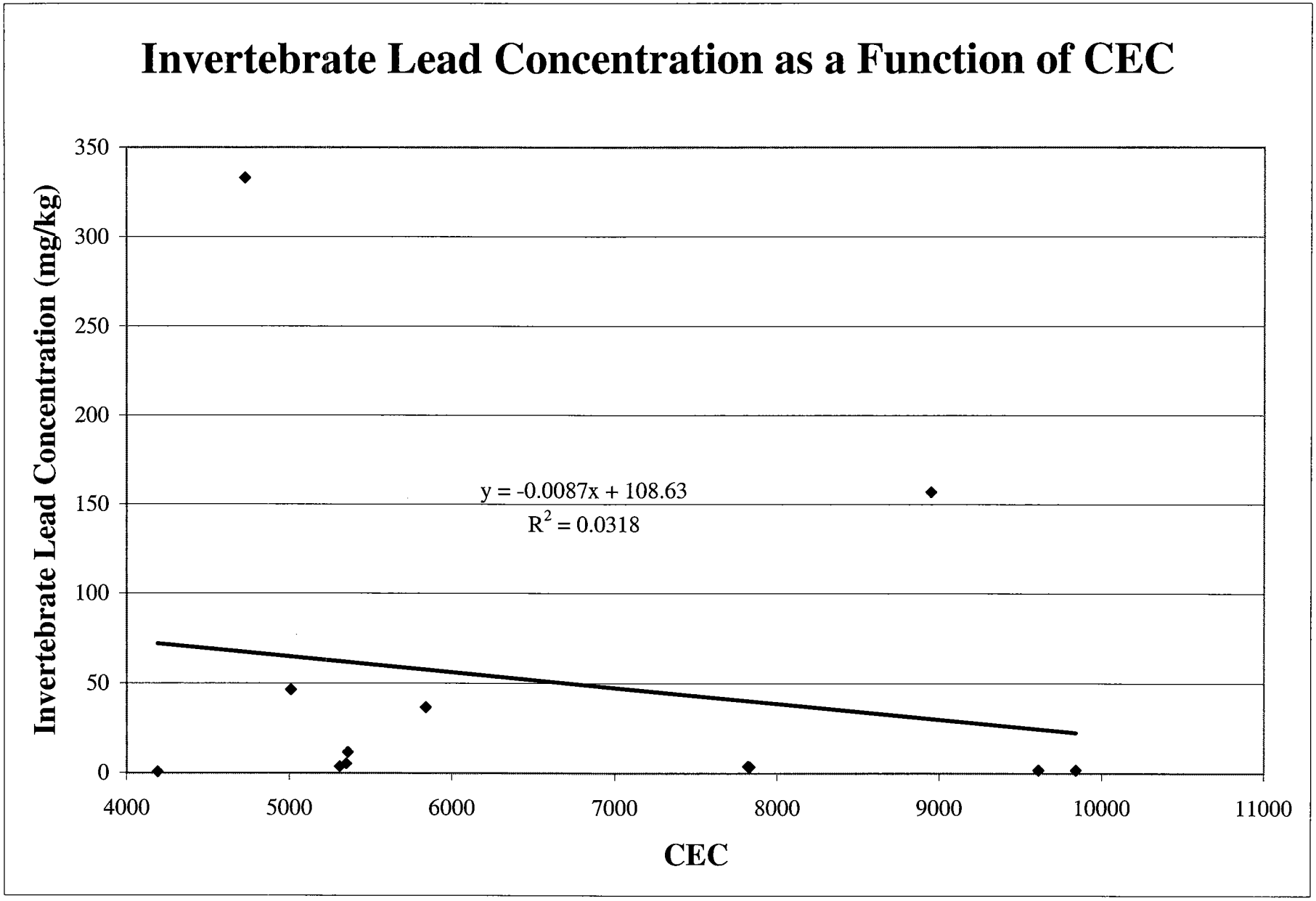
American beauty berry (*Callicarpa americana*)
bald cypress (*Taxodium distichum*)
blackberry (*Rubus sp.*)
blueberry (*Vaccinium* sp.)
bracken fern (*Pteridium aquilinum*)
dog fennel (*Eupatorium capillifolium*)
gallberry (*Ilex glabra*)
greenbrier (*Smilax* sp.)
laurel oak (*Quercus hemisphaerica*)
longleaf pine (*Pinus palustris*)
St. John's wort (*Hypericum* sp.)
poison ivy (*Toxicodendron radicans*)
red root (*Lachnanthes carolina*)
red maple (*Acer rubrum*)
saw palmetto (*Serenoa repens*)
slash pine (*Pinus elliottii*)
water oak (*Quercus nigra*)
wild grape (*Vitis rotundifolia*)
yaupon holly (*Ilex vomitoria*)
yellow jessamine (*Gelsemium sempervirens*)

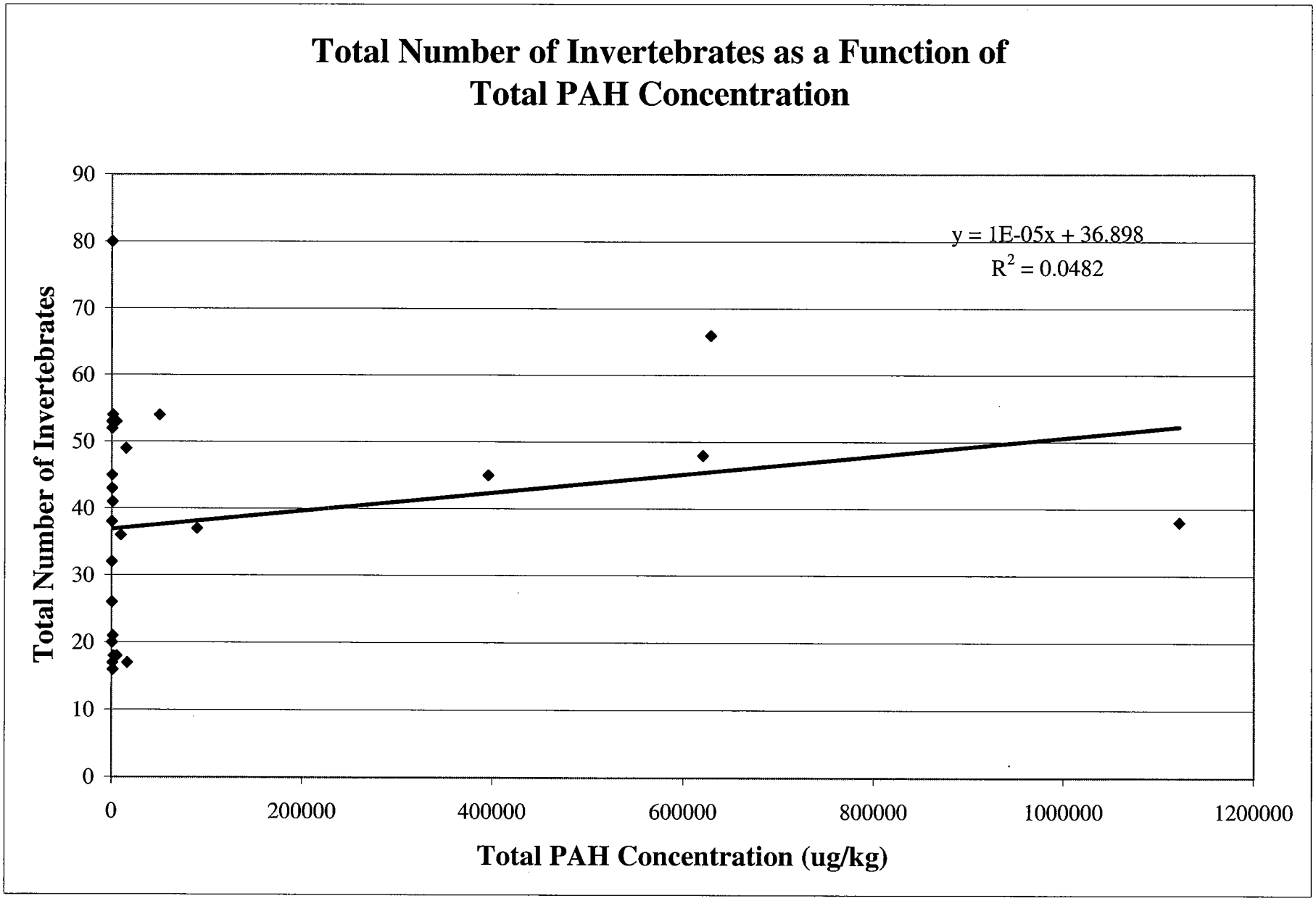
APPENDIX F

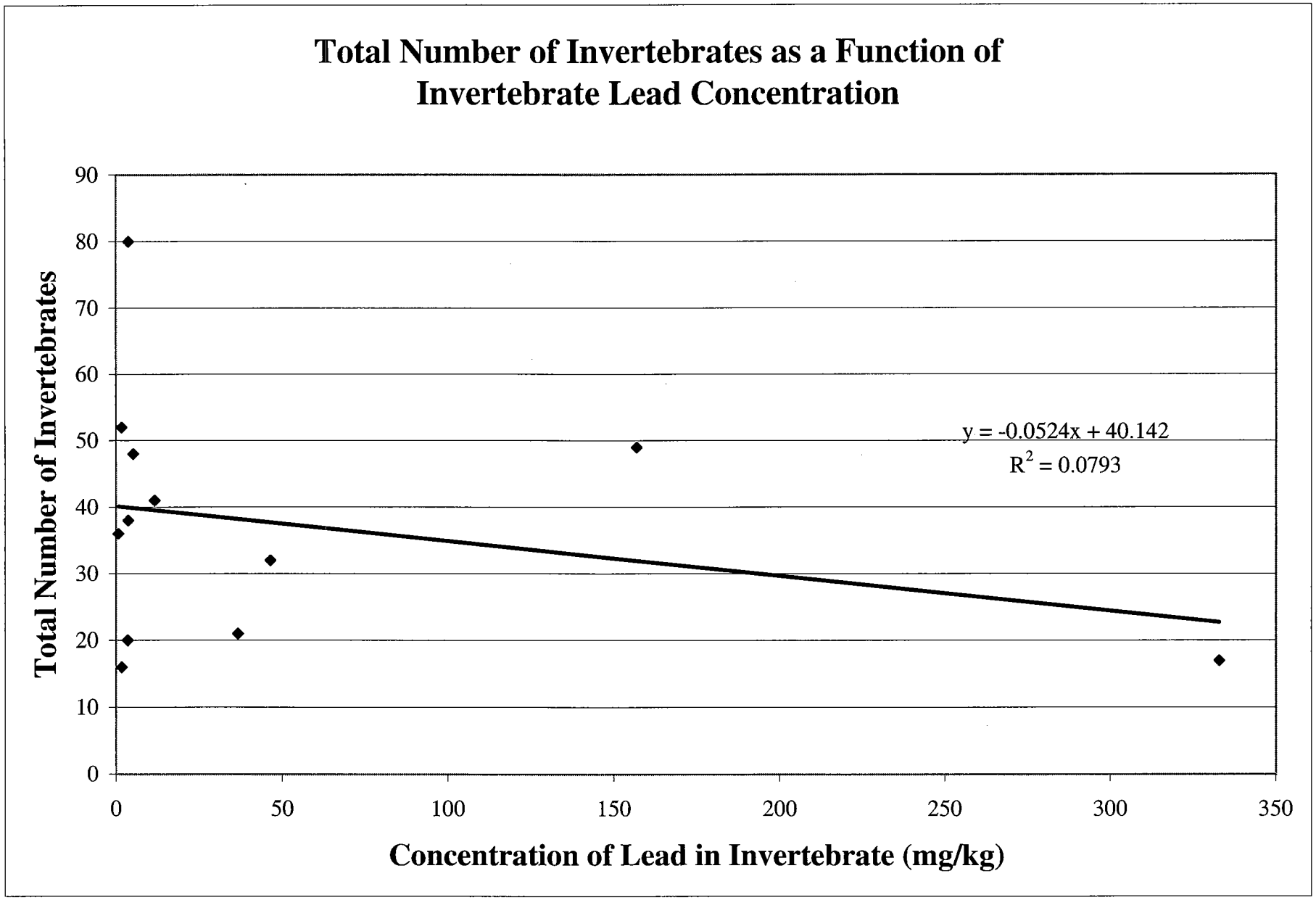
SCATTER PLOTS AND CORRELATION RESULTS

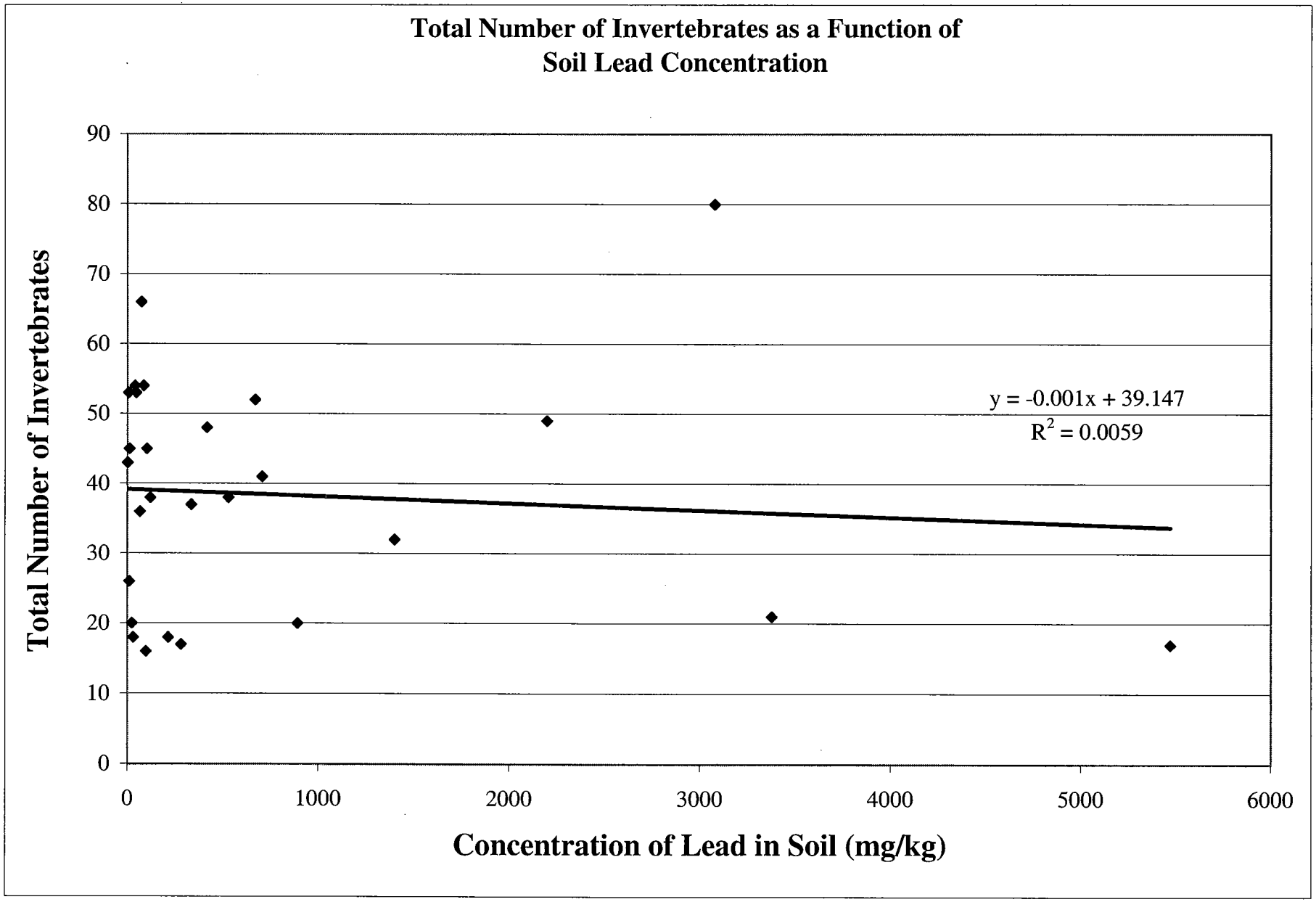

Invertebrate Lead Concentration as a Function of TOC
Invertebrate Lead Concentration (mg/kg)
350
300
250
200
150
100
50
0
y = -0.0008x + 105.72
R2 = 0.0863
0
20000
40000
60000
80000
100000
120000
140000
TOC (mg/kg)

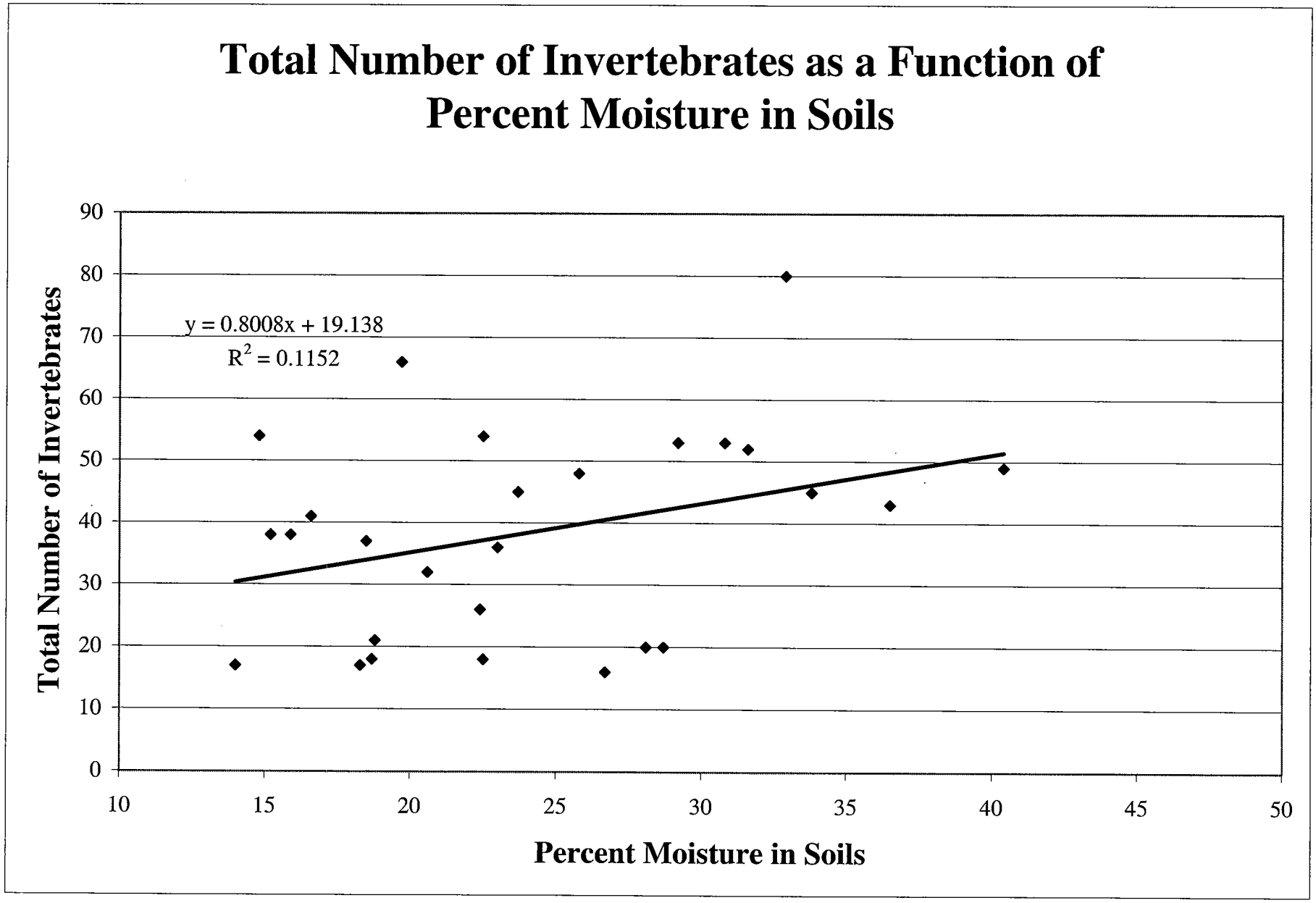

Invertebrate Lead Concentration as a Function of Soil Lead Concentration (Y-intercept set to Zero)
y = 0.04x
R2 = 0.5958
Invertebrate Lead Concentration (mg/kg)
Soil Lead Concentration (mg/kg)
0
50
100
150
200
250
300
350
0
1000
2000
3000
4000
5000
6000

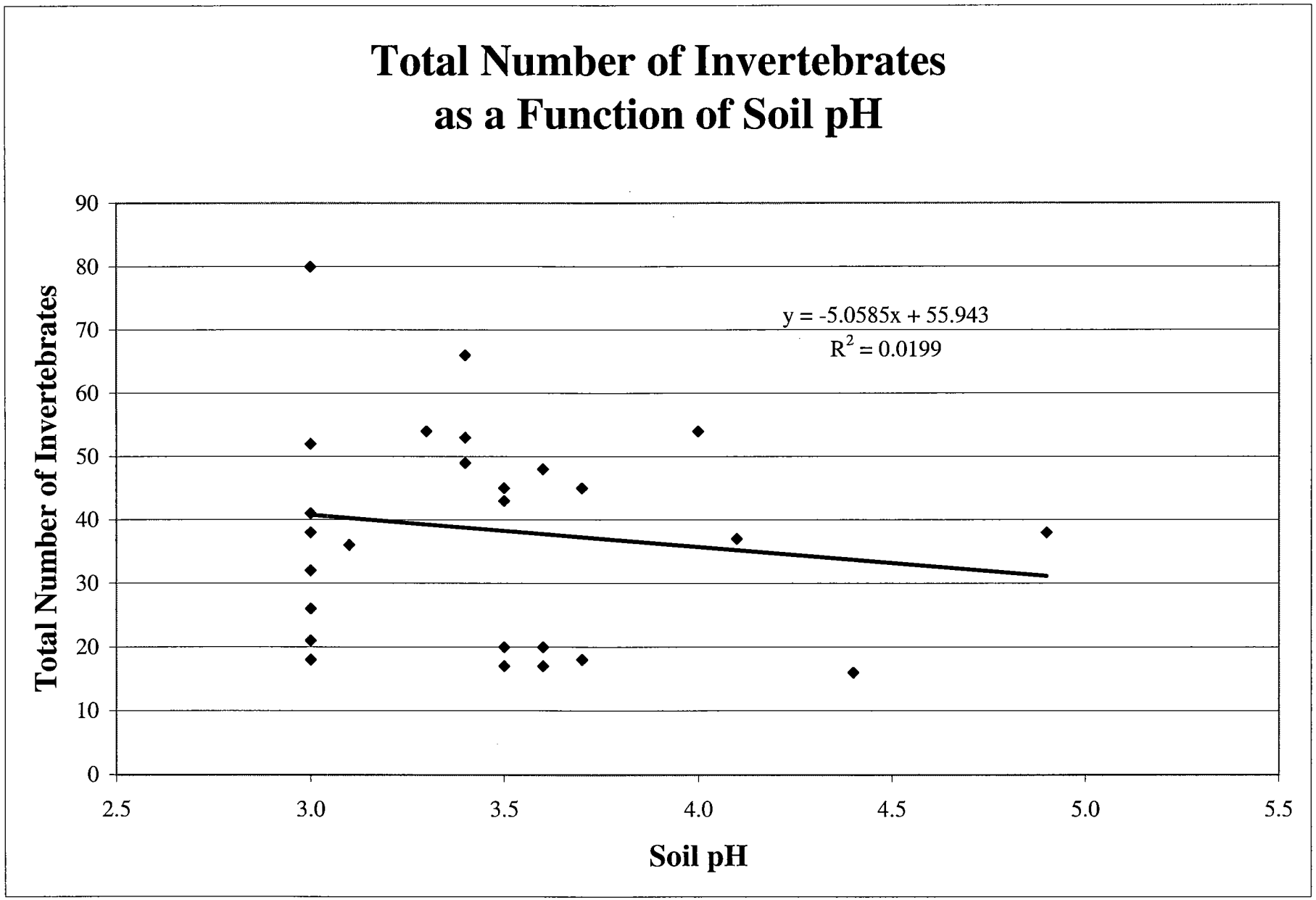

Invertebrate Lead Concentration as a Function of CEC
Invertebrate Lead Concentration (mg/kg)
350
300
250
200
150
100
50
0
y = -0.0087x + 108.63
R2 = 0.0318
4000
5000
6000
7000
8000
9000
10000
11000
CEC

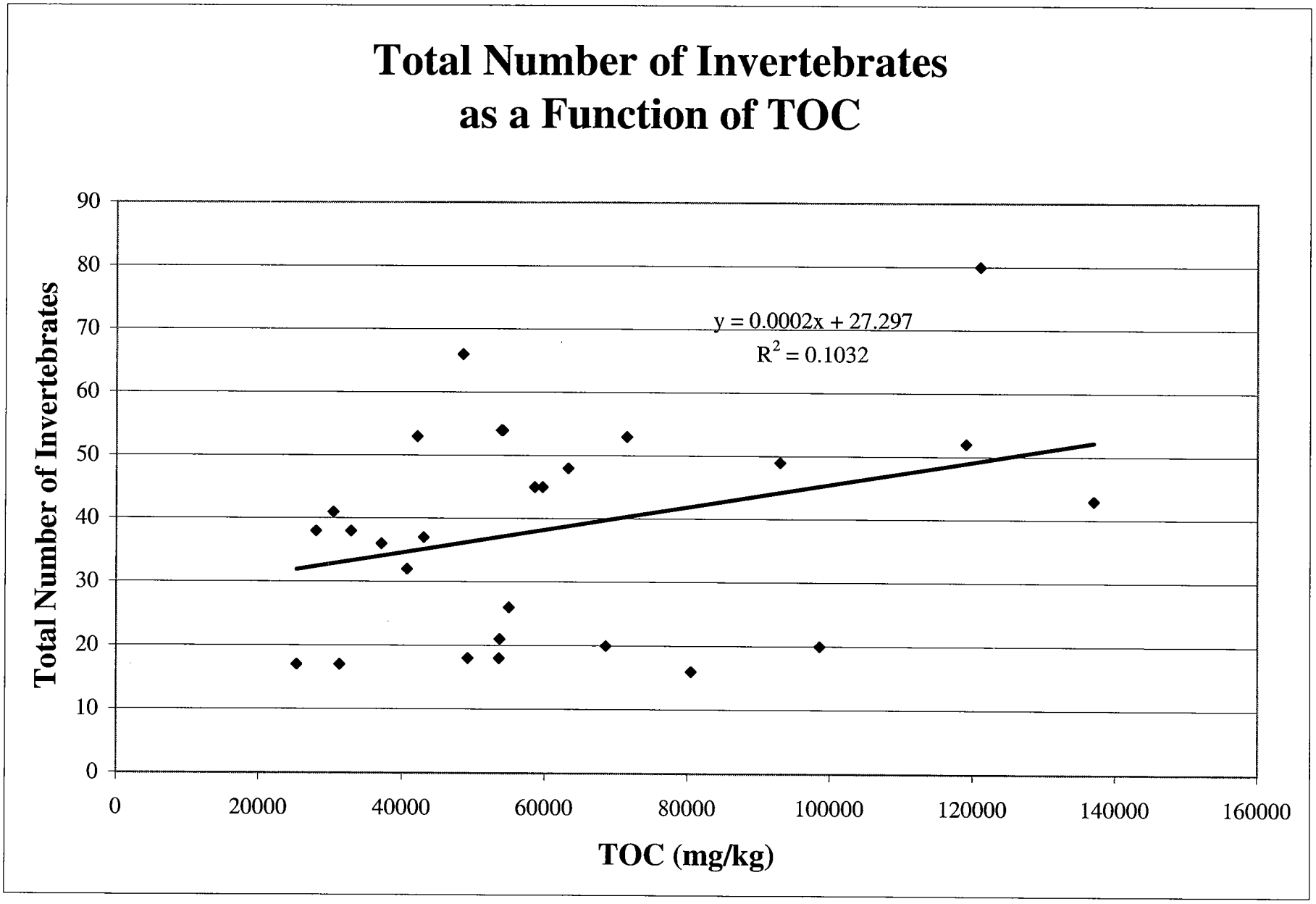

Total Number of Invertebrates as a Function of Total PAH Concentration
y = 1E-05x + 36.898
R2 = 0.0482
Total Number of Invertebrates
0
10
20
30
40
50
60
70
80
90
0
200000
400000
600000
800000
1000000
1200000
Total PAH Concentration (ug/kg)

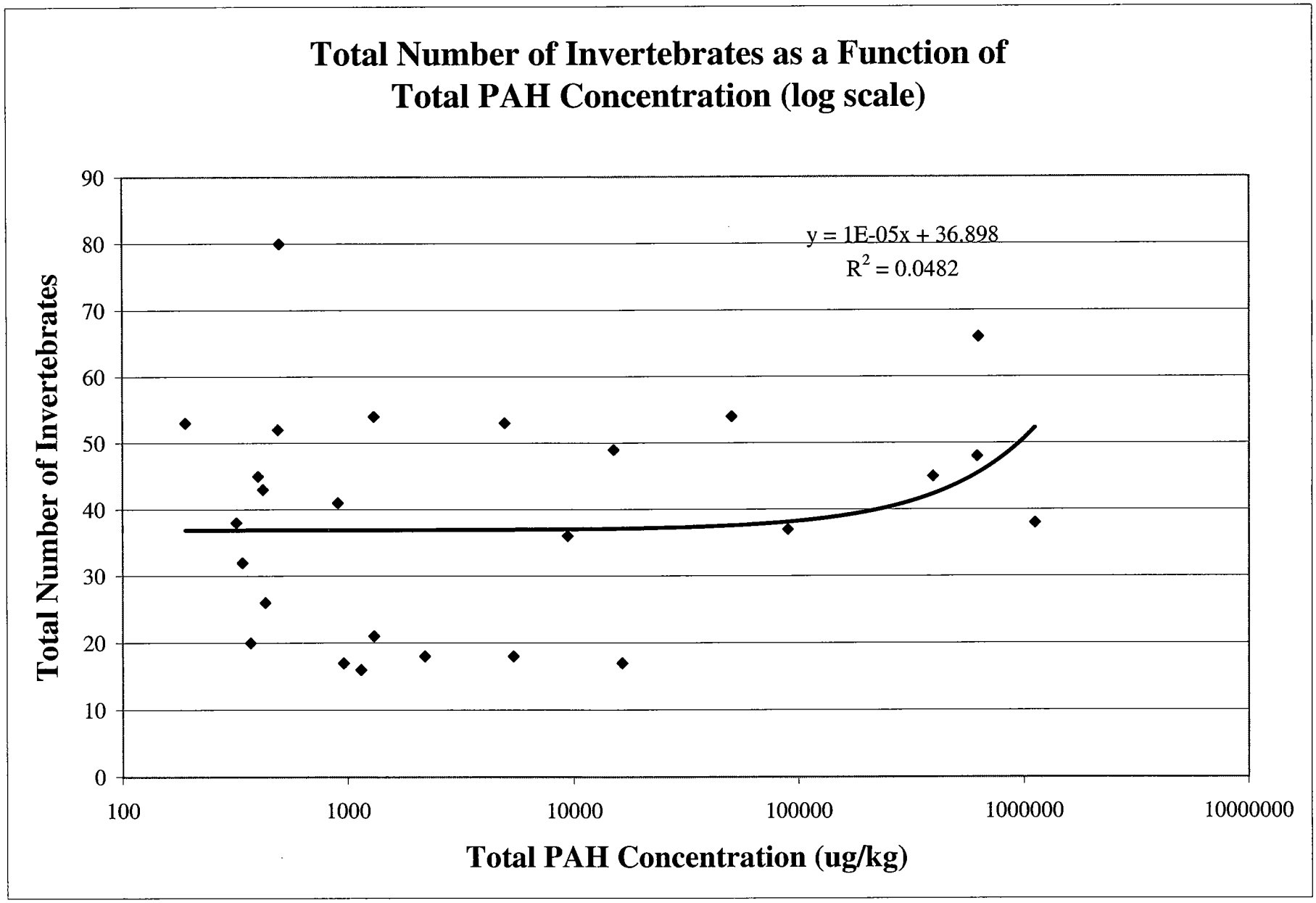

Total Number of Invertebrates as a Function of Invertebrate Lead Concentration
Total Number of Invertebrates
Concentration of Lead in Invertebrate (mg/kg)
y = -0.0524x + 40.142
R2 = 0.0793
0
10
20
30
40
50
60
70
80
90
0
50
100
150
200
250
300
350

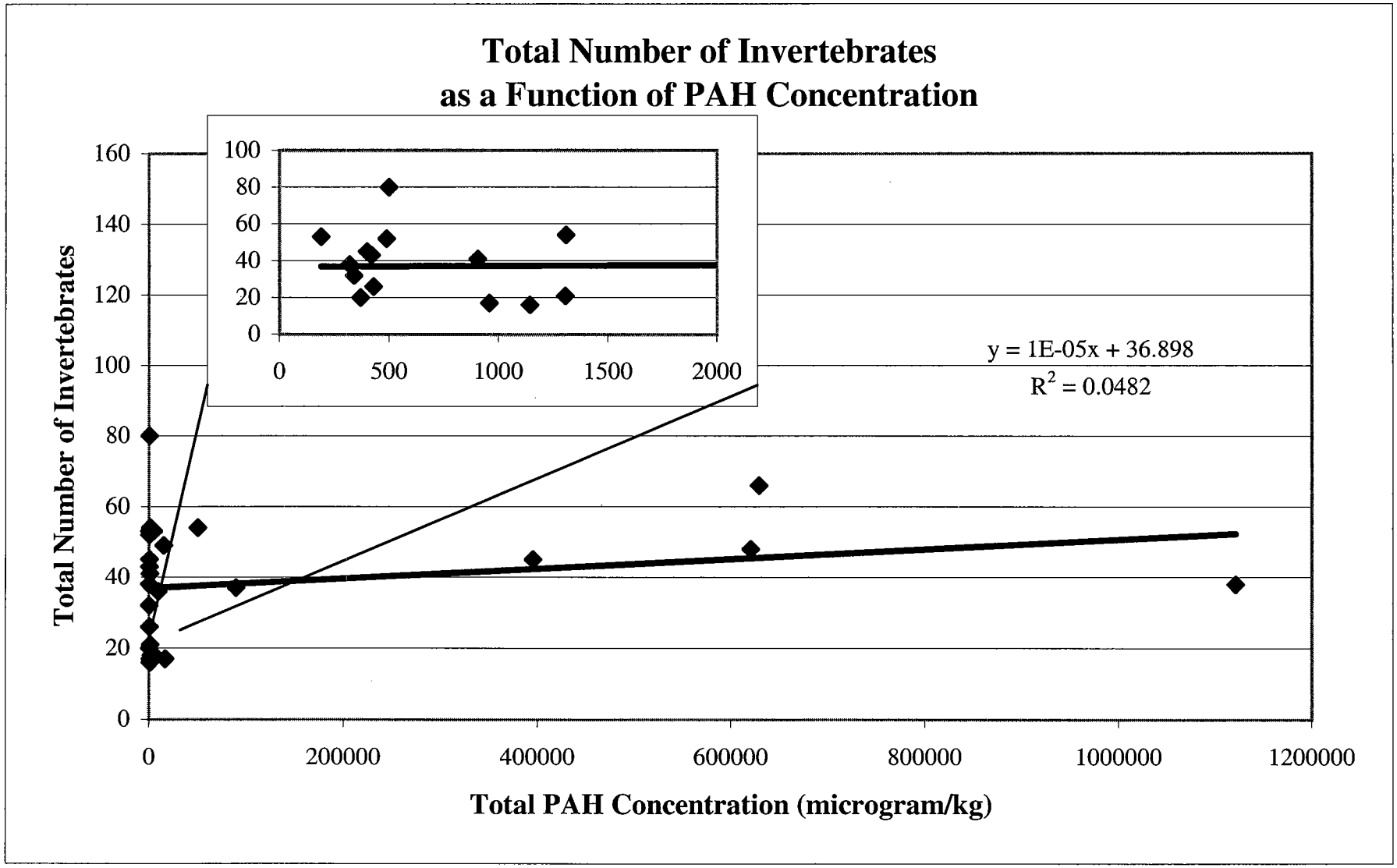

Total Number of Invertebrates as a Function of
Soil Lead Concentration
Total Number of Invertebrates
90
80
70
60
50
40
30
20
10
0
0
1000
2000
3000
4000
5000
6000
Concentration of Lead in Soil (mg/kg)
y = -0.001x + 39.147
R2 = 0.0059


Total Number of Invertebrates as a Function of Percent Moisture in Soils
y = 0.8008x + 19.138
R2 = 0.1152
Total Number of Invertebrates
Percent Moisture in Soils
0
10
20
30
40
50
60
70
80
90
10
15
20
25
30
35
40
45
50

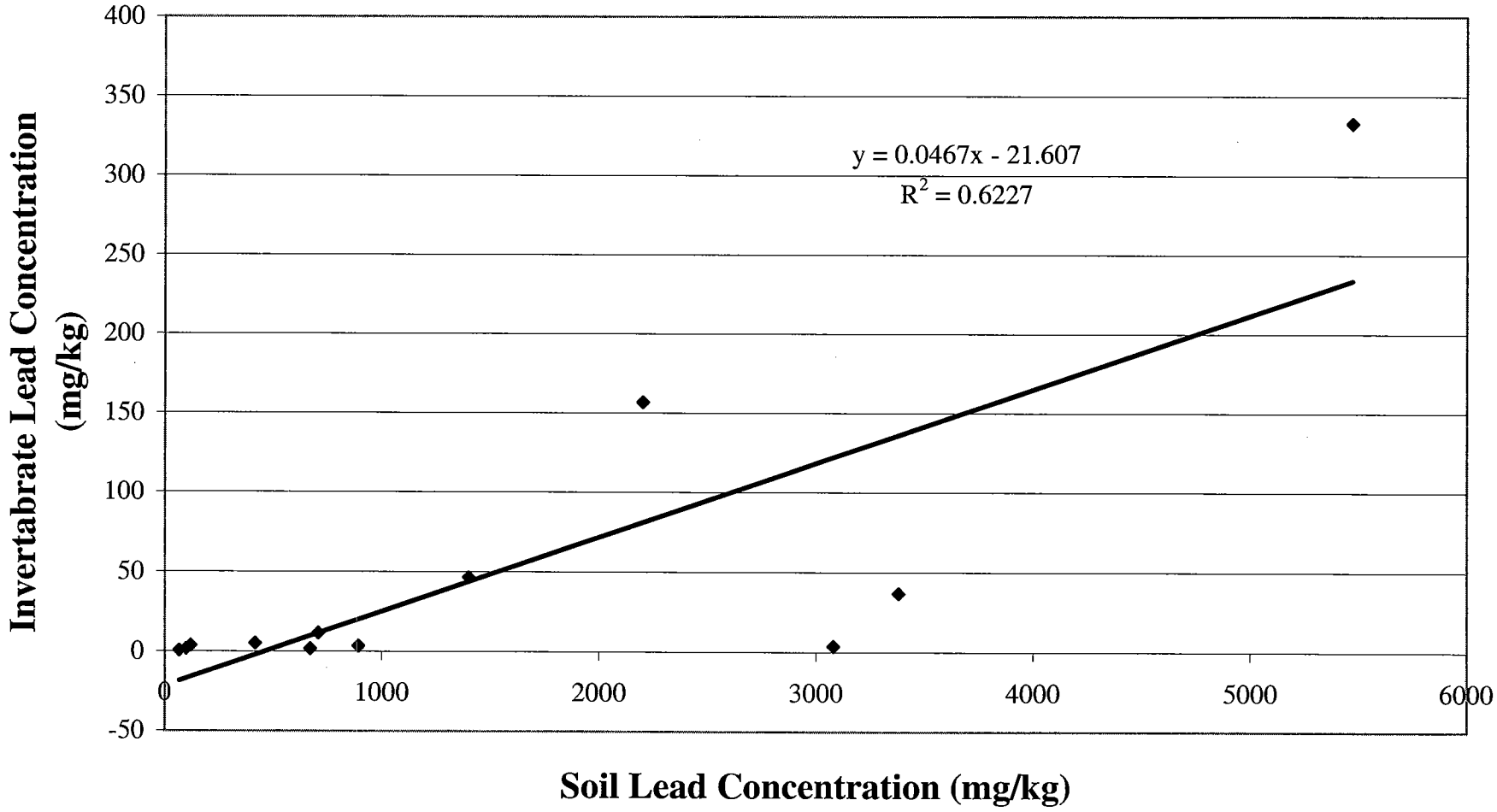

Total Number of Invertebrates
as a Function of Soil pH
y = -5.0585x + 55.943
R2 = 0.0199
Total Number of Invertebrates
Soil pH
0
10
20
30
40
50
60
70
80
90
2.5
3.0
3.5
4.0
4.5
5.0
5.5

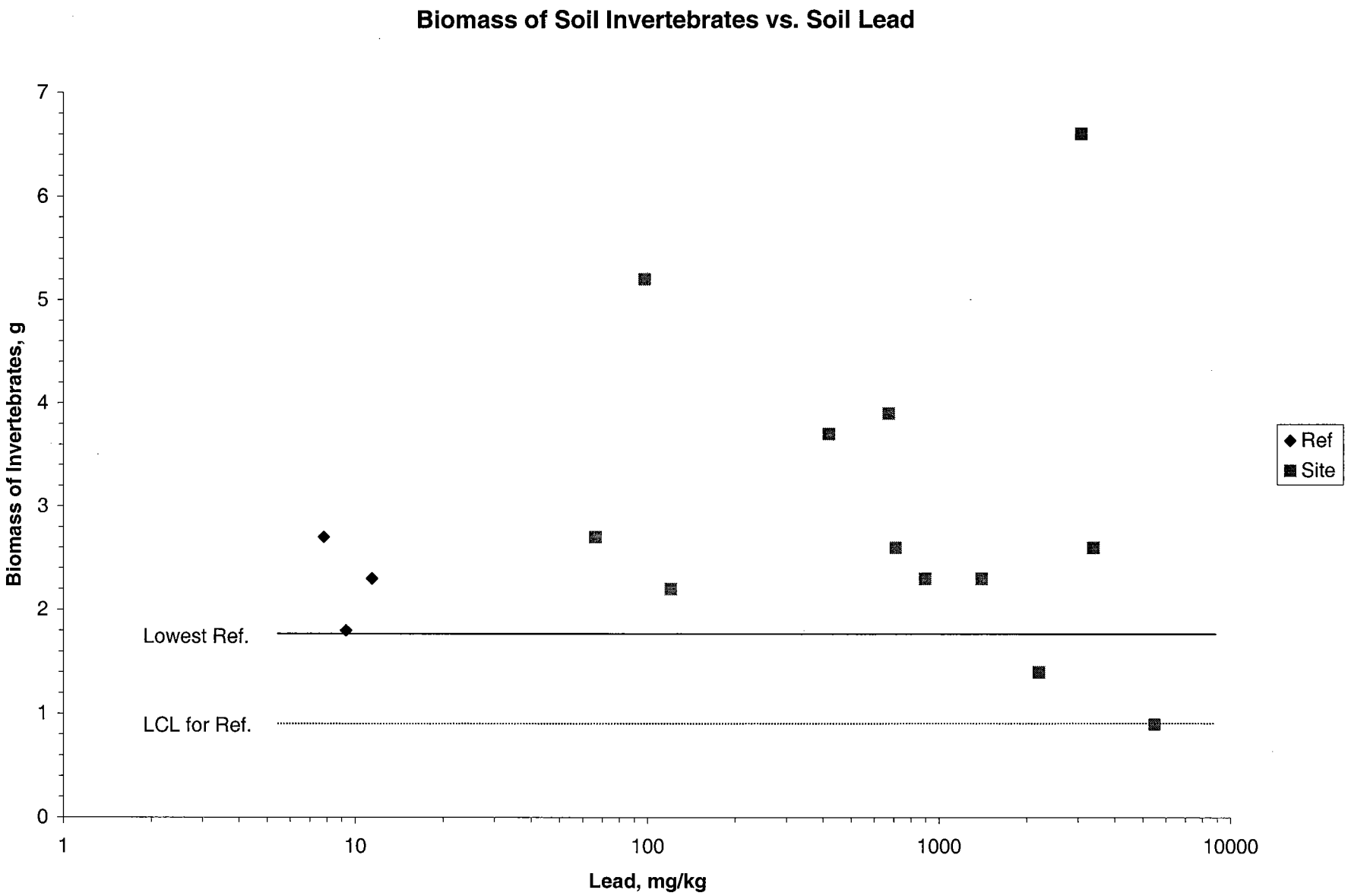

Total Number of Invertebrates
as a Function of TOC
y = 0.0002x + 27.297
R2 = 0.1032
Total Number of Invertebrates
TOC (mg/kg)
0
10
20
30
40
50
60
70
80
90
0
20000
40000
60000
80000
100000
120000
140000
160000

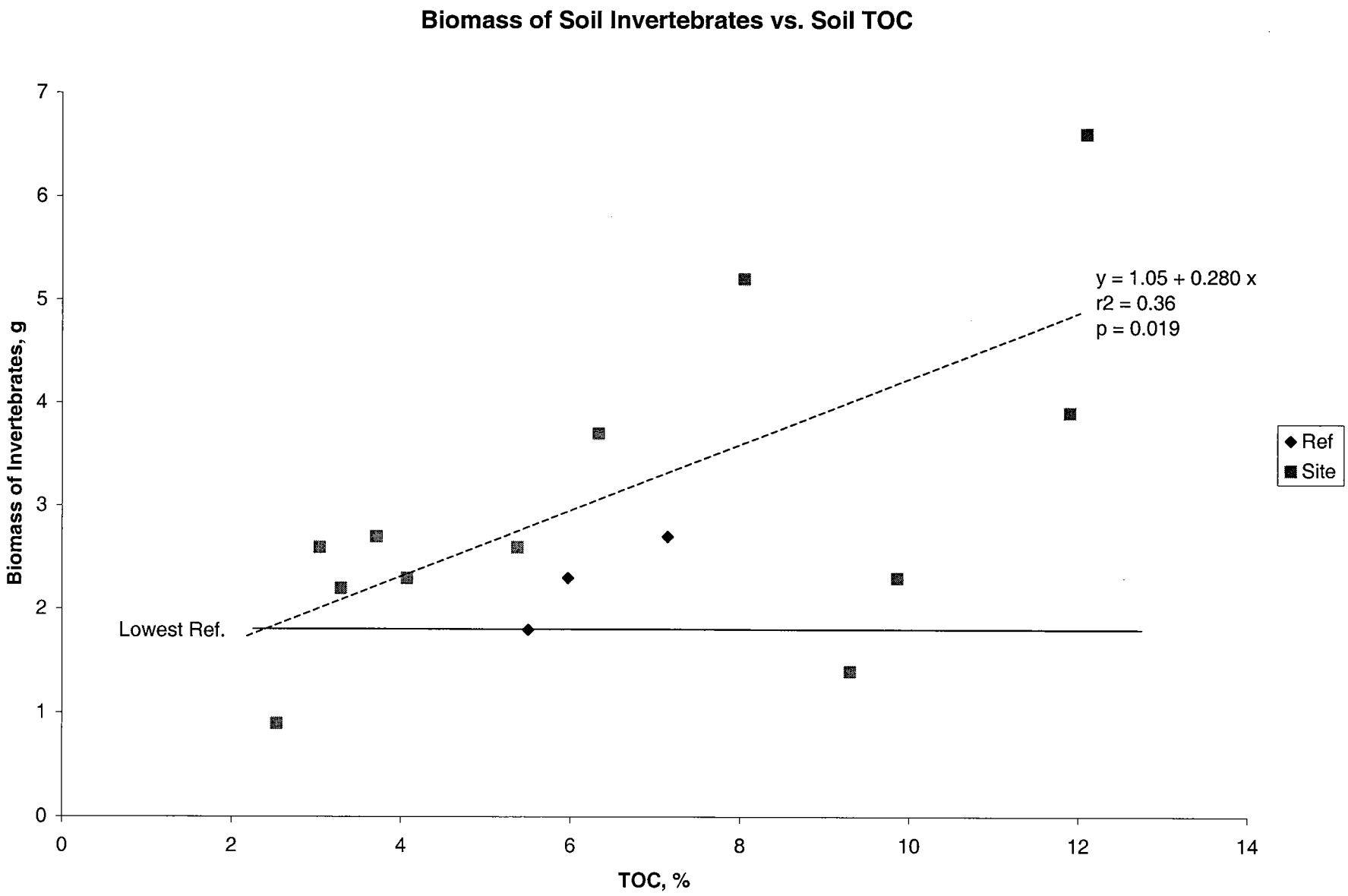

Total Number of Invertebrates as a Function of
Total PAH Concentration (log scale)
y = 1E-05x + 36.898
R2 = 0.0482
Total Number of Invertebrates
0
10
20
30
40
50
60
70
80
90
100
1000
10000
100000
1000000
10000000
Total PAH Concentration (ug/kg)


Total Number of Invertebrates
as a Function of PAH Concentration
Total Number of Invertebrates
Total PAH Concentration (microgram/kg)
y = 1E-05x + 36.898
R2 = 0.0482
0
20
40
60
80
100
120
140
160
0
200000
400000
600000
800000
1000000
1200000
0
500
1000
1500
2000

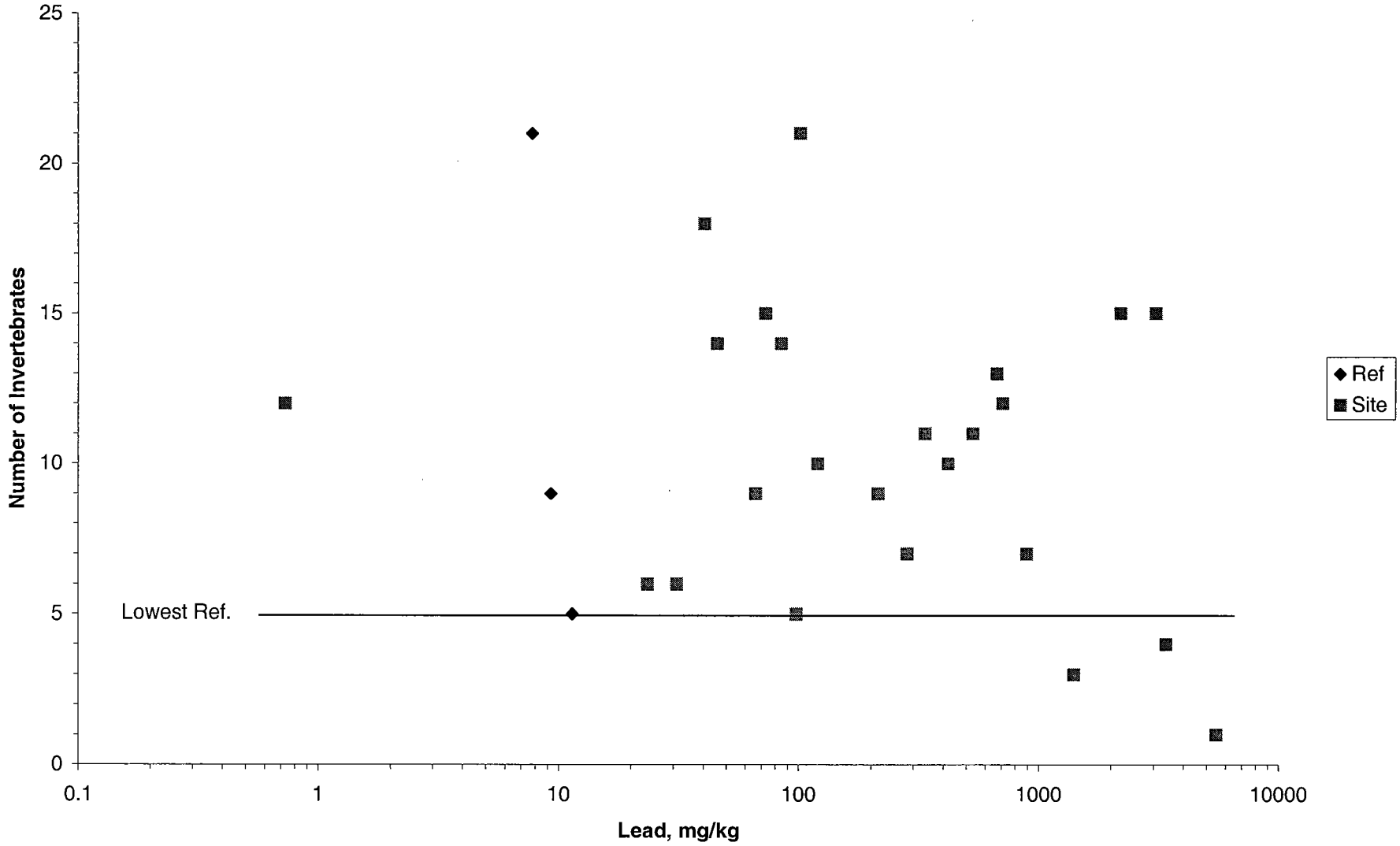
Invertebrate Lead Concentration as a Function of Soil Lead Concentration (Y-intercept not set to Zero)

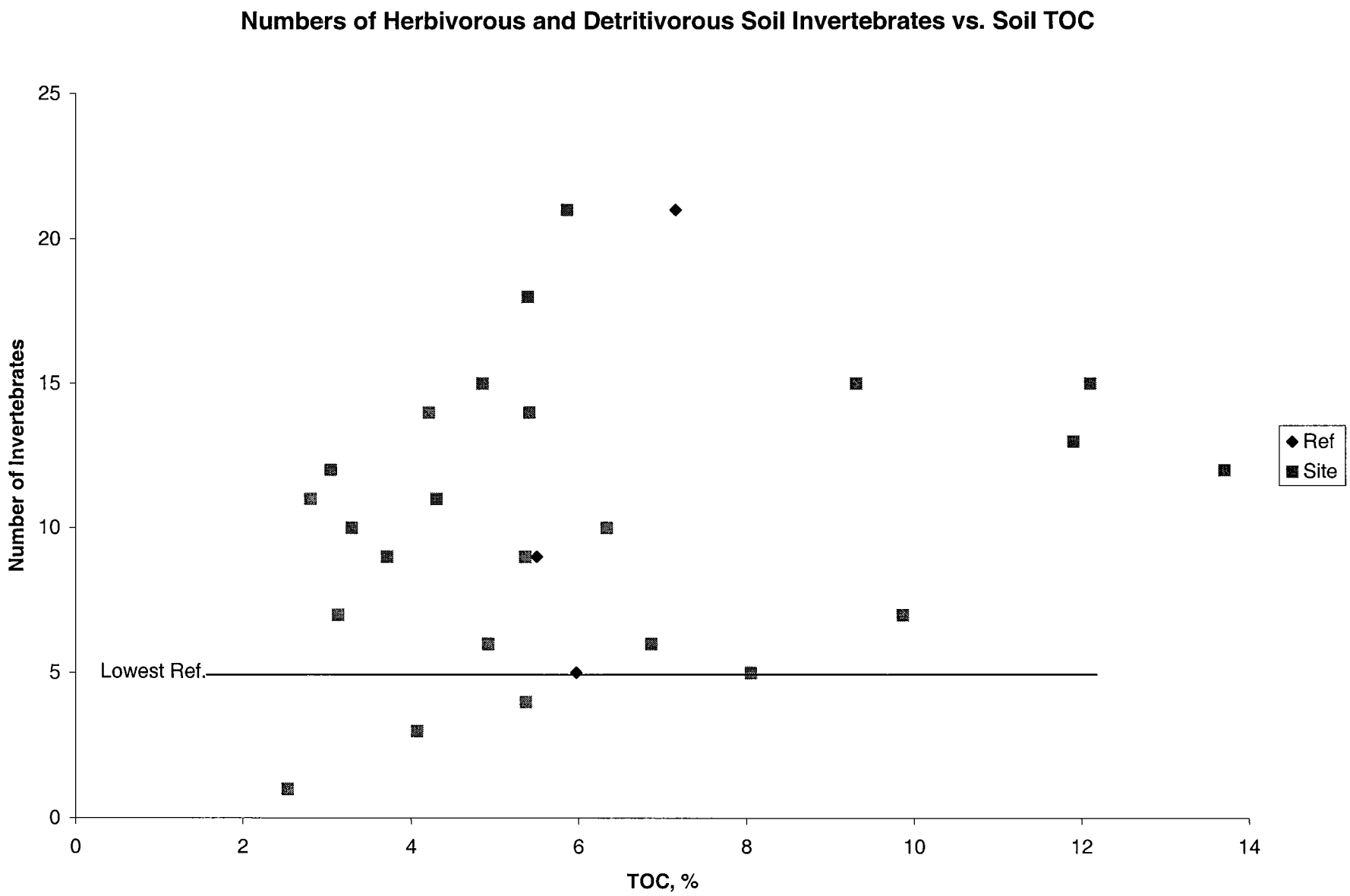


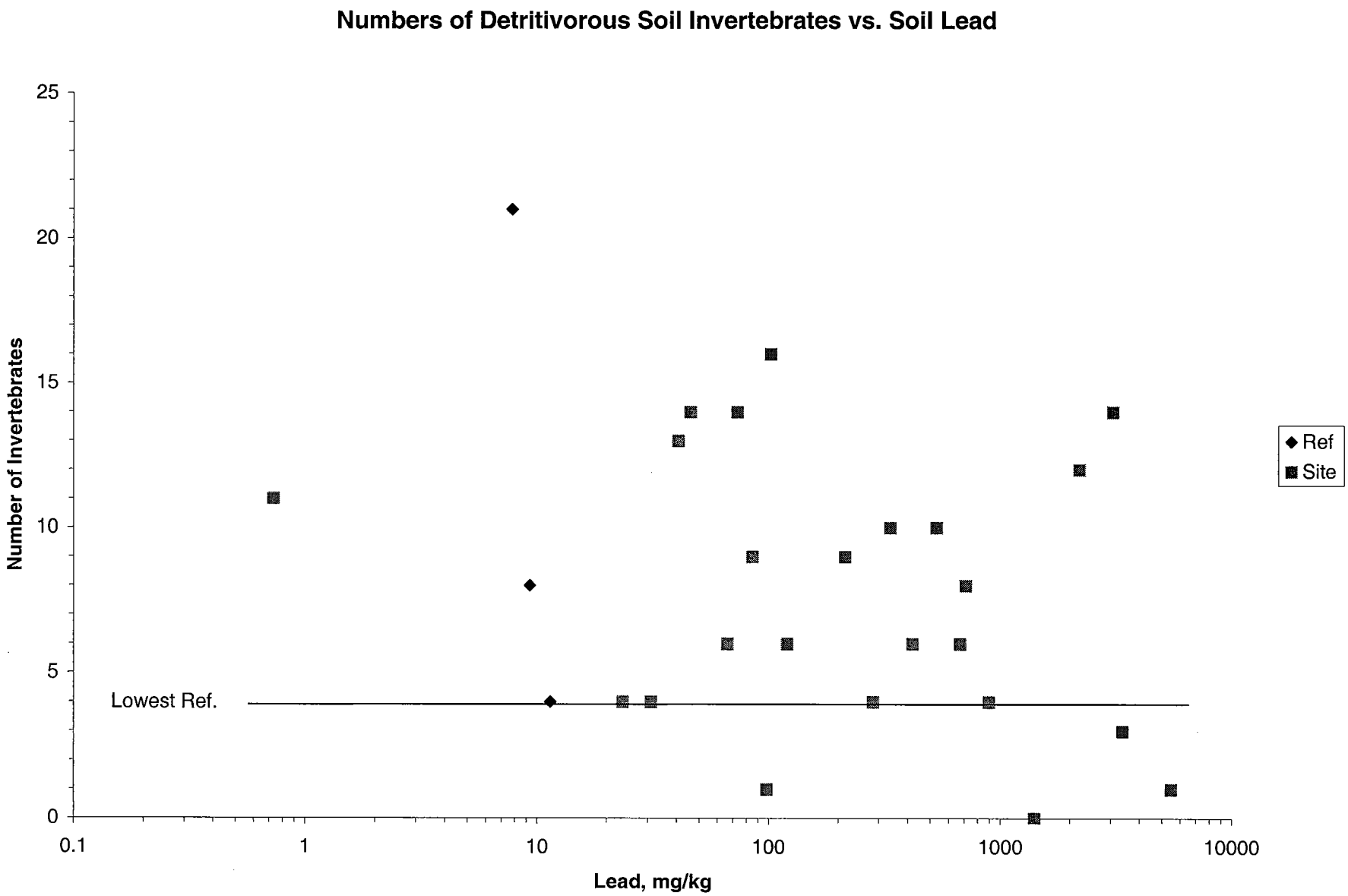

Biomass of Soil Invertebrates vs. Soil Lead
Biomass of Invertebrates, g
0
1
2
3
4
5
6
7
Lowest Ref.
LCL for Ref.
1
10
100
1000
10000
Lead, mg/kg
Ref
Site

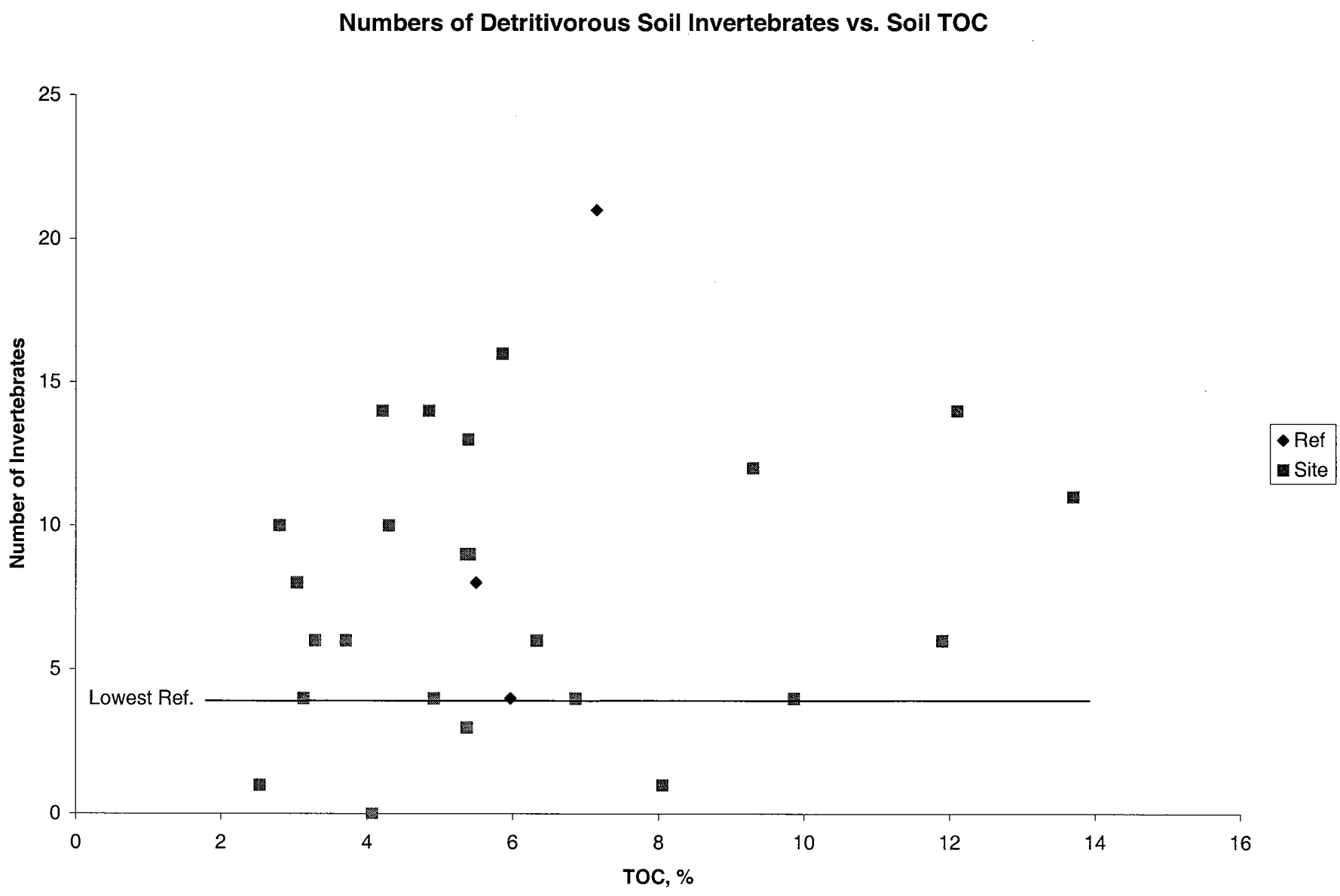

Biomass of Soil Invertebrates vs. Soil TOC
Biomass of Invertebrates, g
TOC, %
0
1
2
3
4
5
6
7
0
2
4
6
8
10
12
14
y = 1.05 + 0.280 x
r2 = 0.36
p = 0.019
Lowest Ref.
Ref
Site

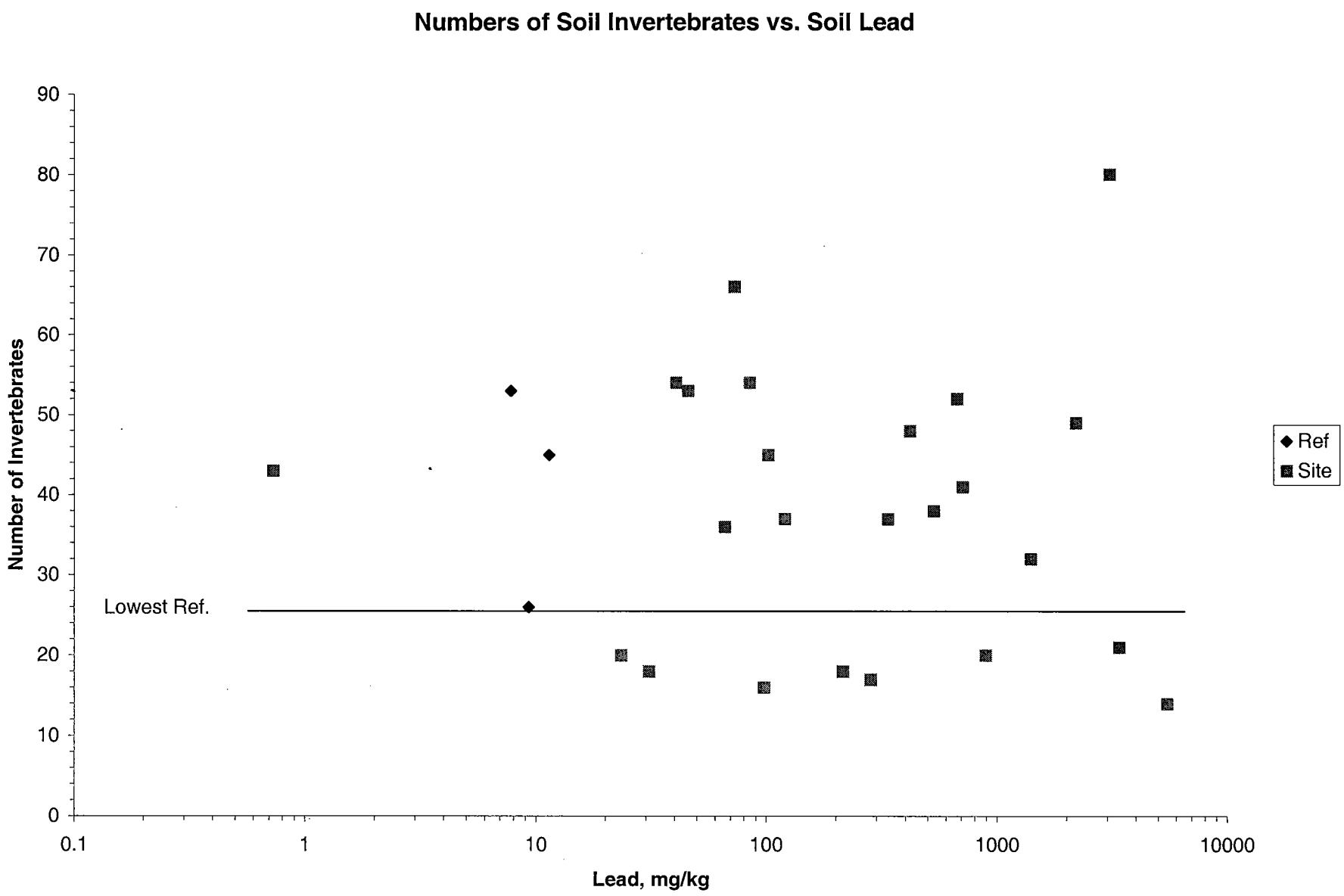
Numbers of Herbivorous and Detritivorous Soil Invertebrates vs. Soil Lead

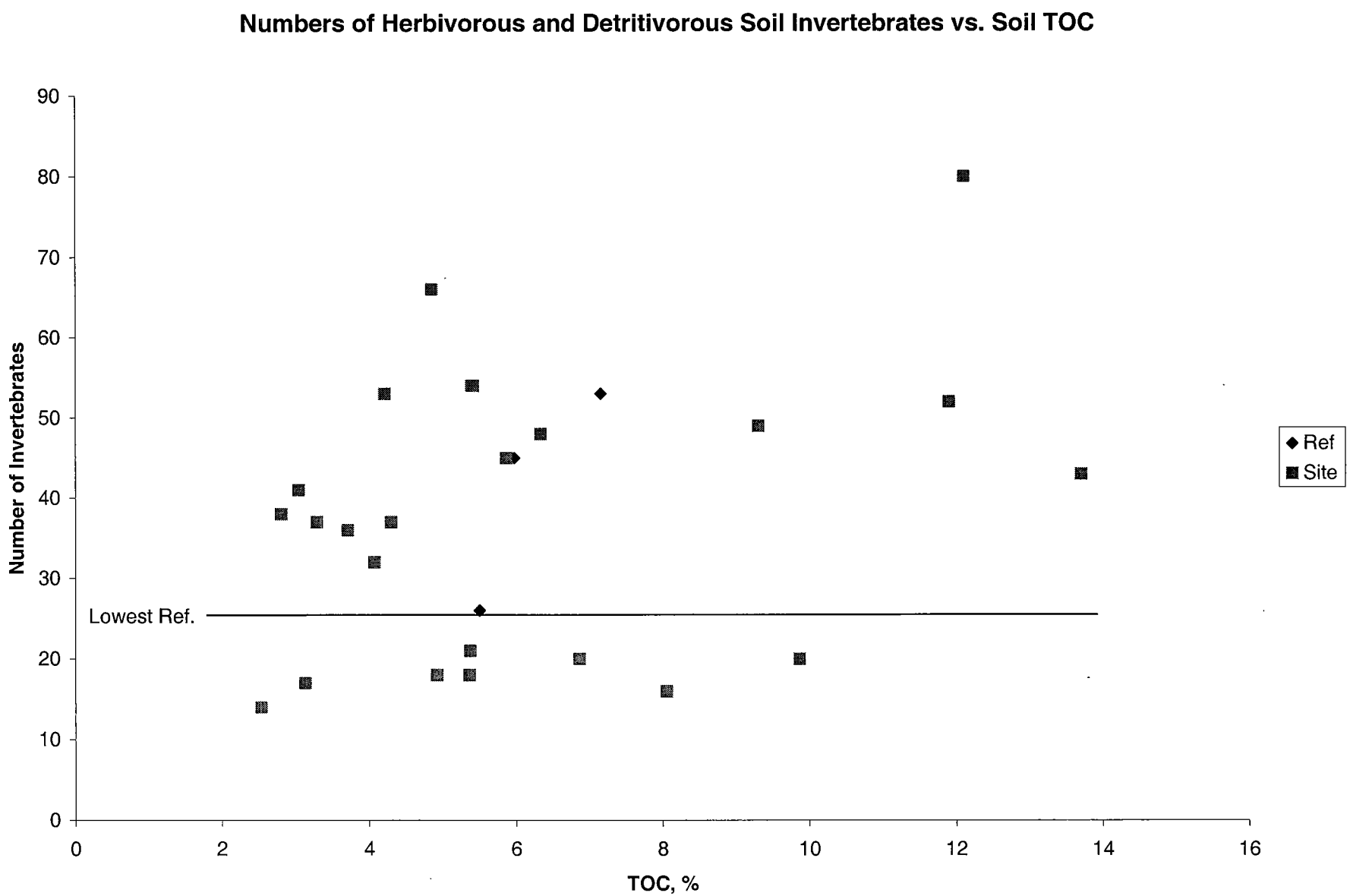


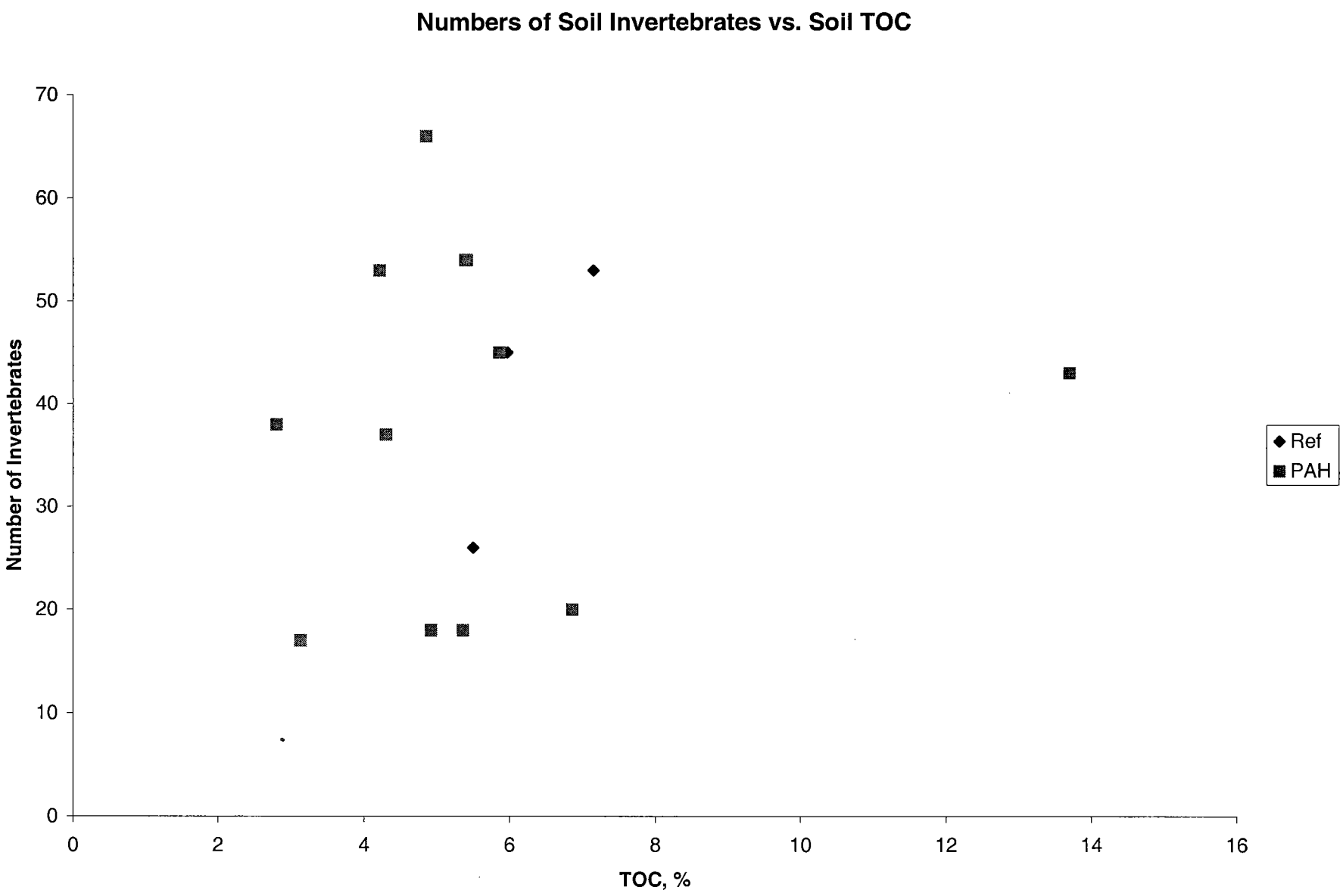

Numbers of Herbivorous and Detritivorous Soil Invertebrates vs. Soil TOC
Number of Invertebrates
25
20
15
10
5
0
Lowest Ref.
0
2
4
6
8
10
12
14
TOC, %
Ref
Site


Numbers of Detritivorous Soil Invertebrates vs. Soil Lead
Number of Invertebrates
25
20
15
10
5
0
Lowest Ref.
0.1
1
10
100
1000
10000
Lead, mg/kg
Ref
Site


Numbers of Detritivorous Soil Invertebrates vs. Soil TOC
Number of Invertebrates
25
20
15
10
5
0
Lowest Ref.
0
2
4
6
8
10
12
14
16
TOC, %
Ref
Site


Numbers of Soil Invertebrates vs. Soil Lead
Number of Invertebrates
90
80
70
60
50
40
30
20
10
0
Lowest Ref.
0.1
1
10
100
1000
10000
Lead, mg/kg
Ref
Site


Numbers of Herbivorous and Detritivorous Soil Invertebrates vs. Soil TOC
Number of Invertebrates
TOC, %
Lowest Ref.
Ref
Site
0
10
20
30
40
50
60
70
80
90
0
2
4
6
8
10
12
14
16


Numbers of Soil Invertebrates vs. Soil TOC
Number of Invertebrates
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
TOC, %
Ref
PAH

APPENDIX G

PRG CALCULATION SPREADSHEETS

Bird (represented by mockingbird) spreadsheet used to calculate soil remediation goals

THI	LOAEL	WR (kg)	CF	AUF	SAs (%)	AF	F	FAs (%)	BAF	Cs(mg/kg)
	(mg/kg/day)						(mg/day)			
1	11.3	0.0490	1.00E+06	1	0.05	1.0	5,040	0.95	0.05	1127

Mammal (represented by shrew) spreadsheet used to calculate soil remediation goals using each of two BAFs

THI	LOAEL	WR (kg)	CF	AUF	SAs (%)	AF	F	FAs (%)	BAF	Cs(mg/kg)
	(mg/kg/day)						(mg/day)			
1	80	0.0055	1.00E+06	1	0.05	1.0	957	0.95	0.14	2512
1	80	0.0055	1.00E+06	1	0.05	1.0	957	0.95	0.05	4716

$$C_S = \frac{TRV \times WR \times CF}{(AUF \times AF \times F) \times (SA_S + BAF \times FA)}$$

THI = target hazard index (set equal to 1.0)
LOAEL = lowest observed adverse effect level (from literature)
WR = weight of receptor
CF = conversion factor (kg to mg)
AUF = area use factor (assumed to be 100%, = 1.0)
SA_s = portion of diet composed of incidentally ingested soil
AF = absorption fraction (assumed to be 100%, = 1.0)
F = total amout of material consumed per day
FA = invertebrates as a portion of diet (1.0 minus portion of soil ingested)
BAF = bioaccumulation factor
Cs = lead concentration in soil

Bird (represented by mockingbird) spreadsheet used to calculate soil remediation goals

THI	LOAEL	WR (kg)	CF	AUF	SAs (%)	AF	F	FAs (%)	BAF	Cs(mg/kg)
	(mg/kg/day)						(mg/day)			
1	11.3	0.0490	1.00E+06	1	0.05	1.0	5,040	0.95	0.05	1127

Mammal (represented by shrew) spreadsheet used to calculate soil remediation goals using each of two BAFs

THI	LOAEL	WR (kg)	CF	AUF	SAs (%)	AF	F	FAs (%)	BAF	Cs(mg/kg)
	(mg/kg/day)						(mg/day)			
1	80	0.0055	1.00E+06	1	0.05	1.0	957	0.95	0.14	2512
1	80	0.0055	1.00E+06	1	0.05	1.0	957	0.95	0.05	4716

$$C_S = \frac{TRV \times WR \times CF}{(AUF \times AF \times F) \times (SA_S + BAF \times FA)}$$

THI = target hazard index (set equal to 1.0)
LOAEL = lowest observed adverse effect level (from literature)
WR = weight of receptor
CF = conversion factor (kg to mg)
AUF = area use factor (assumed to be 100%, = 1.0)
SA_s = portion of diet composed of incidentally ingested soil
AF = absorption fraction (assumed to be 100%, = 1.0)
F = total amout of material consumed per day
FA = invertebrates as a portion of diet (1.0 minus portion of soil ingested)
BAF = bioaccumulation factor
Cs = lead concentration in soil

Bird (represented by mockingbird) spreadsheet showing soil remediation goals (Cs) for three BAF values, two absorption fraction values, two invertebrate food consumption values, and two soil ingestion rate values.

THI	LOAEL (mg/kg/day)	WR (kg)	CF	AUF	SAs (%)	AF (%)	F (mg/day)	FAs (%)	BAF	Cs(mg/kg)
1	11.3	0.0490	1.00E+06	1	0.093	1.0	37,600	0.907	0.071	94
1	11.3	0.0490	1.00E+06	1	0.093	1.0	37,600	0.907	0.04	114
1	11.3	0.0490	1.00E+06	1	0.093	1.0	37,600	0.907	0.014	139
1	11.3	0.0490	1.00E+06	1	0.02	1.0	37,600	0.98	0.071	164
1	11.3	0.0490	1.00E+06	1	0.02	1.0	37,600	0.98	0.04	249
1	11.3	0.0490	1.00E+06	1	0.02	1.0	37,600	0.98	0.014	437
1	11.3	0.0490	1.00E+06	1	0.093	0.72	37,600	0.907	0.071	130
1	11.3	0.0490	1.00E+06	1	0.093	0.72	37,600	0.907	0.04	158
1	11.3	0.0490	1.00E+06	1	0.093	0.72	37,600	0.907	0.014	194
1	11.3	0.0490	1.00E+06	1	0.02	0.72	37,600	0.98	0.071	228
1	11.3	0.0490	1.00E+06	1	0.02	0.72	37,600	0.98	0.04	345
1	11.3	0.0490	1.00E+06	1	0.02	0.72	37,600	0.98	0.014	607
1	11.3	0.0490	1.00E+06	1	0.093	1.0	18,800	0.907	0.071	187
1	11.3	0.0490	1.00E+06	1	0.093	1.0	18,800	0.907	0.04	228
1	11.3	0.0490	1.00E+06	1	0.093	1.0	18,800	0.907	0.014	279
1	11.3	0.0490	1.00E+06	1	0.02	1.0	18,800	0.98	0.071	329
1	11.3	0.0490	1.00E+06	1	0.02	1.0	18,800	0.98	0.04	498
1	11.3	0.0490	1.00E+06	1	0.02	1.0	18,800	0.98	0.014	873
1	11.3	0.0490	1.00E+06	1	0.093	0.72	18,800	0.907	0.071	260
1	11.3	0.0490	1.00E+06	1	0.093	0.72	18,800	0.907	0.04	316
1	11.3	0.0490	1.00E+06	1	0.093	0.72	18,800	0.907	0.014	387
1	11.3	0.0490	1.00E+06	1	0.02	0.72	18,800	0.98	0.071	457
1	11.3	0.0490	1.00E+06	1	0.02	0.72	18,800	0.98	0.04	691
1	11.3	0.0490	1.00E+06	1	0.02	0.72	18,800	0.98	0.014	1213

$$C_S = \frac{TRV \times WR \times CF}{(AUF \times AF \times F) \times (SA_S + BAF \times FA)}$$

THI = target hazard index (set equal to 1.0)
LOAEL = lowest observed adverse effect level (from literature)
WR = weight of receptor
CF = conversion factor (kg to mg)
AUF = area use factor (assumed to be 100%, = 1.0)
SA_s = portion of diet composed of incidemntally ingested soil
AF = absorption fraction
F = total amout of material consumed per day
FA = invertebrates as a portion of diet (1.0 minus portion of soil ingested)
BAF = bioaccumulation factor
Cs = lead concentration in soil

Mammal (represented by shrew) spreadsheet showing soil remediation goals (Cs) for three BAF values and two absorption fraction values.

THI	LOAEL	WR (kg)	CF	AUF	SAs (%)	AF (%)	F (mg/d)	FA (%)	BAF	Cs(mg/kg)
	(mg/kg/day)									
1	80	0.0055	1.00E+06	1	0.015	1	3300	0.985	0.014	4631
1	80	0.0055	1.00E+06	1	0.015	0.72	3300	0.985	0.014	6432
1	80	0.0055	1.00E+06	1	0.015	1	3300	0.985	0.04	2451
1	80	0.0055	1.00E+06	1	0.015	0.72	3300	0.985	0.04	3404
1	80	0.0055	1.00E+06	1	0.015	1	3300	0.985	0.071	1570
1	80	0.0055	1.00E+06	1	0.015	0.72	3300	0.985	0.071	2180

$$C_S = \frac{TRV \times WR \times CF}{(AUF \times AF \times F) \times (SA_S + BAF \times FA)}$$

THI = target hazard index (set equal to 1.0)
LOAEL = lowest observed adverse effect level (from literature)
WR = weight of receptor
CF = conversion factor (kg to mg)
AUF = area use factor (assumed to be 100%, = 1.0)
SA_s = portion of diet composed of incidemntally ingested soil
AF = absorption fraction
F = total amout of material consumed per day
FA = invertebrates as a portion of diet (1.0 minus portion of soil ingested)
BAF = bioaccumulation factor
Cs = lead concentration in soil