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Site Screening Process Report

Site 2 – Waste Crankcase Oil Applied to Torrense Road
Site 4 – Lloyd Road Oil Spills
Site 23 – Hydraulic Oil Discharges from Extrusion Plant

Naval Support Facility,
Indian Head
Indian Head, Maryland

Naval Facilities Engineering Command
Washington

Contract Number N62472-03-D-0057
Contract Task Order 007

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SITE SCREENING PROCESS REPORT

SITE 2 – WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
SITE 4 – LLOYD ROAD OIL SPILLS
SITE 23 – HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT

NAVAL SUPPORT FACILITY, INDIAN HEAD
INDIAN HEAD, MARYLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS AND ABBREVIATIONS

B&R	Brown & Root
BERA	baseline ecological risk assessment
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COPC	chemical of potential concern
CTO	Contract Task Order
DAF	dilution attenuation factor
DoN	Department of the Navy
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
FFA	Federal Facility Agreement
FS	feasibility study
Hart	Fred C. Hart Associates
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IHDIV-NSWC	Indian Head Division, Naval Surface Warfare Center
IHIRT	Indian Head Installation Restoration Team
ILCR	incremental lifetime cancer risk
IW18	Industrial Wastewater Outfall 18
MDE	Maryland Department of the Environment
MS	matrix spike
MSD	matrix spike duplicate
NOEC	no observed effects concentration
NPDES	National Pollution Discharge Elimination System
NSA	Naval Support Activity
NSF-IH	Naval Support Facility, Indian Head
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	probable effects level
QA	quality assurance

QC	quality control
RBC	risk-based concentration
RI	remedial investigation
SOW	Statement of Work
SQG	Soil Quality Guideline
SSA	Site Screening Area
SSL	soil screening level
SSP	Site Screening Process
TAL	Target Analyte List
TCL	Target Compound List
TEC	threshold effects concentration
TtNUS	Tetra Tech NUS, Inc.
UTL	upper tolerance limit

EXECUTIVE SUMMARY

INTRODUCTION

This Site Screening Process (SSP) Report for Naval Support Facility, Indian Head (NSF-IH) in Indian Head, Maryland was prepared by Tetra Tech NUS, Inc. (TtNUS) in response to Contract Task Order 007 under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-D-03-0057. NSF-IH is a Naval Support Activity (NSA), South Potomac facility within the Naval District Washington Region. The report describes the SSP for Site 2 – Waste Crankcase Oil Applied to Torrense Road, Site 4 – Lloyd Road Oil Spills, and Site 23 – Hydraulic Oil Discharges from Extrusion Plant.

The objective of the SSP was to collect and evaluate sufficient data to provide the basis for a determination that either: (1) additional investigation or remediation is needed or (2) the area does not pose a threat or potential threat to public health, welfare, or the environment and should be removed from further study under the Federal Facility Agreement (FFA) (EPA Region 3 and DoN, 2000). The field investigations leading to this report were outlined in a site-specific work plan (TtNUS, 2005) that detailed the environmental samples and analytical methods needed to make decisions for these sites.

Site 2 – Waste Crankcase Oil Applied to Torrense Road

Site 2 is located in the northern portion of the Main Area. Prior to 1965, waste oil from Transportation Branch buildings was reportedly applied to unpaved Torrense Road behind Building 290 (Public Works maintenance garage) for dust control. The waste oil consisted of crankcase, hydraulic, transmission, and motor oils. The amount of oil and frequency of application are not known. Torrense Road is now paved. Chemicals present in the waste oil would have been deposited directly on the roadway and could have migrated to adjacent areas via overland flow.

Site 4 – Lloyd Road Oil Spills

Site 4 is located in the northern portion of the Main Area and covers a relatively small area of the wooded hillside between Building 290 (Public Works maintenance garage) and Lloyd Road. Waste oil from Public Works maintenance operations were deposited in a dumpster near Building 290 prior to 1981. The waste oil consisted of fuel oil, motor oil, and kerosene. These wastes reportedly leaked from the dumpster on two or three occasions. The total volume of leakage was estimated at 50 to 100 gallons. An underground tank was installed to replace the dumpster. Waste oil is no longer stored in the area, and the tank and any associated contaminated soil have been removed. Chemicals present in waste oil reportedly spilled at the site would have been deposited in the immediate area of the spill and could have migrated down the hillside toward Lloyd Road via overland flow.

Site 23 – Hydraulic Oil Discharges from Extrusion Plant

Site 23 is located in the southern portion of the Main Area near Mattawoman Creek. From approximately 1943 to 1981, an unknown amount of hydraulic oil from press lines at Buildings 560 through 566 was discharged with wastewater used to cool pumps and press dies. Wastewater from these facilities discharged to floor drains into sewer lines that discharged to Industrial Wastewater Outfall 18 (IW18). The discharge from the outfall pipe flowed through a drainage swale for approximately 150 feet before entering Mattawoman Creek. An oil/water separator for this discharge was installed in 1981. The floor drains in the press line buildings have been sealed and no longer discharge to IW18. Industrial wastewater discharges to IW18 have ceased, and the outfall has been removed from the National Pollutant Discharge Elimination System (NPDES) permit. The quantity of hydraulic oil that was present in the wastewater is not known. Contaminants present in the wastewater that discharged from the outfall pipe would have been deposited in the drainage swale or entered Mattawoman Creek.

FIELD INVESTIGATIONS AND DATA EVALUATION

Prior to the SSP investigations, no environmental sampling had been conducted at Sites 2, 4, and 23. The FFA designated these sites for an SSP to determine whether the sites should proceed to a remedial investigation.

Site 2 – Waste Crankcase Oil Applied to Torrense Road

Ten surface soil samples were collected from a depth of 0 to 1 foot below ground surface (bgs). Five samples were collected along each side of Torrense Road. Quality control (QC) samples (duplicates and blanks) were also collected. All samples were analyzed for polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, and cyanide. PAHs and metals were detected in all samples, and cyanide was detected in most samples. PCBs were not detected in any sample.

The human health risk characterization resulted in an incremental lifetime cancer risk (ILCR) of 4.6E-06, which is within the United Stated Environmental Protection Agency (EPA) acceptable risk range of 1.0E-04 to 1.0E-06. The hazard index (HI) was less than the EPA target level of 1.0. Therefore, there are no unacceptable risks to human health under a residential use scenario.

Based on the ecological risk evaluation, potential impacts, if any, are acceptable, and the risks are not great enough to warrant having the site proceed further in the ecological risk assessment (ERA) process.

The potential for migration of surface soil contaminants to groundwater is not considered to be problematic.

Site 4 – Lloyd Road Oil Spills

Three surface soil samples were collected from a depth of 0 to 1 foot bgs from the hillside near the reported spill area. QC samples were also collected. All samples were analyzed for PAHs, PCBs, TAL metals, and cyanide. PAHs, PCBs, metals, and cyanide were detected in all samples.

The human health risk characterization did not estimate an ILCR because EPA has not established a cancer slope factor for any of the COPCs. The HI for each target organ was less than the EPA target level of 1.0. Therefore, there are no unacceptable risks to human health based on a residential use scenario.

Based on the ecological risk evaluation, potential impacts, if any, are acceptable, and risks are not great enough to warrant having the site proceed further in the ERA process.

The potential for migration of surface soil contaminants to groundwater is not considered to be problematic.

Site 23 – Hydraulic Oil Discharges from Extrusion Plant

Two sediment samples were collected from a depth of 0 to 6 inches bgs from the drainage swale between the discharge outfall pipe and Mattawoman Creek. QC samples were also collected. All samples were analyzed for PAHs, PCBs, explosives, TAL metals, and cyanide. PAHs, the explosive nitrocellulose, metals, and cyanide were detected at both sample locations, and the PCB Aroclor-1260 was detected at one location.

The human health risk characterization resulted in an ILCR of 3.8E-06, which is within the EPA acceptable risk range. The total HI was not estimated because EPA has not established a reference dose for benzo(a)pyrene, which was the only COPC identified. Therefore, there are no unacceptable risks to human health based on a residential use scenario.

Based on the ecological risk evaluation, potential impacts to sediment invertebrates from chemicals in the sediment are not expected.

The potential for migration of sediment contaminants to groundwater is not considered to be problematic.

CONCLUSIONS AND RECOMMENDATIONS

- There are no unacceptable risks to human health based on a residential use scenario at any of the sites.

- Potential impacts to ecological receptors exposed to surface soil, if any, are acceptable, and the risks are not great enough to warrant having Sites 2 or 4 proceed further in the ERA process.

- Potential impacts to ecological receptors exposed to Site 23 sediment are not expected.

- The potential for migration of surface soil and sediment contaminants to groundwater is not considered to be problematic.

- Past activities at Sites 2, 4, and 23 have not resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern.

- Based on the nature and extent of the chemicals detected in surface soil and sediment, the human health risk screening, the ecological risk screening, and risk management decisions, Sites 2, 4, and 23 do not pose a threat or potential threat to public health, welfare, or the environment. Therefore, these areas should be removed from further study under the FFA.

1.0 INTRODUCTION

This Site Screening Process (SSP) Report for Naval Support Facility, Indian Head (NSF-IH) in Indian Head, Maryland was prepared by Tetra Tech NUS, Inc. (TtNUS) in response to Contract Task Order (CTO) 007 under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-03-D-0057. NSF-IH is a Naval Support Activity (NSA), South Potomac facility within the Naval District Washington Region. The report describes the SSP for Site 2 – Waste Crankcase Oil Applied to Torrense Road, Site 4 – Lloyd Road Oil Spills, and Site 23 – Hydraulic Oil Discharges from Extrusion Plant.

1.1 PURPOSE AND REPORT ORGANIZATION

The purpose of the SSP is to determine whether operations at Sites 2, 4, or 23 have resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern. Sites 2, 4, and 23 are among the Site Screening Areas (SSAs) identified in Appendix A of the Federal Facility Agreement (FFA) (EPA Region 3 and DoN, 2000). SSAs are those geographical areas with suspected contamination that will require some level of investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program.

Section 1.0 presents the purpose, objectives, and scope of this report and summarizes facility background information. Sections 2.0 and 3.0 provide the general investigative procedures and evaluation methods, respectively. Sections 4.0, 5.0, and 6.0 provide the results of the SSP for Sites 2, 4, and 23, respectively.

1.2 OBJECTIVE AND SCOPE

The objective of the SSP investigation was to collect sufficient data to provide the basis for a determination that either: (1) a remedial investigation (RI)/feasibility study (FS), an FS, another investigation, and/or removal action, as appropriate, is required at the area addressed by the SSP or (2) the area does not pose a threat or potential threat to public health, welfare, or the environment and therefore the area should be removed from further study under the FFA. The general scope of the SSP investigations at Sites 2, 4, and 23 was agreed upon by the Indian Head Installation Restoration Team (IHIRT) through approval of the SSP Investigation Work Plan (TtNUS, 2005).

The investigation process consisted of research, media sampling, and analytical data evaluation. The research consisted of a review of historical facility documents related to the operations at Sites 2, 4,

and 23. Surface soil samples were collected at Sites 2 and 4, and sediment samples were collected at Site 23. Analytical data were evaluated via a formal data validation process, background comparisons, and human health and ecological risk screening analyses.

1.3 FACILITY BACKGROUND

NSF-IH is located in northwestern Charles County, Maryland. As shown on Figure 1-1, NSF-IH is approximately 25 miles southwest of Washington, D.C. NSF-IH is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. As shown on Figure 1-2, the Main Area is bounded by the Potomac River on the northwest, west, and south, Mattawoman Creek to the south and east, and the Town of Indian Head to the northeast. Stump Neck Annex is located across Mattawoman Creek and is not contiguous with the Main Area. The locations of Sites 2, 4, and 23 are shown on Figure 1-2.

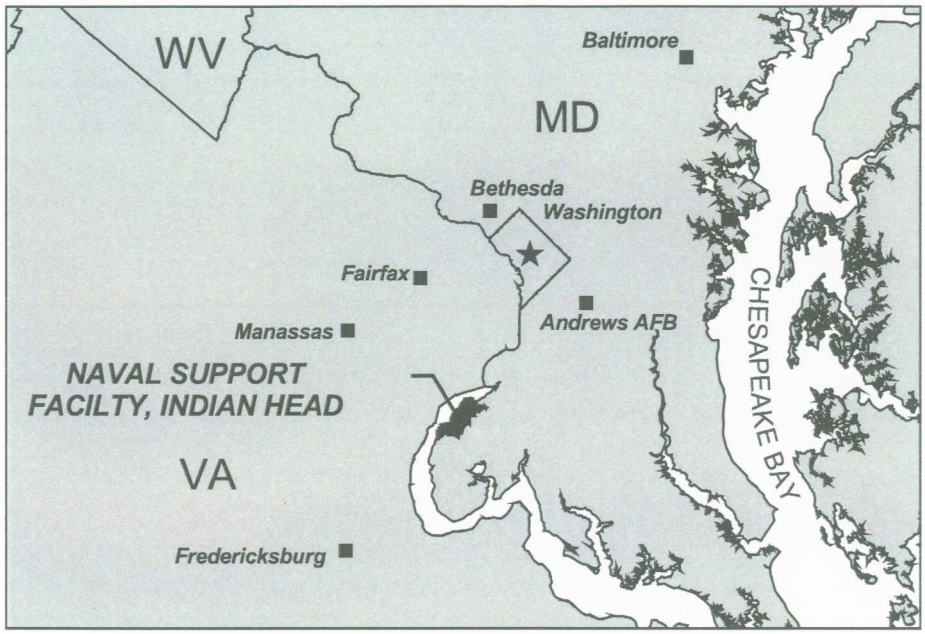
The primary mission of the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), the main tenant of NSF-IH, is as follows:

- To provide services in energetics for all warfare centers through engineering, fleet and operation support, manufacturing technology, limited production, and industrial base support.

- To provide research, development, testing, and evaluation of energetic materials, ordnance devices and components, and other related ordnance engineering standards including chemicals, propellants and their propulsion systems, explosives, pyrotechnics, warheads, and simulators.

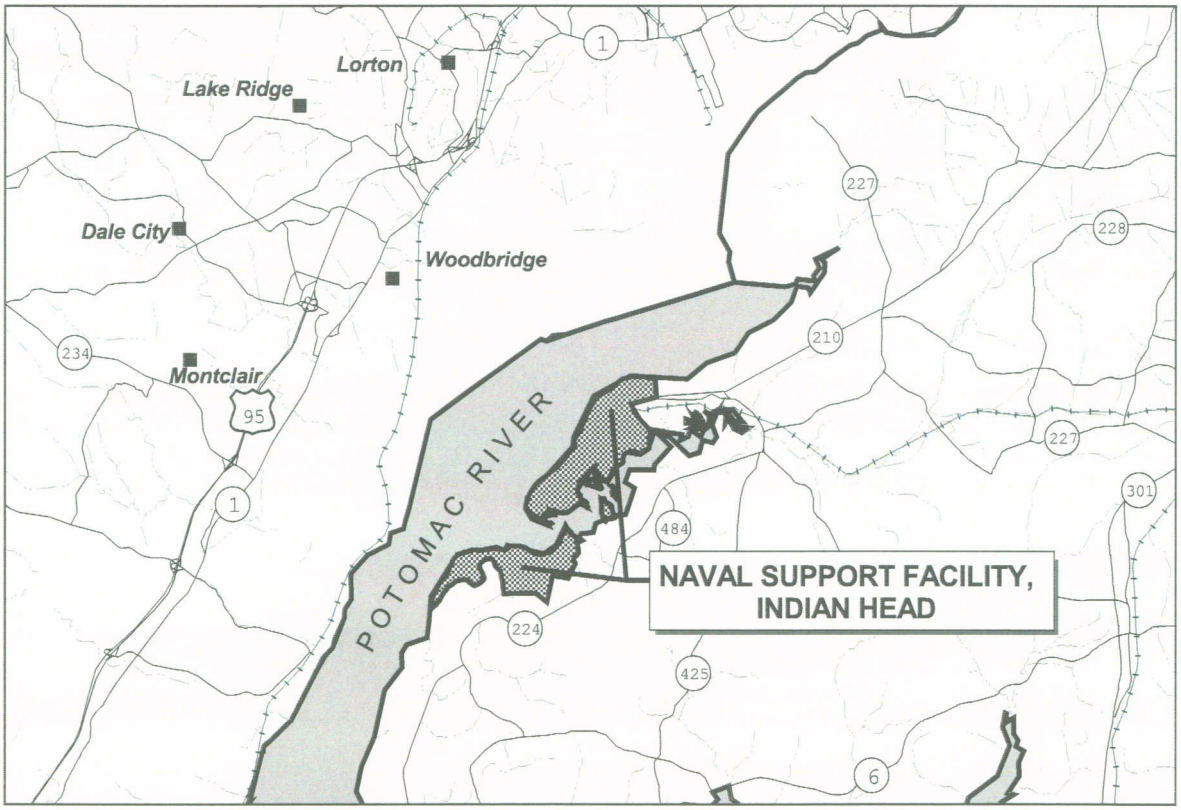
- To provide support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

- To execute other responsibilities as assigned by the Commander of the IHDIV-NSWC.



LEGEND

- City
- Highway
- Railroad
- River



DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NO.
K. PEILA	3/17/05		2194	0006
CHECKED BY	DATE	FACILITY LOCATION MAP	APPROVED BY	DATE
K. TURNBULL	10/25/05	NAVAL SUPPORT FACILITY, INDIAN HEAD	KCT	10/25/05
COST/SCHEDULE-AREA		INDIAN HEAD, MARYLAND	APPROVED BY	DATE
			—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 1 - 1	0

P:\GIS\NSWC_INDIAN_HEAD\SITE57_PILOTSTUDY_SITELOCATION.APR FACILITY LOCATION MAP 10/25/05 AJ

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SSP SITES2_4_23 LAYOUT 10/25/05 AJ

DRAWN BY K. PEILA DATE 6/01/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2194	OWNER NUMBER 0007
CHECKED BY K. TURNBULL DATE 10/25/05	SITE LOCATION MAP SSP SITES 2, 4 AND 23 NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY KCT DATE 10/25/05	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 1 - 2	REV 0

2.0 GENERAL INVESTIGATIVE PROCEDURES

Investigations at Sites 2, 4, and 23 were conducted in accordance with the SSP Work Plan (TtNUS, 2005). This plan was developed to identify the presence or absence of contaminants at these sites. Surface soil samples were collected at Sites 2 and 4, and sediment samples were collected at Site 23.

2.1 FIELD SAMPLING

2.1.1 Surface Soil Sampling

Ten surface soil samples were collected from a depth interval of 0 to 1 foot below ground surface (bgs) from locations along Torrense Road (Site 2). Three surface soil samples were collected from the same depth interval from the area of the suspected release at Site 4. A shovel was used to remove the sod (typically 3 inches thick) at each sampling location. After the sod was removed, a dedicated, plastic, disposable trowel was used to dig to approximately 1 foot bgs. Another trowel was then used to continue digging and composite soil in the pit prior to filling the required sample containers. Sample log sheets and chain of custody forms are provided in Appendix A.

2.1.2 Sediment Sampling

Two sediment samples were collected from a drainage ditch downstream from the outfall pipe that discharged wastewater associated with Site 23. The samples were collected from the top 0 to 6 inches of the streambed using dedicated, plastic, disposable trowels and placed into the required sample containers. Flowing water was present in the drainage ditch at the time of sample collection. Sample log sheets and chain of custody forms are provided in Appendix A.

2.1.3 Quality Control Samples

Quality assurance/quality control (QA/QC) samples were collected in accordance with the work plan (TtNUS, 2005) and included field duplicates, an equipment (rinsate) blank, and matrix spike (MS) and matrix spike duplicate (MSD) samples. One field duplicate was collected at each site. One rinsate blank was generated by pouring reagent grade water over an unused trowel. One MS/MSD sample was collected for each medium (i.e., surface soil and sediment).

2.2 LABORATORY ANALYSES

The surface soil samples from Sites 2 and 4 were analyzed for polynuclear aromatic hydrocarbons (PAHs), Target Compound List (TCL) polychlorinated biphenyls (PCBs), and Target Analyte List (TAL)

metals including cyanide. The sediment samples from Site 23 were analyzed for the same parameters plus explosives, nitrocellulose, nitroglycerin, and nitroguanidine. The following analytical methods were used:

- PAHs via SW-846 Method 8310
- PCBs via SW-846 Method 8082
- TAL metals and cyanide via Contract Laboratory Program (CLP) Statement of Work (SOW) ILM4.0
- Explosives and nitroguanidine via SW-846 Method 8330
- Nitroglycerin via SW-846 Method 8332
- Nitrocellulose via United States Environmental Protection Agency (EPA) Method 353.2

2.3 INVESTIGATION-DERIVED WASTE HANDLING

The sampling trowels and miscellaneous trash generated during sampling activities were double bagged in plastic trash bags and disposed in a dumpster at the facility.

2.4 SURVEYING

Surveying of the sampling locations was not necessary. The samples were collected near permanent structures, and the sampling locations were measured from fixed points associated with the structures.

3.0 GENERAL DATA EVALUATION METHODS

3.1 DATA VALIDATION

All samples were subjected to data validation. Data validation is an objective, systematic process in which analytical data are reviewed to ascertain the validity of the reported results and to identify for the data user the possible limitations of these results. This section summarizes the various aspects of the data validation process. Appendix B contains the analytical data for all samples. Data validation memoranda are provided in Appendix C.

3.1.1 General Data Validation Procedures

Validation of the data generated for samples collected during the field effort was completed in accordance with EPA National Functional Guidelines for Organic and Inorganic Data Review as modified for use in EPA Region 3 (EPA, 1994a and 1993).

The organic data review was based on data completeness, system performance, holding times, initial and continuing calibrations, field and laboratory method blank contamination, surrogate spike recoveries, blank spike results, MS/MSD results, field and laboratory duplicate results, compound identification, compound quantitation, and detection limits.

The inorganic data review was based data completeness, holding times, calibration data, field and laboratory method/preparation blanks, interference check sample results, MS results, field and laboratory duplicate precision, laboratory control sample results, inductively coupled plasma serial dilution results, detection limits, and analyte quantitation.

Evaluation of laboratory and field QC blanks aided in the elimination of false positive results, which were identified as laboratory and/or field artifacts. Noncompliances observed during the validation process resulted in qualification of analytical data. The qualifiers alert the data user to imprecise or estimated results and, in the worst case, unreliable or unusable data.

The results of the validation process were summarized in sample delivery group-specific technical reports consisting of a memorandum, qualified analytical results, results as reported by the laboratory, and supporting documentation that provided the rationale for changes and/or qualification of the data. These memoranda provide a detailed explanation of the results of the data validation review. Copies of the data validation memoranda are included in Appendix C. All other data validation documentation is retained on file at the TtNUS Pittsburgh, Pennsylvania office.

3.1.2 Data Validation Qualifiers

Various qualifiers were attached to analytical data by the laboratory and as a result of the data validation process. The attachment of data qualifiers to analytical results signifies the occurrence of QC noncompliance. The data qualifiers assigned to the analytical results for Sites 2, 4, and 23 are defined as follows:

- B – This qualifier is added to a positive result reported by the laboratory if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis. The result is considered to be a false positive.

- J – Indicates that the chemical was detected. However, based on laboratory noncompliances, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The concentration reported by the laboratory is considered to be an estimated value. The bias (high or low) of this result cannot be determined.

- K – Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The concentration reported by the laboratory is considered to be biased high based on laboratory noncompliances noted during the data validation process.

- L – Indicates that the chemical was detected. However, the associated numerical result is not a precise representation of the amount that is actually present in the sample. The concentration reported by the laboratory is considered to be biased low based on laboratory noncompliances noted during the data validation process.

- U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific quantitation limit) noted. Nondetect results are reported in this manner by the laboratory.

- UJ – Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be estimated based on problems encountered during laboratory analysis, as noted during the data validation process. The associated numerical detection limit is regarded as inaccurate or imprecise. The bias (high or low) of this result cannot be determined.

- UL – Indicates that the chemical was not detected. However, the detection limit (sample-specific quantitation limit) is considered to be biased low based on problems encountered during laboratory

analysis, as noted during the data validation process. The associated numerical detection limit is regarded as inaccurate or imprecise.

- UR – Indicates that the chemical may or may not be present. The nondetect analytical result reported by the laboratory is considered to be unreliable and unusable. During the data validation process, this qualifier is applied in cases of gross laboratory technical deficiencies (i.e., holding times missed by a factor two times the specified time limit, severe calibration noncompliances, and extremely low QC recoveries.

The preceding data qualifiers may be categorized as indicative of major or minor problems. Major problems are defined as issues that result in the rejection of data, qualified with UR data validation qualifiers. These data are considered invalid and were not used for risk screening analysis or decision-making purposes. Minor problems are defined as issues resulting in estimation of data, qualified with B, J, K, L, U, UJ, and UL data validation qualifiers. Analytical results qualified as estimated or biased are suitable for risk screening analysis and decision-making purposes.

3.2 BACKGROUND DATABASE

A basewide background investigation was conducted at NSF-IH in 1997 (B&R Environmental, 1997). Additional background samples were collected, and the background investigation was revised in 2002 (TtNUS, 2002). The purpose of this investigation was to establish a basewide background database that would be used as a tool to evaluate analytical results for soil. The data are used to determine whether soil samples collected at NSF-IH contain chemicals at concentrations that are higher than naturally occurring background concentrations.

With few exceptions, the inorganic concentrations reported in background surface soils are within the range of background concentrations reported for surface soils in the eastern United States (Shacklette and Boerngen, 1984) and the State of Maryland (Dragun, 1991).

The background values for surface soil are presented in Table 3-1. For the SSP, the 95-percent upper tolerance limit (UTL) was used as the threshold background concentration. Chemicals detected in surface soil samples at concentrations less than background were not considered as chemicals of potential concern (COPCs).

Surface soil background concentrations were also used to represent background sediment concentrations for sediment samples collected from an intermittent drainage ditch. Because of the intermittent nature of the ditch, it is assumed that the source of sediment in the ditch would be the surrounding soil.

3.3 HUMAN HEALTH RISK SCREENING METHODOLOGY

The purpose of the human health risk screening was to conservatively estimate the potential risks to human health so that management decisions can be made (e.g., additional study or no further action). The risk screening analysis conducted for SSP sites consists of the following steps, which are similar to those in a baseline human health risk assessment:

- Data evaluation (i.e., selection of COPCs)
- Exposure assessment
- Toxicity assessment
- Risk characterization

The risk screening analysis is based on the methodologies used to calculate EPA Region 3 risk-based concentrations (RBCs) (EPA, 2003) to conservatively assess potential exposure and toxicity to human receptors. The RBCs for soil are based on a lifetime resident for carcinogens and a child resident for noncarcinogens. Residential soil RBCs were also used to evaluate chemicals detected in sediment samples.

3.3.1 Selection of Chemicals of Potential Concern

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

- Occurrence and distribution of chemicals in environmental media
- Chemical toxicity
- Comparison of site-specific concentrations with representative basewide background concentrations

3.3.1.1 Occurrence and Distribution

The initial list of COPCs included any chemical detected at least once in environmental samples. Essential human nutrients not otherwise known to be associated with the site (calcium, magnesium, potassium, and sodium) and present at low concentrations and toxic only at high doses were not included in the initial list of COPCs.

3.3.1.2 Chemical Toxicity

After the initial list of COPCs was completed, the data were further screened on the basis of chemical toxicity. For the purposes of this report, the values used to select COPCs based on chemical toxicity are referred to as “risk screening levels.” In general, if the maximum detected concentration was greater than

a risk screening level, the chemical was identified as a COPC. Because of the additive noncarcinogenic effects of some chemicals (some chemicals impact the same target organs or exhibit similar mechanisms of action), one-tenth of the RBC for noncarcinogenic effects was used as the risk screening level.

For soil and sediment, the following risk screening levels were used to select COPCs:

- EPA Region 3 RBCs for soil ingestion under residential land use (EPA, 2005a)
- EPA Region 3 soil screening levels (SSLs) for migration of chemicals to groundwater (EPA, 2005a)
- Federal SSLs for inhalation (transfers from soil to air) (EPA, 2004)

EPA Region 3 SSLs for migration to groundwater have not been developed for all chemicals. For chemicals without a Region 3 SSL, federal SSLs were used, if available. For this report, federal SSLs were used for 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, mercury, and nickel. Table 3-2 summarizes the human health risk screening levels for soil and sediment.

3.3.1.3 Background

COPCs for inorganics in soil and sediment were also selected based on a comparison of site concentrations to representative basewide background concentrations. If the maximum detected concentration was higher than both the risk screening level and the representative background concentration, the chemical was retained as a COPC for further risk evaluation. If the maximum concentration was less than the background concentration, the chemical was not retained as a COPC.

3.3.2 Exposure Assessment

The human health exposure assessment defines and evaluates, quantitatively or qualitatively, the type and magnitude of human exposure to the COPCs. Potential human exposure to environmental media at Sites 2, 4, and 23 is expected to be limited. Based on the current and anticipated future land use and location of the sites, military personnel, civilian employees, contractors, and trespassers are the most likely individuals exposed. However, to evaluate the sites on a conservative basis, the risks were evaluated based on a hypothetical future residential exposure scenario.

For purposes to the risk screening analysis, maximum detected site concentrations and exposure assumptions used to derive the EPA Region 3 RBCs for soil ingestion and SSLs for inhalation (transfers from soil to air) were used to assess potential exposure to environmental media.

3.3.3 Risk Characterization

The equations and exposure factors used by EPA Region 3 to calculate RBCs based on residential land use were used to estimate potential carcinogenic and noncarcinogenic risks at Sites 2, 4, and 23. For carcinogens, the incremental lifetime cancer risk (ILCR) was calculated for each COPC by dividing the maximum concentration by the RBC based on an ILCR of 1E-6. The individual ILCRs were added and compared to the EPA target risk range of 1E-6 to 1E-4. If the total ILCR is within or less than this range, no action is needed at a site based on potential carcinogenic risk. For noncarcinogens, the hazard quotient (HQ) was calculated for each COPC by dividing the maximum concentration by the RBC based on an HQ of 1.0. The individual HQs were added to calculate the hazard index (HI), which was compared to the EPA target level of 1.0. If the HI is less than this value, no action is needed based on potential noncarcinogenic risk.

3.4 ECOLOGICAL RISK SCREENING METHODOLOGY

The screening-level ecological risk assessment (ERA) was conducted in accordance with EPA guidance (EPA, 1997 and 1998) and Navy policy (DoN, 1999). Steps 1 and 2 consist of a site visit, pathway identification/problem formulation, toxicity evaluation, exposure estimation, and risk calculation. Step 3A of the Navy approach consists of refining the conservative exposure assumptions, which may result in a reduced list of COPCs.

The goal of this ecological risk screening was to conduct an initial screening of the analytical data using conservative screening values and assumptions to determine whether Sites 2, 4, or 23 needed to be further evaluated as part of a baseline ERA. The following steps were completed for the risk screening:

- Problem formulation
- Exposure assessment
- Ecological effects assessment
- Risk characterization
- Step 3A – Refinement of COPCs

3.4.1 Problem Formulation

Problem formulation is the first step of the ERA and discusses the goals, breadth, and focus of the assessment. It includes a general description of the site with emphasis on the habitats and ecological receptors present. This phase also involves characterization of site-related contaminants, contaminant sources, migration routes, and an evaluation of routes of contaminant exposure.

3.4.2 Exposure Assessment

This portion of the ecological risk screening includes identification of contaminant concentration data used to represent ecological exposure to various media and the selection of exposure point concentrations. The ecological risk screening uses the maximum detected concentration as the exposure point concentration in each medium.

3.4.3 Ecological Effects Assessment

In the ecological effects assessment, screening levels for toxicity of each chemical to terrestrial and aquatic receptors were compiled.

The EPA Ecological SSLs (EPA, 2005b) were used to screen for soil COPCs. These screening levels were supplemented with EPA Region 3 Biological Technical Assistance Group (BTAG) screening levels for soil, when necessary. Table 3-3 summarizes the ecological screening levels used to evaluate surface soil concentrations at Sites 2 and 4.

Region 3 BTAG screening levels for freshwater sediment (EPA, 2005c) were used to screen for sediment COPCs. Table 3-4 summarizes the ecological screening values used to evaluate sediment concentrations at Site 23.

3.4.4 Preliminary Risk Characterization

The preliminary risk characterization compares maximum site concentrations to ecological screening levels. When maximum concentrations are less than ecological screening levels, it is an indication that ecological receptors are not at risk. However, when maximum concentrations are greater than the screening levels, additional evaluation of data is necessary to confirm with greater certainty whether ecological receptors are potentially at risk, especially because most screening levels are developed using conservative exposure assumptions or studies.

Chemicals that do not have screening levels were also retained as COPCs for further evaluation. Calcium, magnesium, potassium, and sodium were excluded as COPCs in both media because they are essential nutrients that can be tolerated by living systems even at high concentrations. Therefore, these chemicals will not be discussed in the ecological risk screening. Chemicals without screening levels will be retained as COPCs but will only be evaluated qualitatively.

3.4.5 Step 3A – Refinement of Chemicals of Potential Concern

Step 3 of the eight-step ERA process is baseline ERA problem formulation. This step consists of several sub-steps designed to develop the goals, breadth, and focus of the baseline ERA. Generally, this step is beyond the scope of the initial, screening-level ERA. However, the initial sub-step in the process is the refinement of COPCs. The use of conservative screening levels and maximum detected concentrations in the ecological risk screening is necessary to ensure that potential risks are not underestimated. However, if a comparison to conservative screening levels is used as the single factor for including a COPC in the baseline ERA without consideration of other information, additional studies, such as toxicity testing or tissue analysis, could be undertaken to investigate risks from a COPC that may not in actuality pose significant risk. Site 3A involves using certain tools to reduce the uncertainties and the conservative nature of the screening level ERA. These items include the following:

- Alternate guidelines
- Background data (for inorganics)
- Frequency of detection/spatial analysis of concentrations exceeding guidelines

Table 3-5 presents the maximum chemical concentrations in soil samples that were selected for toxicity tests at Site 47 at NSF-IH as part of a baseline ecological risk assessment (BERA) (CH2MHILL, 2005). Because none of the surface soil was considered to be toxic, the maximum detected concentrations are considered no observed effects concentrations (NOECs), although they were not designated as such in the Site 47 BERA. The Background Soil Investigation Report for Indian Head (TtNUS, 2002) concluded that the distinction between the grain sizes in surface soil produced data sets that in most cases were not statistically significantly different from each other. The pH values in the background soils ranged from 4.5 to 7, but most of the results were between 4.5 and 5.5 and were similar to the pH levels in the soil at Site 47 (4.1 to 7.1 with most of the pH levels less than 6.0). The pH of soil at Sites 2 and 4 was not measured but is likely within the pH range at Site 47 because background soils across NSF-IH are within that range. Grain size analysis was not conducted on the soil at Sites 2 and 4, but the sampling logs describe the samples as sand and silt, sand and gravel, and silt, sand, and gravel (gravel was removed from the samples before the samples were placed in the sample containers). The soil in the samples collected at Site 47 had varying levels of sand, silt, and gravel (CH2MHILL, 2005). Because the soil types appear to be relatively similar between Sites 2, 4, and 47, the results of the earthworm toxicity tests conducted at Site 47 were used in a lines-of-evidence approach in the Step 3A evaluation for Sites 2 and 4, where appropriate.

TABLE 3-1

BASEWIDE BACKGROUND CONCENTRATIONS
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Surface Soil (mg/kg)[1]
Aluminum	19,700
Antimony	ND
Arsenic	14.9
Barium	80.4
Beryllium	1.1
Cadmium	2.5
Calcium	2,060
Chromium	33.4
Cobalt	22.3
Copper	20.3
Iron	38,500
Lead	62.5
Magnesium	1,620
Manganese	1,390
Mercury	0.16
Nickel	15.4
Potassium	1,470
Selenium	1.2
Silver	0.84
Sodium	120
Thallium	2.3
Vanadium	53.3
Zinc	37.5

1 95-percent upper tolerance limit.

Source: TtNUS, 2002.

ND – Not detected.

TABLE 3-2

HUMAN HEALTH SCREENING CRITERIA - SOIL AND SEDIMENT
SITES 2, 4, AND 23
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	EPA Region 3 RBC[1]				EPA SSL[2]
	Residential		Soil to GW DAF=1	Soil to GW DAF=20	Soil to Air
Semivolatile Organics (µg/kg)					
ACENAPHTHENE	4,700,000	N	5,200	100,000	---
ACENAPHTHYLENE	---		---	---	---
ANTHRACENE	23,000,000	N	23,000	470,000	---
BENZO(A)ANTHRACENE	870	C	73	1,500	---
BENZO(A)PYRENE	87	C	19	370	---
BENZO(B)FLUORANTHENE	870	C	230	4,500	---
BENZO(G,H,I)PERYLENE	---		---	---	---
BENZO(K)FLUORANTHENE	8,700	C	2,300	45,000	---
CHRYSENE	87,000	C	7,300	150,000	7,500,000
DIBENZO(A,H)ANTHRACENE	87	C	70	1,400	---
FLUORANTHENE	3,100,000	N	310,000	6,300,000	---
FLUORENE	3,100,000	N	6,800	140,000	---
INDENO(1,2,3-CD)PYRENE	870	C	640	13,000	---
NAPHTHALENE	1,600,000	N	7.7	150	170,000
PHENANTHRENE	---		---	---	---
PYRENE	2,300,000	N	34,000	680,000	---
PCBs (ug/kg)					
AROCLOR-1016	5,500	N	210	4,200	---
AROCLOR-1221	320	C	---	---	---
AROCLOR-1232	320	C	---	---	---
AROCLOR-1242	320	C	---	---	---
AROCLOR-1248	320	C	---	---	---
AROCLOR-1254	320	C	54	1,100	---
AROCLOR-1260	320	C	---	---	---
Explosives (mg/kg)					
1,3,5-TRINITROBENZENE	2,300	N	250[2]	5,000[2]	---
1,3-DINITROBENZENE	7.8	N	0.0018	0.037	91
2,4,6-TRINITROTOLUENE	21	C	0.057[2]	11[2]	---
2,4-DINITROTOLUENE	160	N	0.029	0.57	---
2,6-DINITROTOLUENE	78	N	0.012	0.25	---
2-AMINO-4,6-DINITROTOLUENE	---		---	---	---
2-NITROTOLUENE	780	N	600[2]	12,000[2]	---
3-NITROTOLUENE	---		0.15[2]	3[2]	---
4-AMINO-2,6-DINITROTOLUENE	---		---	---	---
4-NITROTOLUENE	---		2.1[2]	41[2]	---
HMX	3,900	N	---	---	---
NITROBENZENE	39	N	0.0012	0.023	91
NITROCELLULOSE	---		---	---	---
NITROGLYCERIN	---		---	---	---
NITROGUANIDINE	---		---	---	---
RDX	6	C	---	---	---
TETRYL	310	N	---	---	---

TABLE 3-2

HUMAN HEALTH SCREENING CRITERIA - SOIL AND SEDIMENT
SITES 2, 4, AND 23
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	EPA Region 3 RBC[1]				EPA SSL[2]
	Residential		Soil to GW DAF=1	Soil to GW DAF=20	Soil to Air
Inorganics (mg/kg)					
ALUMINUM	---		---	---	---
ANTIMONY	31	N	0.66	13	---
ARSENIC	0.43	C	0.0013	0.026	750
BARIUM	16,000	N	300	6,000	686,000
BERYLLIUM	160	N	58	1,200	1,330
CADMIUM	39[3]	N	1.4	27	1,800
CALCIUM	---		---	---	---
CHROMIUM	230[4]	N	2.1	42	270
COBALT	---		---	---	1,140
COPPER	3,100	N	530	11,000	---
IRON	23,000	N	---	---	---
LEAD	400[5]		---	---	---
MAGNESIUM	---		---	---	---
MANGANESE	1,600[6]	N	48	950	68,600
MERCURY	23[7]	N	0.1[2]	2.1[2]	2.9
NICKEL	1,600	N	14[2]	280[2]	13,300
POTASSIUM	---		---	---	---
SELENIUM	390	N	0.95	19	---
SILVER	390	N	1.6	31	---
SODIUM	---		---	---	---
THALLIUM	5.5	N	0.18	3.6	---
VANADIUM	78	N	37	730	---
ZINC	23,000	N	680	14,000	---
Miscellaneous Parameters (mg/kg)					
CYANIDE	1,600[9]	N	7.4	150	---

1 EPA, 2005a.
2 EPA, 2004.
3 Based on oral reference dose for water.
4 Value is for hexavalent chromium.
5 Office of Solid Waste and Emergency Response soil screening level (EPA, 1994b).
6 Based on the oral reference dose for nonfood.
7 Value is for mercuric chloride.
8 Value is for free cyanide.

---: No screening level available. If detected, a surrogate value will be used, if appropriate.
C - Carcinogen.
DAF - Dilution attenutation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
N - Noncarcinogen.
RBC - Risk-based concentration.
SSL - Soil screening level.

TABLE 3-3

ECOLOGICAL SCREENING CRITERIA - SOIL
SITES 2 AND 4
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Screening Value	Source
Semivolatile Organics (µg/kg)		
ACENAPHTHENE	100	BTAG
ACENAPHTHYLENE	100	BTAG
ANTHRACENE	100	BTAG
BENZO(A)ANTHRACENE	100	BTAG
BENZO(A)PYRENE	100	BTAG
BENZO(B)FLUORANTHENE	100	BTAG
BENZO(G,H,I)PERYLENE	100	BTAG
BENZO(K)FLUORANTHENE	100	BTAG
CHRYSENE	100	BTAG
DIBENZO(A,H)ANTHRACENE	100	BTAG
FLUORANTHENE	100	BTAG
FLUORENE	100	BTAG
INDENO(1,2,3-CD)PYRENE	100	BTAG
NAPHTHALENE	100	BTAG
PHENANTHRENE	100	BTAG
PYRENE	100	BTAG
PCBs (ug/kg)		
AROCLOR-1016	100	BTAG
AROCLOR-1221	100	BTAG
AROCLOR-1232	100	BTAG
AROCLOR-1242	100	BTAG
AROCLOR-1248	100	BTAG
AROCLOR-1254	100	BTAG
AROCLOR-1260	100	BTAG
Explosives (mg/kg)		
1,3,5-TRINITROBENZENE	---	---
1,3-DINITROBENZENE	---	---
2,4,6-TRINITROTOLUENE	---	---
2,4-DINITROTOLUENE	---	---
2,6-DINITROTOLUENE	---	---
2-AMINO-4,6-DINITROTOLUENE	---	---
2-NITROTOLUENE	---	---
3-NITROTOLUENE	---	---
4-AMINO-2,6-DINITROTOLUENE	---	---
4-NITROTOLUENE	---	---
HMX	---	---
NITROBENZENE	---	---
NITROCELLULOSE	---	---
NITROGLYCERIN	---	---
NITROGUANIDINE	---	---
RDX	---	---
TETRYL	---	---

TABLE 3-3

ECOLOGICAL SCREENING CRITERIA - SOIL
SITES 2 AND 4
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Screening Value	Source
Inorganics (mg/kg)		
ALUMINUM	---(1)	EPA SSL
ANTIMONY	0.27	EPA SSL
ARSENIC	18	EPA SSL
BARIUM	330	EPA SSL
BERYLLIUM	21	EPA SSL
CADMIUM	0.36	EPA SSL
CALCIUM	---	
CHROMIUM	26	EPA SSL
COBALT	13	EPA SSL
COPPER	15	BTAG
IRON	12	BTAG
LEAD	11	EPA SSL
MAGNESIUM	---	
MANGANESE	330	BTAG
MERCURY	0.058	BTAG
NICKEL	2	BTAG
POTASSIUM	---	
SELENIUM	1.8	BTAG
SILVER	0.0098	BTAG
SODIUM	---	
THALLIUM	0.001	BTAG
VANADIUM	7.8	EPA SSL
ZINC	10	BTAG
Miscellaneous Parameters (mg/kg)		
CYANIDE	5	BTAG

1 Potential for ecological risk only if soil pH is less than 5.5.

---: No screening level available.
EPA SSL - United States Environmental Protection Agency (EPA) Soil Screening Level (EPA, 2005b).
BTAG - EPA Region 3 Biological Technical Assistance Group screening level (EPA, 1995).

TABLE 3-4

ECOLOGICAL SCREENING CRITERIA - SEDIMENT
SITE 23
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	EPA Region 3 BTAG Freshwater Sediment Screening Benchmark
Semivolatile Organics (µg/kg)	
ACENAPHTHENE	6.7
ACENAPHTHYLENE	5.9
ANTHRACENE	57.2
BENZO(A)ANTHRACENE	108
BENZO(A)PYRENE	150
BENZO(B)FLUORANTHENE	27.2
BENZO(G,H,I)PERYLENE	170
BENZO(K)FLUORANTHENE	240
CHRYSENE	166
DIBENZO(A,H)ANTHRACENE	33
FLUORANTHENE	423
FLUORENE	77.4
INDENO(1,2,3-CD)PYRENE	17
NAPHTHALENE	176
PHENANTHRENE	204
PYRENE	195
PCBs (ug/kg)	
AROCLOR-1016	59.8
AROCLOR-1221	59.8
AROCLOR-1232	59.8
AROCLOR-1242	59.8
AROCLOR-1248	59.8
AROCLOR-1254	59.8
AROCLOR-1260	59.8
Explosives (mg/kg)	
1,3,5-TRINITROBENZENE	---
1,3-DINITROBENZENE	---
2,4,6-TRINITROTOLUENE	0.092
2,4-DINITROTOLUENE	0.0416
2,6-DINITROTOLUENE	---
2-AMINO-4,6-DINITROTOLUENE	---
2-NITROTOLUENE	---
3-NITROTOLUENE	---
4-AMINO-2,6-DINITROTOLUENE	---
4-NITROTOLUENE	4
HMX	---
NITROBENZENE	---
NITROCELLULOSE	---
NITROGLYCERIN	---
NITROGUANIDINE	---
RDX	0.013
TETRYL	---

TABLE 3-4

ECOLOGICAL SCREENING CRITERIA - SEDIMENT
SITE 23
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	EPA Region 3 BTAG Freshwater Sediment Screening Benchmark
Inorganics (mg/kg)	
ALUMINUM	---
ANTIMONY	2
ARSENIC	9.8
BARIUM	---
BERYLLIUM	---
CADMIUM	0.99
CALCIUM	---
CHROMIUM	43.4
COBALT	50
COPPER	31.6
IRON	20000
LEAD	35.8
MAGNESIUM	---
MANGANESE	460
MERCURY	0.18
NICKEL	22.7
POTASSIUM	---
SELENIUM	2
SILVER	1
SODIUM	---
THALLIUM	---
VANADIUM	---
ZINC	121
Miscellaneous Parameters (mg/kg)	
CYANIDE	0.1

Source: United States Enviromental Protection Agency (EPA), 2005c.

---: No screening level available.
BTAG - Biological Technical Assistance Group.

TABLE 3-5

NO OBSERVED EFFECTS CONCENTRATIONS FOR SITE 47 SURFACE SOIL
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Concentration[1]
Polynuclear Aromatic Hydrocarbons (µg/kg)	
Acenaphthene	570
Acenaphthylene	160
Anthracene	1,500
Benzo(a)anthracene	3,400
Benzo(a)pyrene	2,400
Benzo(b)fluoranthene	3,500
Benzo(g,h,i)perylene	1,100
Benzo(k)fluoranthene	1,400
Chrysene	2,500
Dibenz(a,h)anthracene	470
Fluoranthene	7,100
Fluorene	630
Indeno(1,2,3-cd)pyrene	1,100
Naphthalene	160
Phenanthrene	5,800
Pyrene	5,200
Metals (mg/kg)	
Aluminum	16,500
Antimony	0.88
Arsenic	5.2
Barium	73.4
Beryllium	0.67
Boron	3.6
Cadmium	1.4
Calcium	1,890
Chromium	28.5
Cobalt	15.8
Copper	40.6
Iron	18,000
Lead	583
Magnesium	1,790
Manganese	1,100
Mercury	3.0
Molybdenum	16.4
Nickel	16.8
Potassium	1,150
Selenium	1.0
Silver	425
Sodium	133
Thallium	Not Detected
Vanadium	42.3
Zinc	219

1 - The concentrations are the maximum concentrations detected in soil samples tested in the Baseline Ecological Risk Assessment for Site 47 (CH2MHILL, 2005). Because none of the soil samples exhibited toxicity to earthworms, the maximum concentration was considered to be the no observed effects concentration.

4.0 SITE SCREENING PROCESS RESULTS – SITE 2

4.1 BACKGROUND

Site 2 – Crankcase Oil Applied to Torrense Road is located in the northern portion of the Main Area of NSF-IH. Prior to 1965, waste oil from Transportation Branch buildings was reportedly applied to unpaved Torrense Road behind Building 290 (Public Works maintenance garage) for dust control. The waste oil consisted of crankcase, hydraulic, transmission, and motor oils. The amount of oil and frequency of application are not known. Torrense Road is now paved.

Prior to the SSP investigation, no environmental sampling had been conducted at Site 2. The site was identified in the Initial Assessment Study (IAS) (Hart, 1983). A site reconnaissance during the IAS indicated no signs of stressed vegetation near the alleged oil application areas. However, a small amount of oil was noted in standing water in the drainage ditch next to the road. Further study was not recommended in the IAS; however, the FFA designated Site 2 for the SSP to determine whether the site should proceed to an RI. In 1996, before the FFA was signed, the Navy, EPA, and Maryland Department of the Environment (MDE) decided that the site would enter the SSP, which would provide a second evaluation to confirm the presence or absence of contamination and the need for further action.

4.2 SITE CHARACTERISTICS

4.2.1 Topography and Surface Features

As illustrated on Figure 4-1, Torrense Road is located in a valley that slopes toward the Potomac River. The area near Torrense Road is mostly covered with mowed grasses. The valley walls are wooded. A parking lot is located adjacent to the Potomac River. A site photograph is included at the end of this section.

4.2.2 Surface Water

Drainage ditches are located on both sides of Torrense Road. The runoff either infiltrates into the soil or flows into the Potomac River.

4.2.3 Geology/Soils

No subsurface investigation was conducted at Site 2. The surface soil samples were described as sand and silt, sand and gravel, or sand, gravel, and silt.

4.2.4 Hydrogeology

No groundwater monitoring wells were installed at Site 2.

4.3 FIELD INVESTIGATION AND RESULTS

Surface soil samples were collected from 10 locations (S02SS001 through S02SS010) from a depth of 0 to 1 foot bgs along both sides of Torrense Road (see Figure 4-1). A field duplicate sample was collected at location S02SS007. The samples and analyses are summarized in Table 4-1. Sample log sheets are provided in Appendix A. A summary of positive results is presented in Table 4-2, and all analytical data are provided in Appendix B.

PAHs and metals were detected in all samples, and cyanide was detected in most samples. PCBs were not detected in any sample.

4.4 HUMAN HEALTH RISK SCREENING EVALUATION

This section contains the results of the human health risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.3

Table 4-3 is a summary of the Site 2 surface soil data and includes frequencies of detection, ranges of detections, samples containing the maximum detected concentration, ranges of nondetected concentrations, average concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares maximum concentrations to representative basewide background concentrations and to human health screening criteria and summarizes COPC selection and rationale. COPCs for surface soil based on the RBC for residential use are benzo(a)pyrene, chromium, lead, mercury, and nickel. Although the maximum concentrations of arsenic, iron, manganese, and vanadium exceeded one or more screening criteria, all concentrations were less than basewide background concentrations.

Table 4-4 provides a human health risk evaluation for the COPCs discussed above. The ILCR was estimated by dividing the maximum concentrations by the respective carcinogenic RBCs (based on residential exposure and a 1E-06 cancer risk) and adding the results for each COPC. The HQ was estimated by dividing the maximum concentrations by the respective noncarcinogenic RBCs (based on residential exposure) and adding the results for each COPC. The estimated ILCR is 4.6E-06, which is within the EPA acceptable range of 1E-04 to 1E-06. The total HI is 0.67, which is less than the EPA threshold of 1.0. Therefore, there are no unacceptable risks to human health associated with exposure to surface soil under a residential use scenario at Site 2.

The maximum concentrations of several PAHs exceed screening levels for migration from soil to groundwater. The maximum concentrations of benzo(a)anthracene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and naphthalene exceeded these screening levels based on a dilution attenuation factor (DAF) of 1 but not for a DAF of 20, which is appropriate for PAHs. The maximum concentration of benzo(a)pyrene exceeded this screening level based on a DAF of 20; however, the average concentration was less than this screening level. Therefore, migration of PAHs from soil to groundwater is not considered to be problematic.

The maximum concentrations of several metals also exceeded screening levels for migration from soil to groundwater. The maximum concentrations of manganese, nickel, and vanadium exceeded these screening levels based on a DAF of 1 but not for a DAF of 20, which is more appropriate for metals. In addition, the concentrations of manganese and vanadium were less than basewide background concentrations. The maximum concentrations of chromium and mercury exceeded these screening levels based on a DAF of 20; however, the average concentrations were less than this screening level. In addition, the concentrations that exceeded this screening level were only observed at one or two locations. The maximum concentration of arsenic exceeded this screening level based on a DAF of 20; however, the concentration was less than the basewide background concentration. Therefore, migration of metals from soil to groundwater is not considered to be problematic.

The maximum concentration of mercury exceeded the screening level for migration from soil to air. This was only observed at one location. Therefore, migration of mercury from soil to air is not considered to be problematic.

4.5 ECOLOGICAL RISK SCREENING EVALUATION

This section contains the results of the ecological risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.4. Information on site features is discussed elsewhere in this report and not repeated in this section.

PAHs, metals, and possibly PCBs could be present in the waste oil that was applied to Torrense Road. PCBs were not detected in any surface soil samples. Contaminants present in the waste oil would have been deposited directly on the roadway, which is now paved, and could have migrated to adjacent areas via overland flow. Drainage from the area eventually flows toward the Potomac River. The section of road where the waste oil was applied is approximately 1,000 feet long.

The ecological risk screening is not an in-depth evaluation because of the nature of the site (paved roadway) and the relatively immobile nature of the chemicals detected (PAHs and metals). Likely

receptors for exposure to surface soil contaminants would be soil invertebrates and plants rather than wildlife. However, the lowest available screening levels were used for the preliminary screening.

4.5.1 Steps 1 and 2 – Preliminary Screening

Table 4-5 is a summary of Site 2 surface soil data and includes frequencies of detection, ranges of detections, samples containing the maximum detected concentrations, ranges of nondetected concentrations, average concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares maximum concentrations to representative basewide background concentrations for surface soil and ecological screening levels and summarizes COPC selection and rationale. Ecological COPCs for surface soil include PAHs and metals. PCBs were not detected. The PAHs include anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene. The metals include antimony, chromium, copper, lead, mercury, nickel, and zinc.

4.5.2 Step 3A – Refinement of COPCs

The methodology for refinement of COPCs was discussed in Section 3.4.5. PAHs and metals were identified as preliminary COPCs for surface soil.

4.5.2.1 PAHs

Eleven PAHs were initially selected as COPCs because they were detected at concentrations that exceeded their respective screening levels. The screening level for PAHs is 100 µg/kg, which is based on mice having stomach tumors after being treated with this dose for 197 days (EPA, 1995). There are few screening values for PAHs based on risks to plants and/or invertebrates, but there is a Canadian Soil Quality Guideline (SQG) for benzo(a)pyrene (700 µg/kg), which is based on decreased growth efficiency in woodlouse (EC, 1999a). This value will be used as a surrogate for evaluating risks from other PAHs. In Appendix III of the SQG document, a NOEC of 26,000 mg/kg (based on mortality) was reported for earthworms after 14 days, and the lowest reported NOEC value for plants was 4,400 mg/kg (based on seedling emergence after 3 days of exposure). This indicates that the SQG for benzo(a)pyrene is likely a conservative value. Two samples (S02SS003 and S02SS004) had detected concentrations slightly greater than the Canadian SQG for two PAHs (fluoranthene and pyrene), with a maximum concentration of 910 µg/kg. The NOECs from the Site 47 BERA for fluoranthene and pyrene were 7,100 and 5,200 µg/kg, respectively. Therefore, based on all of the data presented above, it is unlikely that plants or invertebrates are being significantly impacted by PAHs in the soil at Site 2.

4.5.2.2 Metals

Antimony was initially selected as a COPC because it was detected at a concentration that exceeded its screening level. The screening level is based on risks to mammals and birds. However, because of the small size of the site and its location next to a road, it is not likely that mammals and birds will obtain a significant portion of their food from this area. Therefore, screening levels for plants and invertebrates are more appropriate for further evaluating risks to these receptors. The invertebrate SSL for antimony (78 mg/kg) (EPA, 2005d) is greater than the maximum detected concentration at Site 2. A plant SSL has not been developed for antimony, but the Oak Ridge National Laboratory (ORNL) plant benchmark for antimony (Efroymson et al., 1997) is 5 mg/kg, which is also greater than the maximum detected concentration at Site 2. Therefore, impacts to plants or invertebrates from antimony are not expected.

Chromium was initially selected as a COPC because it was detected at concentrations that exceeded its screening level, which is based on risks to mammals and birds. The Canadian SQG for chromium (EC, 1999b), which is protective of plants and invertebrates, is 64 mg/kg; however, the SQG is based on risks to plants because the toxicity test data were lower for plants than invertebrates. In fact, the no-effects concentrations for earthworms ranged from 235 to 900 mg/kg (EC, 1999b). The concentrations in two samples slightly exceeded the SQG, with a maximum detected concentration of 78.1 mg/kg, so slight impacts to plants are possible but impacts to invertebrates are unlikely.

Lead was initially selected as a COPC because it was detected at concentrations that exceeded its screening level, which is based on risks to mammals and birds. The plant and invertebrate SSLs for lead (EPA, 2005e) are 120 and 1,700 mg/kg, respectively. Four samples had lead detections greater than the plant SSL, but no samples had lead detections greater than the invertebrate SSL. Therefore, slight impacts to plants are possible but impacts to invertebrates are unlikely.

Mercury was initially selected as a COPC because it was detected at concentrations that exceeded its screening levels. The Canadian SQG for mercury (EC, 1999c), which is protective of plants and invertebrates, is 12 mg/kg. Also, the NOEC for mercury from the Site 47 BERA is 3 mg/kg. The maximum detected concentration in one sample (4.4 mg/kg) was slightly greater than the NOEC but was much lower than the Canadian SQG. Therefore, impacts to plants and invertebrates from mercury are not expected.

Copper, nickel, and zinc were initially selected as COPCs because they were detected at concentrations that exceeded their screening levels. The Canadian SQGs for copper, nickel, and zinc, which are protective of plants and invertebrates, are 63 (EC, 1999d), 50 (EC, 1999e), and 200 mg/kg (EC, 1999f), respectively. The concentrations in four samples for copper, three samples for nickel, and one sample for zinc exceeded the SQGs, so impacts to plants and invertebrates are possible.

4.5.3 Ecological Risk Screening Summary

Based on comparisons of chemical concentrations in soil to various benchmarks, there are potential impacts to plants and invertebrates from copper, nickel, and zinc and potential impacts to plants from chromium and lead at a few sample locations. The samples were collected along Torrense Road and, as can be seen from the site photograph, the area along the road consists of maintained grass that is surrounded by wooded areas. All of the chromium, copper, and zinc detections that were greater than the benchmarks were less than twice the benchmark values. All of the lead and nickel detections that were greater than the benchmarks were less than approximately five times the benchmark values. Because metals are not very mobile, the concentrations are expected to be less than the benchmarks within a short distance away from the road. Therefore, the spatial extent of the soil with elevated levels of metals is relatively small. Although the concentrations of metals in the soil were greater than the plant benchmarks, no obvious impacts were observed to the maintained grass adjacent to the road. This indicates that the plant benchmarks are conservative for the type of plant (i.e., grass) present at the site. Impacts to earthworms cannot be as easily observed as they can for plants, but earthworms are typically less sensitive to metals than plants as indicated by the higher SSL value for invertebrates than for plants. Therefore, significant impacts to earthworms are not likely. The benchmarks are likely conservative because many of the toxicity tests used to develop screening levels for metals use highly bioavailable forms of the metal, such as metal salts, which in many cases are much more toxic than equivalent concentrations of the metals in field collected soils (Allen, 2002). Based on the low levels of PAHs in the soil samples, it is not likely that the metals are related to waste oil applied to the road. Elevated levels of metals typically are found along roadways and may be the result of vehicular traffic. In summary, although the concentrations of several metals were greater than invertebrate and/or plant benchmarks, the potential impacts, if any, are acceptable, and risks are not great enough to warrant having the site proceed further in the ERA process.

4.6 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

- Site 2 includes an approximately 1,000-foot section of Torrense Road where waste oil was applied for dust control before the road was paved. Chemicals present in the waste oil would have been deposited directly on the roadway and could have migrated to adjacent areas via overland flow.

- Five surface soil samples were collected from each side of the road. All samples were analyzed for PAHs, PCBs, TAL metals, and cyanide.

- Based on the human health risk screening, benzo(a)pyrene, chromium, lead, mercury, and nickel were identified as COPCs for surface soil. The risk characterization resulted in a total ILCR of

4.6E-06, which is within the EPA acceptable risk range. The HI was less than the EPA target level of 1.0. Therefore, there are no unacceptable risks to human health under a residential use scenario.

- The potential for migration of surface soil contaminants to groundwater is not considered to be problematic.

- Based on the ecological risk screening, several PAHs and metals were identified as preliminary COPCs for surface soil. Based on Step 3A, the potential impacts, if any, are acceptable, and the risks are not great enough to warrant having the site proceed further in the ERA process.

- Past activities at Site 2 have not resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern.

- Based on the nature and extent of the chemicals detected in surface soil, the human health risk screening, the ecological risk screening, and risk management decisions, Site 2 does not pose a threat or potential threat to public health, welfare, or the environment. Therefore, the area should be removed from further study under the FFA.

TABLE 4-1

SSP SAMPLING AND ANALYSIS SUMMARY
SITE 2 – WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Location	Sample Number	Sample Depth (feet bgs)	Laboratory Analysis		
			PAHs	PCBs	TAL Metals and Cyanide
Soil					
S02SS001	S02SS0010001	0 to 1	X	X	X
S02SS002	S02SS0020001	0 to 1	X	X	X
S02SS003	S02SS0030001	0 to 1	X	X	X
S02SS004	S02SS0040001	0 to 1	X	X	X
S02SS005	S02SS0050001	0 to 1	X	X	X
S02SS006	S02SS0060001	0 to 1	X	X	X
S02SS007	S02SS0070001	0 to 1	X	X	X
S02SS007	S02SS0070001-D	0 to 1	X	X	X
S02SS008	S02SS0080001	0 to 1	X	X	X
S02SS009	S02SS0090001	0 to 1	X	X	X
S02SS010	S02SS0100001	0 to 1	X	X	X

bgs Below ground surface.
PAH Polynuclear aromatic hydrocarbons.
PCB Polychlorinated biphenyls.
SSP Site Screening Process.
TAL Target Analyte List.

TABLE 4-2

SUMMARY OF POSITIVE DETECTIONS
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

LOCATION	**S02SS001**	**S02SS002**	**S02SS003**	**S02SS004**	**S02SS005**	**S02SS006**	**S02SS007**
SAMPLE NUMBER	**S02SS0010001**	**S02SS0020001**	**S02SS0030001**	**S02SS0040001**	**S02SS0050001**	**S02SS0060001**	**S02SS0070001**
DEPTH RANGE (FEET)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
SAMPLE DATE	**05/04/05**	**05/04/05**	**05/04/05**	**05/04/05**	**05/04/05**	**05/04/05**	**05/04/05**
Semivolatile Organics (µg/kg)							
ACENAPHTHYLENE	20 J	38 U	230 U	570 U	39 UJ	9 J	38 UJ
ANTHRACENE	16 J	6.3 J	100	120	15 J	2.7 J	2.7 J
BENZO(A)ANTHRACENE	130 J	47 J	470	420	67 J	37 J	23 J
BENZO(A)PYRENE	120	43	400	400	76 J	42 J	24 J
BENZO(B)FLUORANTHENE	120 J	41	360	330	75 J	38 J	24 J
BENZO(G,H,I)PERYLENE	180	30 J	250 J	240 J	57 J	27 J	22 J
BENZO(K)FLUORANTHENE	55 J	26 J	240	230	48 J	23 J	14 J
CHRYSENE	120	43	400	370	130 J	43 J	22 J
DIBENZO(A,H)ANTHRACENE	21 J	8.4 J	78 J	68 J	18 J	8.7 J	5.5 J
FLUORANTHENE	220	73	910	820	90 J	7.8 UJ	39 J
FLUORENE	15 J	7.6 U	57	75 J	7.8 UJ	7.8 UJ	7.7 UJ
INDENO(1,2,3-CD)PYRENE	78 J	28	300	290	63 J	29 J	21 J
NAPHTHALENE	210 U	6.2 J	28 J	570 U	39 UJ	7.7 J	38 UJ
PHENANTHRENE	120	36	610	480	32 J	41 J	18 J
PYRENE	200 J	71 J	770 J	730 J	130 J	65 J	61 J
Inorganics (mg/kg)							
ALUMINUM	8340	7070	13100	6750	7830	6890	6550
ANTIMONY	0.67 UL	0.59 L	0.71 UL	0.6 UL	0.61 UL	0.61 UL	0.6 UL
ARSENIC	5.4	3.6	8.3	2.7	4	2.6	5.6
BARIUM	59.5	26.9	64.9	32.9	42	50.4	41.4
CADMIUM	0.51	0.052	0.06 U	0.27	0.051 U	0.051 U	0.05 U
CALCIUM	6520 J	2620 J	2330 J	1520 J	5700 J	1420 J	714 J
CHROMIUM	78.1 J	18.7 J	29.9 J	16 J	17.9 J	22.5 J	31.8 J
COBALT	10.1	4.4	4.9	3	4.4	4.1	2.7
COPPER	113 J	17.9 J	56.7 J	70.3 J	38.4 J	78.4 J	7.2 J
IRON	21900 J	12700 J	25700 J	21100 J	16700 J	26400 J	16700 J
LEAD	411 J	74.6 J	309 J	74.2 J	62.2 J	153 J	40.8 J
MAGNESIUM	10100	2090	1560	769	2610	2980	1460
MANGANESE	226 K	77.8 K	71.5 K	79.1 K	95.9 K	67.3 K	110 K
MERCURY	4.4	0.045	0.38	0.11	0.28	0.62	0.025
NICKEL	161	29.5	28.3	12.6	19.9	41.2	6.4
POTASSIUM	419 J	374 J	609 J	356 J	534 J	359 J	2510 J
SODIUM	441	200	1420	645	216	232	24.1 U
VANADIUM	33	23.1	50	38.4	29.3	37.1	25.7
ZINC	247 J	30.5 J	113 J	88.9 J	60.2 J	137 J	41 J
Miscellaneous Parameters (mg/kg)							
CYANIDE	0.22 J	0.13 J	0.33 J	0.58 UJ	0.15 J	0.13 J	0.14 J

TABLE 4-2

SUMMARY OF POSITIVE DETECTIONS
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

LOCATION **SAMPLE NUMBER** **DEPTH RANGE (FEET)** **SAMPLE DATE**	**S02SS007** **S02SS0070001-AVG** **0 - 1** **05/04/05**	**S02SS007** **S02SS0070001-D** **0 - 1** **05/04/05**	**S02SS008** **S02SS0080001** **0 - 1** **05/04/05**	**S02SS009** **S02SS0090001** **0 - 1** **05/04/05**	**S02SS010** **S02SS0100001** **0 - 1** **05/04/05**
Semivolatile Organics (µg/kg)					
ACENAPHTHYLENE	38 UJ	38 U	36 UJ	210 U	39 U
ANTHRACENE	2.35 J	2 J	6.3 J	8.9 J	7.9 U
BENZO(A)ANTHRACENE	28 J	33 J	53 J	89	4.1 J
BENZO(A)PYRENE	30.5 J	37	49 J	100	3.7 J
BENZO(B)FLUORANTHENE	31 J	38	46 J	91	5.5 J
BENZO(G,H,I)PERYLENE	27 J	32 J	32 J	70 J	8.3 J
BENZO(K)FLUORANTHENE	18 J	22 J	30 J	54	2.4 J
CHRYSENE	27 J	32	48 J	100	4.8 J
DIBENZO(A,H)ANTHRACENE	7.55 J	9.6 J	9.1 J	28 J	7.9 U
FLUORANTHENE	45.5 J	52	79 J	150	8.4
FLUORENE	7.65 UJ	7.6 U	7.3 UJ	43 U	7.9 U
INDENO(1,2,3-CD)PYRENE	26.5 J	32	35 J	86	3.8 J
NAPHTHALENE	5.7 J	5.7 J	6 J	210 U	39 U
PHENANTHRENE	21 J	24	35 J	79	8.2
PYRENE	59.5 J	58 J	78 J	170 J	7 J
Inorganics (mg/kg)					
ALUMINUM	6310	6070	2320	4850	6160
ANTIMONY	0.595 UL	0.59 UL	0.57 UL	0.67 UL	0.62 UL
ARSENIC	4.7	3.8	1.5	13.7	1.3
BARIUM	38.55	35.7	14	76.6	36
CADMIUM	0.05 U	0.05 U	0.048 U	0.48	0.052 U
CALCIUM	681.5 J	649 J	1700 J	1200 J	626 J
CHROMIUM	24.8 J	17.8 J	16.7 J	74.4 J	19 J
COBALT	2.75	2.8	2.9	5.6	2.9
COPPER	7.3 J	7.4 J	19.4 J	91.9 J	42.5 J
IRON	13450 J	10200 J	6680 J	26800 J	13000 J
LEAD	41.4 J	42 J	32.3 J	153 J	53.3 J
MAGNESIUM	1221	982	2060	2090	551
MANGANESE	111 K	112 K	47.3 K	101 K	46.5 K
MERCURY	0.0235	0.022	0.027	0.23	0.025
NICKEL	6.65	6.9	31.7	219	68.9
POTASSIUM	1666 J	822 J	183 J	302 J	340 J
SODIUM	24 U	23.9 U	31	27 UL	24.8 U
VANADIUM	21.8	17.9	9	23.9	26.3
ZINC	44.1 J	47.2 J	26.4 J	141 J	23.4 J
Miscellaneous Parameters (mg/kg)					
CYANIDE	0.145 J	0.15 J	1.3 J	0.13 J	0.74 J

J - Estimated.
K - Biased high.
L - Biased low.
U - Not detected above concentration noted.
UJ - Not detected; estimated detection limit.
UL - Not detected; detection limit biased low.

TABLE 4-3

HUMAN HEALTH DATA EVALUATION
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Sample with Maximum Detection	Range of Nondetects[2]	Average of All Results[3]	Concentration Used for Screening[4]	Background Concentration[5]	Human Health Risk Screening[6]				Selected as a COPC?	Rationale
								Region 3 RBC Residential Soil[7]	Soil to GW DAF=1	Soil to GW DAF=20	EPA SSL Soil to Air		
Semivolatile Organics (µg/kg)													
ACENAPHTHYLENE	2/10	9 - 20	S02SS0010001	36 - 570	62.9	20	NA	470000[8]	---	---	---	No	BSL
ANTHRACENE	9/10	2 - 120	S02SS0040001	7.9	28.2	120	NA	2300000	23000	470000	---	No	BSL
BENZO(A)ANTHRACENE	10/10	4.1 - 470	S02SS0030001	---	135	470	NA	870	**73**	1500	---	Na	BSL
BENZO(A)PYRENE	10/10	3.7 - 400	S02SS0030001, S02SS0040001	---	126	400	NA	**87**	**19**	**370**	---	Yes	ASL
BENZO(B)FLUORANTHENE	10/10	5.5 - 360	S02SS0030001	---	114	360	NA	870	**230**	4500	---	No	BSL
BENZO(G,H,I)PERYLENE	10/10	8.3 - 250	S02SS0030001	---	92.1	250	NA	230000[9]	---	---	---	No	BSL
BENZO(K)FLUORANTHENE	10/10	2.4 - 240	S02SS0030001	---	72.6	240	NA	8700	2300	45000	---	No	BSL
CHRYSENE	10/10	4.8 - 400	S02SS0030001	---	129	400	NA	87000	7300	150000	7500000	No	BSL
DIBENZO(A,H)ANTHRACENE	9/10	5.5 - 78	S02SS0030001	7.9	25.1	78	NA	87	**70**	1400	---	No	BSL
FLUORANTHENE	9/10	8.4 - 910	S02SS0030001	7.8 - 7.8	240	910	NA	310000	310000	6300000	---	No	BSL
FLUORENE	3/10	15 - 75	S02SS0040001	7.3 - 43	19.2	75	NA	310000	6800	140000	---	No	BSL
INDENO(1,2,3-CD)PYRENE	10/10	3.8 - 300	S02SS0030001	---	93.9	300	NA	870	640	13000	---	No	BSL
NAPHTHALENE	5/10	5.7 - 28	S02SS0030001	38 - 570	58.76	28	NA	160000	**7.7**	150	170000	No	BSL
PHENANTHRENE	10/10	8.2 - 610	S02SS0030001	---	146	610	NA	230000[8]	---	---	---	No	BSL
PYRENE	10/10	7 - 770	S02SS0030001	---	228	770	NA	230000	34000	680000	---	No	BSL
Inorganics (mg/kg)													
ALUMINUM	10/10	2320 - 13100	S02SS0030001	---	6962	13100	19700	---	---	---	---	No	NTX, BKG
ANTIMONY	1/10	0.59 - 0.59	S02SS0020001	0.57 - 0.71	0.342	0.59	ND	3.1	0.66	13	---	No	BSL
ARSENIC	10/10	1.3 - 13.7	S02SS0090001	---	4.78	13.7	14.9	**0.43**	**0.0013**	**0.026**	750	No	BKG
BARIUM	10/10	14 - 76.6	S02SS0090001	---	44.2	76.6	80.4	1,600	300	6000	686000	No	BSL, BKG
CADMIUM	4/10	0.052 - 0.51	S02SS0010001	0.048 - 0.06	0.147	0.51	2.5	3.9	1.4	27	1800	No	BSL, BKG
CALCIUM	10/10	626 - 6520	S02SS0010001	---	2432	6520	**2060**	---	---	---	---	No	NUT
CHROMIUM	10/10	16 - 78.1	S02SS0010001	---	31.8	78.1	**33.4**	**23**	**2.1**	**42**	270	Yes	ASL
COBALT	10/10	2.7 - 10.1	S02SS0010001	---	4.51	10.1	22.3	---	---	---	1140	No	NTX, BKG
COPPER	10/10	7.2 - 113	S02SS0010001	---	53.6	113	**20.3**	310	530	11000	---	No	BSL
IRON	10/10	6680 - 26800	S02SS0090001	---	18443	26800	38500	**2300**	---	---	---	No	BKG
LEAD	10/10	32.3 - 411	S02SS0010001	---	136	411	**62.5**	**400**	---	---	---	Yes	ASL
MAGNESIUM	10/10	551 - 10100	S02SS0010001	---	2603	10100	**1620**	---	---	---	---	No	NUT
MANGANESE	10/10	46.5 - 226	S02SS0010001	---	92.3	226	1390	**160**	**48**	950	68600	No	BKG
MERCURY	10/10	0.022 - 4.4	S02SS0010001	---	0.614	4.4	**0.16**	**2.3**	**0.1**	**2.1**	**2.9**	Yes	ASL
NICKEL	10/10	6.4 - 219	S02SS0090001	---	61.9	219	**15.4**	**160**	**14**	280	13300	Yes	ASL
POTASSIUM	10/10	183 - 2510	S02SS0070001	---	514	2510	**1470**	---	---	---	---	No	NUT
SODIUM	7/10	31 - 1420	S02SS0030001	23.9 - 27	322	1420	**120**	---	---	---	---	No	NUT
VANADIUM	10/10	9 - 50	S02SS0030001	---	29.2	50	53.3	**7.8**	**37**	730	---	No	BKG
ZINC	10/10	23.4 - 247	S02SS0010001	---	91.2	247	**37.5**	2300	680	14000	---	No	BSL
Miscellaneous Parameters (mg/kg)													
CYANIDE	9/10	0.13 - 1.3	S02SS0080001	0.58 - 0.58	0.357	1.3	NA	160	7.4	150	---	No	BSL

Shaded cells indicate chemicals selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-2.
7 RBCs for noncarcinogens are divided by 10 to correspond to a target hazard quotient of 0.1.
8 The value for acenaphthene is used as a surrogate for acenaphthylene.
9 The value for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

TABLE 4-3

HUMAN HEALTH DATA EVALUATION
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S02SS0010001
S02SS0020001
S02SS0030001
S02SS0040001
S02SS0050001
S02SS0060001
S02SS0070001
S02SS0070001-D
S02SS0080001
S02SS0090001
S02SS0100001

Definitions
COPC - Chemical of potential concern.
DAF - Dilution/attenuation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
NA = Not available/Not applicable.
ND - Not detected.
RBC - Risk-based concentration.
SSL - Soil screening level.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NTX - No toxicity information available
NUT - Essential nutrient

TABLE 4-4

CHEMICAL-SPECIFIC HUMAN HEALTH RISKS
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Maximum Concentration	Carcinogenic Risks		Noncarcinogenic Risks		
		RBC[1]	Estimated ILCR	Primary Target Organ	RBC[1]	Estimated HQ
Surface Soil (mg/kg)						
Benzo(a)pyrene	0.4	0.087	4.6E-06	NA[2]	NA[2]	---
Chromium	78.1	NA[2]	---	respiratory	230	0.34
Lead	411	NA[4]	---	NA[4]	NA[4]	---
Mercury	4.4	NA[2]	---	CNS	23	0.19
Nickel	219	NA[2]	---	body weight	1,600	0.14
		Total ILCR	4.6E-06		**Total**	0.67

Evaluation of Target Organ HIs	
Target Organ	**Total HI**
body weight	0.14
CNS	0.19
respiratory	0.34

Abbreviations:

CNS	Central nervous system.
HI	Hazard index.
HQ	Hazard quotient.
ILCR	Incremental lifetime cancer risk.
RBC	Risk-based concentration.

Footnotes:

1 RBCs (EPA, 2005a) for residential soil.
2 NA - Not applicable. EPA has not established a cancer slope factor or oral reference dose (RfD) for this chemical.
3 Calculated using the RfD per EPA guidance (EPA, 2003).
4 The average concentration for lead in surface soil is 136 mg/kg. Because the average value is less than the screening of 400 mg/kg, lead does not pose a significant risk to potential receptors.

TABLE 4-5

ECOLOGICAL DATA EVALUATION
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection(1)	Range of Detections(1)	Sample with Maximum Detection	Range of Nondetects(2)	Average of All Results(3)	Concentration Used for Screening(4)	Background Concentration(5)	Ecological Screening Level(6)	Selected as a COPC?	Rationale
Semivolatile Organics (µg/kg)										
ACENAPHTHYLENE	2/10	9 - 20	S02SS0010001	36 - 570	62.9	20	NA	100	No	BSL
ANTHRACENE	9/10	2 - 120	S02SS0040001	7.9 - 7.9	28.2	120	NA	**100**	Yes	ASL
BENZO(A)ANTHRACENE	10/10	4.1 - 470	S02SS0030001	---	135	470	NA	**100**	Yes	ASL
BENZO(A)PYRENE	10/10	3.7 - 400	S02SS0030001	---	126	400	NA	**100**	Yes	ASL
BENZO(B)FLUORANTHENE	10/10	5.5 - 360	S02SS0030001	---	114	360	NA	**100**	Yes	ASL
BENZO(G,H,I)PERYLENE	10/10	8.3 - 250	S02SS0030001	---	92.1	250	NA	**100**	Yes	ASL
BENZO(K)FLUORANTHENE	10/10	2.4 - 240	S02SS0030001	---	72.6	240	NA	**100**	Yes	ASL
CHRYSENE	10/10	4.8 - 400	S02SS0030001	---	129	400	NA	**100**	Yes	ASL
DIBENZO(A,H)ANTHRACENE	9/10	5.5 - 78	S02SS0030001	7.9 - 7.9	25.1	78	NA	100	No	BSL
FLUORANTHENE	9/10	8.4 - 910	S02SS0030001	7.8 - 7.8	240	910	NA	**100**	Yes	ASL
FLUORENE	3/10	15 - 75	S02SS0040001	7.3 - 43	19.2	75	NA	100	No	BSL
INDENO(1,2,3-CD)PYRENE	10/10	3.8 - 300	S02SS0030001	---	93.9	300	NA	**100**	Yes	ASL
NAPHTHALENE	5/10	5.7 - 28	S02SS0030001	38 - 570	58.8	28	NA	100	No	BSL
PHENANTHRENE	10/10	8.2 - 610	S02SS0030001	---	146	610	NA	**100**	Yes	ASL
PYRENE	10/10	7 - 770	S02SS0030001	---	228	770	NA	**100**	Yes	ASL
Inorganics (mg/kg)										
ALUMINUM	10/10	2320 - 13100	S02SS0030001	---	6962	13100	19700	(7)	No	BKG
ANTIMONY	1/10	0.59 - 0.59	S02SS0020001	0.57 - 0.71	0.342	0.59	ND	**0.27**	Yes	ASL
ARSENIC	10/10	1.3 - 13.7	S02SS0090001	---	4.78	13.7	14.9	18	No	BSL, BKG
BARIUM	10/10	14 - 76.6	S02SS0090001	---	44.2	76.6	80.4	330	No	BSL, BKG
CADMIUM	4/10	0.052 - 0.51	S02SS0010001	0.048 - 0.06	0.147	2.5	**0.26**	**0.36**	No	BKG
CALCIUM	10/10	626 - 6520	S02SS0010001	---	2432	6520	**2060**	---	No	NUT
CHROMIUM	10/10	16 - 78.1	S02SS0010001	---	31.8	78.1	**33.4**	**26**	Yes	ASL
COBALT	10/10	2.7 - 10.1	S02SS0010001	---	4.51	10.1	22.3	13	No	BSL, BKG
COPPER	10/10	7.2 - 113	S02SS0010001	---	53.6	113	**20.3**	**15**	Yes	ASL
IRON	10/10	6680 - 26800	S02SS0090001	---	18443	26800	38500	**12**	No	BKG
LEAD	10/10	32.3 - 411	S02SS0010001	---	136	411	**62.5**	**11**	Yes	ASL
MAGNESIUM	10/10	551 - 10100	S02SS0010001	---	2603	10100	**1620**	---	No	NUT
MANGANESE	10/10	46.5 - 226	S02SS0010001	---	92.3	226	1390	330	No	BSL, BKG
MERCURY	10/10	0.022 - 4.4	S02SS0010001	---	0.614	4.4	**0.16**	**0.058**	Yes	ASL
NICKEL	10/10	6.4 - 219	S02SS0090001	---	61.9	219	**15.4**	**2**	Yes	ASL
POTASSIUM	10/10	183 - 2510	S02SS0070001	---	514	2510	**1470**	---	No	NUT
SODIUM	7/10	31 - 1420	S02SS0030001	23.9 - 27	322	1420	**120**	---	No	NUT
VANADIUM	10/10	9 - 50	S02SS0030001	---	29.2	50	53.3	**7.8**	No	BKG
ZINC	10/10	23.4 - 247	S02SS0010001	---	91.2	247	**37.5**	**10**	Yes	ASL
Miscellaneous Parameters (mg/kg)										
CYANIDE	9/10	0.13 - 1.3	S02SS0080001	0.58 - 0.58	0.357	1.3	NA	5	No	BSL

Shaded cells indicate chemical selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-3.
7 Only a COPC if pH is less than 5.5.

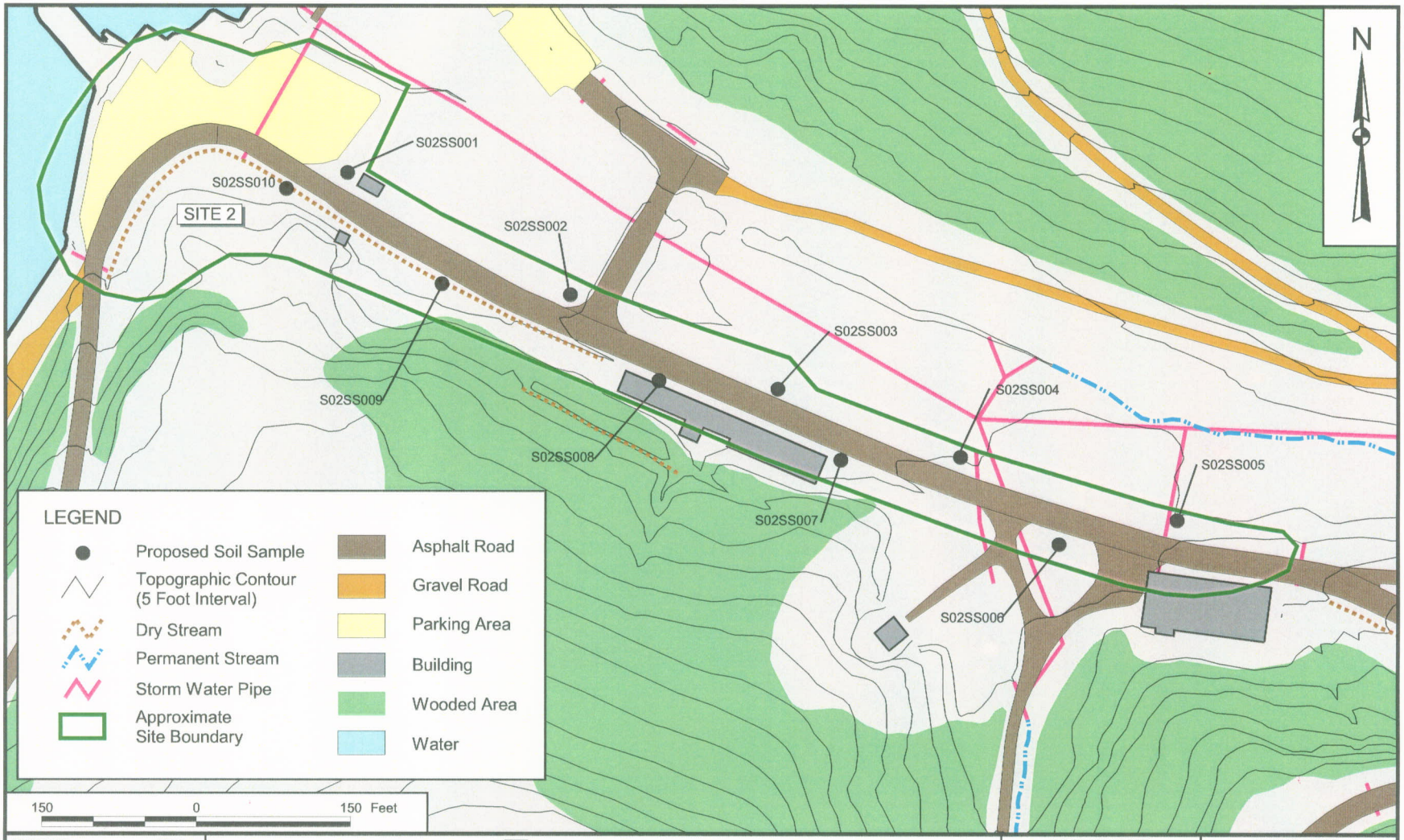
TABLE 4-5

ECOLOGICAL DATA EVALUATION
SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S02SS0010001
S02SS0020001
S02SS0030001
S02SS0040001
S02SS0050001
S02SS0060001
S02SS0070001
S02SS0070001-D
S02SS0080001
S02SS0090001
S02SS0100001

Definitions
COPC - Chemical of potential concern.
DAF - Dilution/attenuation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
ND - Not detected.
RBC - Risk-based concentration.
SSL - Soil screening level.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NTX - No toxicity information available
NUT - Essential nutrient



DRAWN BY K. PEILA DATE 6/01/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2194	OWNER NUMBER 0007
CHECKED BY K. TURNBULL DATE 10/25/05	SSP SAMPLE LOCATIONS SITE 2 - WASTE CRANKCASE OIL APPLIED TO TORRENSE ROAD NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY KCT	DATE 10/25/05
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 4 - 1	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SITE 02 SSP LOCATIONS LAYOUT 10/25/05 AJ

FIGURE 4-1
PAGE 2

Site 2 – Looking downhill toward Potomac River (2005)

Site 2 – Looking uphill away from Potomac River (2005)

5.0 SITE SCREENING PROCESS RESULTS – SITE 4

5.1 BACKGROUND

Site 4 – Lloyd Road Oil Spills is located in the northern portion of the Main Area of NSF-IH. According to the IAS (Hart, 1983), waste oil from Public Works maintenance operations was deposited in a dumpster near Building 290 prior to 1981. The waste oil consisted of fuel oil, motor oil, and kerosene. These wastes reportedly leaked from the dumpster on two or three occasions. The total volume of leakage was estimated at 50 to 100 gallons. An underground storage tank was installed to replace the dumpster. Waste oil is no longer stored in this area, and the tank has been removed. According to the Desk-Top Decision Document (IHIRT, 2002), the underground storage tank had a volume of 500 gallons. The Navy removed the tank and any contaminated soil. The MDE Hazardous Waste and Solid Waste Management Administration, Oil Control Division, issued a close-out letter for the tank on June 29, 1991.

Prior to the SSP investigation, no environmental sampling had been conducted at Site 4. The site was identified in the IAS (Hart, 1983). A site reconnaissance during the IAS indicated no signs of spillage attributable to the abandoned dumpster storage operation. Further study was not recommended in the IAS because the site area is steeply sloped, which would enhance rapid runoff, and because of the low potential for contaminant migration to groundwater. However, the FFA designated Site 4 for the SSP to determine whether the site should proceed to an RI. In 1996, before the FFA was signed, the Navy, EPA, and MDE decided that this site would enter the SSP, which would provide for a second evaluation to confirm the presence or absence of contamination at the site and the need for further action.

5.2 SITE CHARACTERISTICS

5.2.1 Topography and Surface Features

As illustrated on Figure 5-1, the much of the area near Building 290 (Public Works Department maintenance garage) is relatively flat and paved. However, there is a relatively steep hillside northwest of this area that slopes toward Lloyd Road. This wooded area could have received runoff from the leaks from the former dumpster. Photographs of the site are included at the end of this section.

5.2.2 Surface Water

The nearest surface water body is the Potomac River located approximately 1,500 feet northwest of the site.

5.2.3 Geology/Soils

No subsurface investigation was conducted at Site 4. The surface soil samples were described as sand, silt, and gravel.

5.2.4 Hydrogeology

No groundwater monitoring wells were installed at Site 4.

5.3 FIELD INVESTIGATION AND RESULTS

Surface soil samples were collected from three locations (S04SS001 through S04SS003) from a depth of 0 to 1 foot bgs in areas that could have received run-off from the suspected former dumpster location (see Figure 5-1). A field duplicate sample was collected at location S04SS001. The samples and analyses are summarized in Table 5-1. Sample log sheets are provided in Appendix A. A summary of positive results is presented in Table 5-2, and all analytical data are provided in Appendix B.

PAHs, PCBs, metals, and cyanide were detected in all samples.

5.4 HUMAN HEALTH RISK SCREENING EVALUATION

This section contains the results of the human health risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.3.

Table 5-3 is a summary of the Site 4 surface soil data and includes frequencies of detection, ranges of detections, samples containing the maximum detected concentrations, ranges of nondetected concentrations, average concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares maximum concentrations to representative basewide background concentrations and to human health screening criteria and summarizes COPC selection and rationale. COPCs for surface soil based on the RBCs for residential use are cadmium, chromium, copper, and lead. Although the maximum concentrations of arsenic, iron, manganese, and vanadium exceeded one or more screening criteria, all concentrations were less than basewide background concentrations.

Table 5-4 provides a human health risk evaluation for the COPCs discussed above. The ILCR was not estimated because EPA has not established a cancer slope factor for any of the COPCs. The HQ was estimated by dividing the maximum concentrations by the respective noncarcinogenic RBCs (based on residential exposure) and adding the results for each COPC. The total HI is 1.01; however, the COPCs do not affect the same target organs. The HI for each target organ is less than the EPA threshold of 1.0.

Therefore, there are no unacceptable risks to human health associated with exposure to surface soil under a residential use scenario at Site 4.

The maximum concentrations of one PAH, one PCB, and several metals exceeded screening levels for migration from soil to groundwater. The maximum concentrations of naphthalene (a PAH), Aroclor-1260 (a PCB), cadmium, manganese, mercury, nickel, and silver exceeded these screening levels based on a DAF of 1 but not for a DAF of 20, which is more appropriate for these chemicals. In addition, the concentrations of manganese are less than basewide background concentrations. The maximum concentration of chromium exceeded this screening level based on a DAF of 20; however, the concentrations at all other locations were less than this screening level. The maximum concentration of arsenic exceeded this screening level based on a DAF of 20; however, the concentration was less than the basewide background concentration. Therefore, the migration of PAHs, PCBs, and metals from soil to groundwater is not considered to be problematic.

5.5 ECOLOGICAL RISK SCREENING EVALUATION

This section contains the results of the ecological risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.4. Information on site features is discussed elsewhere in this report and not repeated in this section.

PAHs, PCBs, and metals could be present in the waste oil that was reportedly spilled at the site. Contaminants present in the waste oil would have been deposited in the immediate vicinity of the dumpster and could have migrated down the hillside toward Lloyd Road via overland flow.

The ecological risk screening is not an in-depth evaluation because of the small size of the site and the relatively immobile nature of the chemicals detected (PAHs and metals). Likely receptors for exposure to surface soil contaminants would be soil invertebrates and plants rather than wildlife. However, the lowest available screening levels were used for the preliminary screening.

5.5.1 Steps 1 and 2 – Preliminary Screening

Table 5-5 is a summary of the Site 4 surface soil data and includes frequencies of detection, ranges of detections, samples containing the maximum detected concentrations, ranges of nondetected concentrations, average concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares the maximum concentrations to representative basewide background concentrations for surface soil and ecological screening levels and summarizes COPC selection and rationale. Ecological COPCs for surface soil include benzo(g,h,i)perylene (a PAH), Aroclor-1260 (a PCB), cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

5.5.2 Step 3A – Refinement of COPCs

The methodology for refinement of COPCs is discussed in Section 3.4.5. PAHs, PCBs, and metals were identified as preliminary COPCs.

5.5.2.1 PAHs

Benzo(g,h,i)perylene was initially selected as a COPC because it was detected at a concentration that exceeded its respective screening level. As discussed in Section 4.5.2.1 for Site 2, the Canadian SQG for benzo(a)pyrene is 700 µg/kg (EC, 1999a), and this value will be used as a surrogate for evaluating risks from benzo(g,h,i)perylene. The maximum detected concentration of benzo(g,h,i)perylene is 130 µg/kg, which is less than the SQG and much lower than the NOEC from the Site 47 BERA (1,100 µg/kg) (CH2MHILL, 2005). Therefore, it is unlikely that plants or invertebrates are being significantly impacted from PAHs in the soil at Site 4.

5.5.2.2 PCBs

Aroclor-1260 was initially selected as a COPC because it was detected at a concentration that exceeded its respective screening level, which is based on risks to mammals and birds. The Canadian SQG for PCBs is 33 mg/kg (EC, 2001). The maximum detected concentration of Aroclor-1260 (0.21 mg/kg) is much lower than the SQG. Therefore, it is unlikely that plants or invertebrates are being significantly impacted from PCBs in the soil at Site 4.

5.5.2.3 Metals

Cadmium was initially selected as a COPC because it was detected at a concentration that exceeded its screening level. The plant and invertebrate SSLs for cadmium (32 and 140 mg/kg, respectively) (EPA, 2005e) are greater than the maximum detected concentration of cadmium at the site (12.4 mg/kg) so impacts to plants or invertebrates from cadmium are not expected.

Chromium was initially selected as a COPC because it was detected at concentrations that exceeded its screening level, which is based on risks to mammals and birds. The Canadian SQG for chromium (EC, 1999b), which is protective of plants and invertebrates, is 64 mg/kg; however, the SQG is based on risks to plants because the toxicity test data were lower for plants than invertebrates. In fact, the no-effects concentrations for earthworms ranged from 235 to 900 mg/kg (EC, 1999b). The concentration at sample location S04SS02 (130 mg/kg) exceeded the SQG, so impacts to plants are possible but impacts to invertebrates are unlikely.

Copper, lead, and zinc were initially selected as COPCs because they were detected at concentrations that exceeded their screening levels. The Canadian SQGs for copper and zinc, which are protective of plants and invertebrates, are 63 (EC, 1999d) and 2000 mg/kg (EC, 1999f), respectively. The plant and invertebrate SSLs for lead (EPA, 2005f) are 120 and 1,700 mg/kg, respectively. Concentrations of these metals exceeded the Canadian SQGs for copper and zinc and the lead SSL for plants at one of the three sample locations (S04SS02); the concentrations of metals at the other two sample locations were less than the above-mentioned benchmarks. Therefore, impacts to plants and invertebrates from copper and zinc and impacts to plants from lead are possible in the area of S04SS02.

Mercury and nickel were initially selected as COPCs because they were detected at concentrations that exceeded their screening levels. The Canadian SQGs for mercury and nickel, which are protective of plants and invertebrates, are 12 (EC, 1999c) and 50 mg/kg (EC, 1999e), respectively. The maximum detected concentrations of mercury (0.31 mg/kg) and nickel (28.6 mg/kg) are less than the SQGs. Also, the NOEC for mercury from the Site 47 BERA is 3 mg/kg (CH2MHILL, 2005). Therefore, impacts to plants and invertebrates from mercury and nickel in the soil are unlikely.

Silver was initially selected as a COPC because it was detected at concentrations that exceeded its screening level. The ORNL plant benchmark for silver is 2 mg/kg (Efroymson et al., 1997), but the NOEC from the Site 47 ERA is 425 mg/kg (CH2MHILL, 2005). The maximum detected concentration (8 mg/kg at location S04SS002) exceeds the plant benchmark but not the NOEC for soil invertebrates. Therefore, impacts to plants are possible but impacts to invertebrates are unlikely.

5.5.3 Ecological Risk Screening Summary

Based on comparisons of chemical concentrations in soil to various benchmarks, there are potential impacts to plants and invertebrates from copper and zinc and potential impacts to plants from chromium and lead in the area of S04SS02. S04SS02 is located approximately 5 feet outside of the fence, under approximately 3 inches of gravel. S04SS02 is bounded on two sides by S04SS01 and S04SS03, on one side by the suspected former dumpster location (which is a gravel lot), and on the other side by Lloyd Road, which is located about 100 feet down the slope (see Figure 5-1). Therefore, the potentially impacted area is relatively small, especially given the fact that the chemical concentrations are expected to decrease away from the source because metals are not very mobile in soil. As can be seen from the site photographs, the area outside of the fence is heavily vegetated, and no obvious impacts (i.e., stressed vegetation) are visible. Impacts to earthworms cannot be as easily observed as they can for plants, but earthworms are typically less sensitive to metals than plants as indicated by the higher SSL value for invertebrates than for plants. The lack of apparent impact even though the metals concentrations were greater than invertebrate and/or plant benchmarks is probably because the metals are sequestered in the soil and are not very bioavailable. For example, many of the toxicity tests used to

develop screening levels for metals use highly bioavailable forms of the metal, such as metal salts, which in many cases are much more toxic than equivalent concentrations of the metals in field collected soils (Allen, 2002). In summary, although the concentrations of several metals were greater than invertebrate and/or plant benchmarks, the potential impacts, if any, are acceptable and risks are not great enough to warrant having the site proceed further in the ERA process.

5.6 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

- Site 4 covers a relatively small area of the wooded hillside between Building 290 (Public Works Department maintenance garage) and Lloyd Road. Chemicals present in waste oil reportedly spilled at the site would have been deposited in the immediate area of the spill and could have migrated down the hillside toward Lloyd Road via overland flow.

- Three surface soil samples were collected from the hillside near the reported spill area. All samples were analyzed for PAHs, PCBs, TAL metals, and cyanide.

- Based on the human health risk screening, cadmium, chromium, copper, and lead were identified as COPCs for surface soil. The risk characterization did not estimate the ILCR because EPA has not established a cancer slope factor for any of the COPCs. The HI for each target organ was less than the EPA target level of 1.0. Therefore, there are no unacceptable risks to human health under a residential use scenario.

- The potential for migration of surface soil contaminants to groundwater is not considered to be problematic.

- Based on the ecological risk screening, benzo(g,h,i)perylene (a PAH), Aroclor-1260 (a PCB), and several metals were identified as preliminary COPCs for surface soil. Following Step 3A, the potential impacts, if any, are acceptable, and risks are not great enough to warrant having the site proceed further in the ERA process.

- Past activities at Site 4 have not resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern.

- Based on the nature and extent of the chemicals detected in surface soil, the human health risk screening, the ecological risk screening, and risk management decisions, Site 4 does not pose a

threat or potential threat to public health, welfare, or the environment. Therefore, the area should be removed from further study under the FFA.

TABLE 5-1

SSP SAMPLING AND ANALYSIS SUMMARY
SITE 4 – LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Location	Sample Number	Sample Depth (feet bgs)	Laboratory Analyses		
			PAHs	PCBs	TAL Metals and Cyanide
Soil					
S04SS001	S04SS0010001	0 to 1	X	X	X
S04SS001	S04SS0010001-D	0 to 1	X	X	X
S04SS002	S04SS0020001	0 to 1	X	X	X
S04SS003	S04SS0030001	0 to 1	X	X	X

bgs Below ground surface.
PAH Polynuclear aromatic hydrocarbons.
PCB Polychlorinated biphenyls.
TAL Target Analyte List.

TABLE 5-2

SUMMARY OF POSITIVE DETECTIONS
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

LOCATION **SAMPLE NUMBER** **DEPTH RANGE (FEET)** **SAMPLE DATE**	**S04SS001** **S04SS0010001** **0 - 1** **05/03/05**	**S04SS001** **S04SS0010001-AVG** **0 - 1** **05/03/05**	**S04SS001** **S04SS0010001-D** **0 - 1** **05/03/05**	**S04SS002** **S04SS0020001** **0 - 1** **05/03/05**	**S04SS003** **S04SS0030001** **0 - 1** **05/03/05**
Semivolatile Organics (µg/kg)					
ANTHRACENE	7.9 UJ	7.7 UJ	7.5 UJ	5.8 J	8.3 UJ
BENZO(A)ANTHRACENE	15 J	14 J	13 J	26 J	8.3 J
BENZO(A)PYRENE	18 J	16.5 J	15 J	21 J	10 J
BENZO(B)FLUORANTHENE	21 J	19.5 J	18 J	49 J	11 J
BENZO(G,H,I)PERYLENE	25 J	22.5 J	20 J	130 J	19 J
BENZO(K)FLUORANTHENE	9.4 J	9.55 J	9.7 J	27 J	6.4 J
CHRYSENE	16 J	15 J	14 J	30 J	9.9 J
FLUORANTHENE	7.9 UJ	7.7 UJ	7.5 UJ	64 J	18 J
INDENO(1,2,3-CD)PYRENE	22 J	20 J	18 J	58 J	6.2 J
NAPHTHALENE	7.1 J	7.75 J	8.4 J	38 J	41 UJ
PHENANTHRENE	22 J	20.5 J	19 J	66 J	11 J
PYRENE	26 J	24 J	22 J	66 J	18 J
PCBs (µg/kg)					
AROCLOR-1260	78	99	120	210	120
Inorganics (mg/kg)					
ALUMINUM	6510	6270	6030	13400	7380
ARSENIC	3.8	3.75	3.7	9.2	3.5
BARIUM	40.1	39.75	39.4	133	38
CADMIUM	1.3	1.35	1.4	12.4	0.84
CALCIUM	14200 J	16600 J	19000 J	6310 J	2950 J
CHROMIUM	12.7 J	14.5 J	16.3 J	130 J	21 J
COBALT	5.5	5.05	4.6	8.4	6.5
COPPER	62.5 J	55.15 J	47.8 J	379 J	36.3 J
IRON	12600 J	12500 J	12400 J	25800 J	33300 J
LEAD	100 J	105.5 J	111 J	1030 J	95 J
MAGNESIUM	2860	3210	3560	7570	1750
MANGANESE	136 K	132 K	128 K	284 K	200 K
MERCURY	0.074	0.068	0.062	0.31	0.11
NICKEL	9.3	9.85	10.4	28.6	14.6
POTASSIUM	375 J	390.5 J	406 J	1010 J	448 J
SILVER	0.37 B	0.9925 K	1.8 K	8.2	0.45 B
SODIUM	189	175.5	162	161 L	61.2 L
VANADIUM	26.3	24.5	22.7	35.8	21.9
ZINC	191 J	160.5 J	130 J	346 J	181 J
Miscellaneous Parameters (mg/kg)					
CYANIDE	0.18 J	0.165 J	0.15 J	0.31 J	0.3 J

B - Detected in blank; false positive.
J - Estimated.
K - Biased high.
L - Biased low.
U - Not detected above concentration noted.
UJ - Not detected; estimated detection limit.

TABLE 5-3

HUMAN HEALTH DATA EVALUATION
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Sample with Maximum Detection	Range of Nondetects[2]	Average of All Results[3]	Concentration Used for Screening[4]	Background Concentration[5]	Human Health Risk Screening[6]				Selected as a COPC?	Rationale
								Region 3 RBC Residential Soil[7]	Soil to GW DAF=1	Soil to GW DAF=20	EPA SSL Soil to Air		
Semivolatile Organics (µg/kg)													
ANTHRACENE	1/3	5.8 - 5.8	S04SS0020001	7.5 - 8.3	4.60	5.8	NA	2300000	23000	470000	---	No	BSL
BENZO(A)ANTHRACENE	3/3	8.3 - 26	S04SS0020001	---	16.1	26	NA	870	73	1500	---	No	BSL
BENZO(A)PYRENE	3/3	10 - 21	S04SS0020001	---	15.8	21	NA	87	19	370	---	No	BSL
BENZO(B)FLUORANTHENE	3/3	11 - 49	S04SS0020001	---	26.5	49	NA	870	230	4500	---	No	BSL
BENZO(G,H,I)PERYLENE	3/3	19 - 130	S04SS0020001	---	57.2	130	NA	230000[8]	---	---	---	No	BSL
BENZO(K)FLUORANTHENE	3/3	6.4 - 27	S04SS0020001	---	14.3	27	NA	8700	2300	45000	---	No	BSL
CHRYSENE	3/3	9.9 - 30	S04SS0020001	---	18.3	30	NA	87000	7300	150000	7500000	No	BSL
FLUORANTHENE	2/3	18 - 64	S04SS0020001	7.5 - 7.9	28.6	64	NA	310000	310000	6300000	---	No	BSL
INDENO(1,2,3-CD)PYRENE	3/3	6.2 - 58	S04SS0020001	---	28.1	58	NA	870	640	13000	---	No	BSL
NAPHTHALENE	2/3	7.1 - 38	S04SS0020001	41 - 41	22.1	38	NA	160000	**7.7**	150	170	No	BSL
PHENANTHRENE	3/3	11 - 66	S04SS0020001	---	32.5	66	NA	230000[8]	---	---	---	No	BSL
PYRENE	3/3	18 - 66	S04SS0020001	---	36.0	66	NA	230000	34000	680000	---	No	BSL
PCBs (µg/kg)													
AROCLOR-1260	3/3	78 - 210	S04SS0020001	---	143	210	NA	320	**21**	410	---	No	BSL
Inorganics (mg/kg)													
ALUMINUM	3/3	6030 - 13400	S04SS0020001	---	9017	13400	19700	---	---	---	---	No	NTX, BKG
ARSENIC	3/3	3.5 - 9.2	S04SS0020001	---	5.48	9.2	14.9	**0.43**	**0.0013**	**0.026**	750	No	BKG
BARIUM	3/3	38 - 133	S04SS0020001	---	70.3	133	**80.4**	16000	300	6000	686000	No	BSL
CADMIUM	3/3	0.84 - 12.4	S04SS0020001	---	4.86	12.4	**2.5**	**3.9**	**1.4**	27	1800	Yes	ASL
CALCIUM	3/3	2950 - 19000	S04SS0010001-D	---	8620	19000	**2060**	---	---	---	---	No	NUT
CHROMIUM	3/3	12.7 - 130	S04SS0020001	---	55.2	130	**33.4**	**23**	**2.1**	**42**	270	Yes	ASL
COBALT	3/3	4.6 - 8.4	S04SS0020001	---	6.65	8.4	22.3	---	---	---	1140	No	NTX, BKG
COPPER	3/3	36.3 - 379	S04SS0020001	---	157	379	**20.3**	**310**	530	11000	---	Yes	ASL
IRON	3/3	12400 - 33300	S04SS0030001	---	23867	33300	38500	**2300**	---	---	---	No	BKG
LEAD	3/3	95 - 1030	S04SS0020001	---	410	1030	**62.5**	**400**	---	---	---	Yes	ASL
MAGNESIUM	3/3	1750 - 7570	S04SS0020001	---	4177	7570	**1620**	---	---	---	---	No	NUT
MANGANESE	3/3	128 - 284	S04SS0020001	---	205	284	1390	**160**	**48**	950	68600	No	BKG
MERCURY	3/3	0.062 - 0.31	S04SS0020001	---	0.163	0.31	**0.16**	2.3	**0.1**	2.1	2.9	No	BSL
NICKEL	3/3	9.3 - 28.6	S04SS0020001	---	17.7	28.6	**15.4**	160	**14**	280	13300	No	BSL
POTASSIUM	3/3	375 - 1010	S04SS0020001	---	616	1010	1470	---	---	---	---	No	NUT
SILVER	2/3	1.8 - 8.2	S04SS0020001	0.37 - 0.45	3.14	8.2	**0.84**	39	**1.6**	31	---	No	BSL
SODIUM	3/3	61.2 - 189	S04SS0010001	---	133	189	**120**	---	---	---	---	No	NUT
VANADIUM	3/3	21.9 - 35.8	S04SS0020001	---	27.4	35.8	53.3	**7.8**	37	730	---	No	BKG
ZINC	3/3	130 - 346	S04SS0020001	---	229	346	**37.5**	2300	680	14000	---	No	BSL
Miscellaneous Parameters (mg/kg)													
CYANIDE	3/3	0.15 - 0.31	S04SS0020001	---	0.258	0.31	NA	160	7.4	150	---	No	BSL

Shaded cells indicate chemicals selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-2.
7 RBCs for noncarcinogens are divided by 10 to correspond to a target hazard quotient of 0.1.
8 The value for pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

TABLE 5-3

HUMAN HEALTH DATA EVALUATION
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S04SS0010001
S04SS0010001-D
S04SS0020001
S04SS0030001

Definitions
COPC - Chemical of potential concern.
DAF - Dilution/attenuation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
NA - Not available/Not applicable.
ND - Not detected.
RBC - Risk-based concentration.
SSL - Soil screening level.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NTX - No toxicity information available.
NUT - Essential nutrient

TABLE 5-4

CHEMICAL-SPECIFIC HUMAN HEALTH RISKS
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Maximum Concentration	Carcinogenic Risks		Noncarcinogenic Risks		
		RBC[1]	Estimated ILCR	Primary Target Organ	RBC[1]	Estimated HQ
Surface Soil (mg/kg)						
Cadmium	12.4	NA[2]	---	kidney	39	0.32
Chromium	130	NA[2]	---	respiratory	230	0.57
Copper	379	NA[2]	---	gastrointestinal	3,100	0.12
Lead	1,030	NA[3]	---	NA[3]	NA[3]	---
		Total ILCR	---		**Total**	1.01

Evaluation of Target Organ HIs	
Target Organ	**Total HI**
gastrointestinal	0.12
kidney	0.32
respiratory	0.57

Abbreviations:

HI	Hazard index.
HQ	Hazard quotient.
ILCR	Incremental lifetime cancer risk.
RBC	Risk-based concentration.

Footnotes:

1 RBCs (EPA, 2005a) for residential soil.

2 NA - Not applicable. EPA has not established a cancer slope factor or oral RfD for this chemical.

3 The average concentration for lead is 410 mg/kg, which is higher than the screening level of 400 mg/kg. Exposure to lead was evaluated using the EPA IEUBK Model (results on following three pages). Default parameters were used for the rest of the model input. The estimated geometric blood-lead level for children was 5.2 µg/dL, which is less than the level of concern of 10 µg/dL. Therefore, no adverse effects are anticipated.

TABLE 5-5

ECOLOGICAL DATA EVALUATION
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection(1)	Range of Detections(1)	Sample with Maximum Detection	Range of Nondetects(2)	Average of All Results(3)	Concentration Used for Screening(4)	Background Concentration(5)	Ecological Screening Level(6)	Selected as a COPC?	Rationale
Semivolatile Organics (µg/kg)										
ANTHRACENE	1/3	5.8 - 5.8	S04SS0020001	7.5 - 8.3	4.60	5.8	NA	100	No	BSL
BENZO(A)ANTHRACENE	3/3	8.3 - 26	S04SS0020001	---	16.1	26	NA	100	No	BSL
BENZO(A)PYRENE	3/3	10 - 21	S04SS0020001	---	15.8	21	NA	100	No	BSL
BENZO(B)FLUORANTHENE	3/3	11 - 49	S04SS0020001	---	26.5	49	NA	100	No	BSL
BENZO(G,H,I)PERYLENE	3/3	19 - 130	S04SS0020001	---	57.2	130	NA	**100**	Yes	ASL
BENZO(K)FLUORANTHENE	3/3	6.4 - 27	S04SS0020001	---	14.3	27	NA	100	No	BSL
CHRYSENE	3/3	9.9 - 30	S04SS0020001	---	18.3	30	NA	100	No	BSL
FLUORANTHENE	2/3	18 - 64	S04SS0020001	7.5 - 7.9	28.6	64	NA	100	No	BSL
INDENO(1,2,3-CD)PYRENE	3/3	6.2 - 58	S04SS0020001	---	28.1	58	NA	100	No	BSL
NAPHTHALENE	2/3	7.1 - 38	S04SS0020001	41 - 41	22.1	38	NA	100	No	BSL
PHENANTHRENE	3/3	11 - 66	S04SS0020001	---	32.5	66	NA	100	No	BSL
PYRENE	3/3	18 - 66	S04SS0020001	---	36.0	66	NA	100	No	BSL
PCBs (µg/kg)										
AROCLOR-1260	3/3	78 - 210	S04SS0020001	---	143	210	NA	**100**	Yes	ASL
Inorganics (mg/kg)										
ALUMINUM	3/3	6030 - 13400	S04SS0020001	---	9017	13400	19700	(7)	No	BKG
ARSENIC	3/3	3.5 - 9.2	S04SS0020001	---	5.48	9.2	14.9	18	No	BSL, BKG
BARIUM	3/3	38 - 133	S04SS0020001	---	70.3	133	**80.4**	330	No	BSL
CADMIUM	3/3	0.84 - 12.4	S04SS0020001	---	4.86	12.4	**2.5**	**0.36**	Yes	ASL
CALCIUM	3/3	2950 - 19000	S04SS0010001-D	---	8620	19000	**2060**	---	No	NUT
CHROMIUM	3/3	12.7 - 130	S04SS0020001	---	55.2	130	**33.4**	**26**	Yes	ASL
COBALT	3/3	4.6 - 8.4	S04SS0020001	---	6.65	8.4	22.3	13	No	BSL, BKG
COPPER	3/3	36.3 - 379	S04SS0020001	---	157	379	**20.3**	**15**	Yes	ASL
IRON	3/3	12400 - 33300	S04SS0030001	---	23867	33300	38500	**12**	No	BKG
LEAD	3/3	95 - 1030	S04SS0020001	---	410	1030	**62.5**	**11**	Yes	ASL
MAGNESIUM	3/3	1750 - 7570	S04SS0020001	---	4177	7570	**1620**	**4400**	No	NUT
MANGANESE	3/3	128 - 284	S04SS0020001	---	205	284	1390	330	No	BSL, BKG
MERCURY	3/3	0.062 - 0.31	S04SS0020001	---	0.163	0.31	**0.16**	**0.058**	Yes	ASL
NICKEL	3/3	9.3 - 28.6	S04SS0020001	---	17.7	28.6	**15.4**	**2**	Yes	ASL
POTASSIUM	3/3	375 - 1010	S04SS0020001	---	616	1010	1470	---	No	NUT
SILVER	2/3	1.8 - 8.2	S04SS0020001	---	3.14	8.2	**1.2**	**0.0098**	Yes	ASL
SODIUM	3/3	61.2 - 189	S04SS0010001	---	133	189	**120**	---	No	NUT
VANADIUM	3/3	21.9 - 35.8	S04SS0020001	---	27.4	35.8	53.3	**7.8**	No	BKG
ZINC	3/3	130 - 346	S04SS0020001	---	229	346	**37.5**	**10**	Yes	ASL
Miscellaneous Parameters (mg/kg)										
CYANIDE	3/3	0.15 - 0.31	S04SS0020001	---	0.258	0.31	NA	5	No	BSL

Shaded cells indicate chemical selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-3.
7 Only a COPC if pH is less than 5.5.

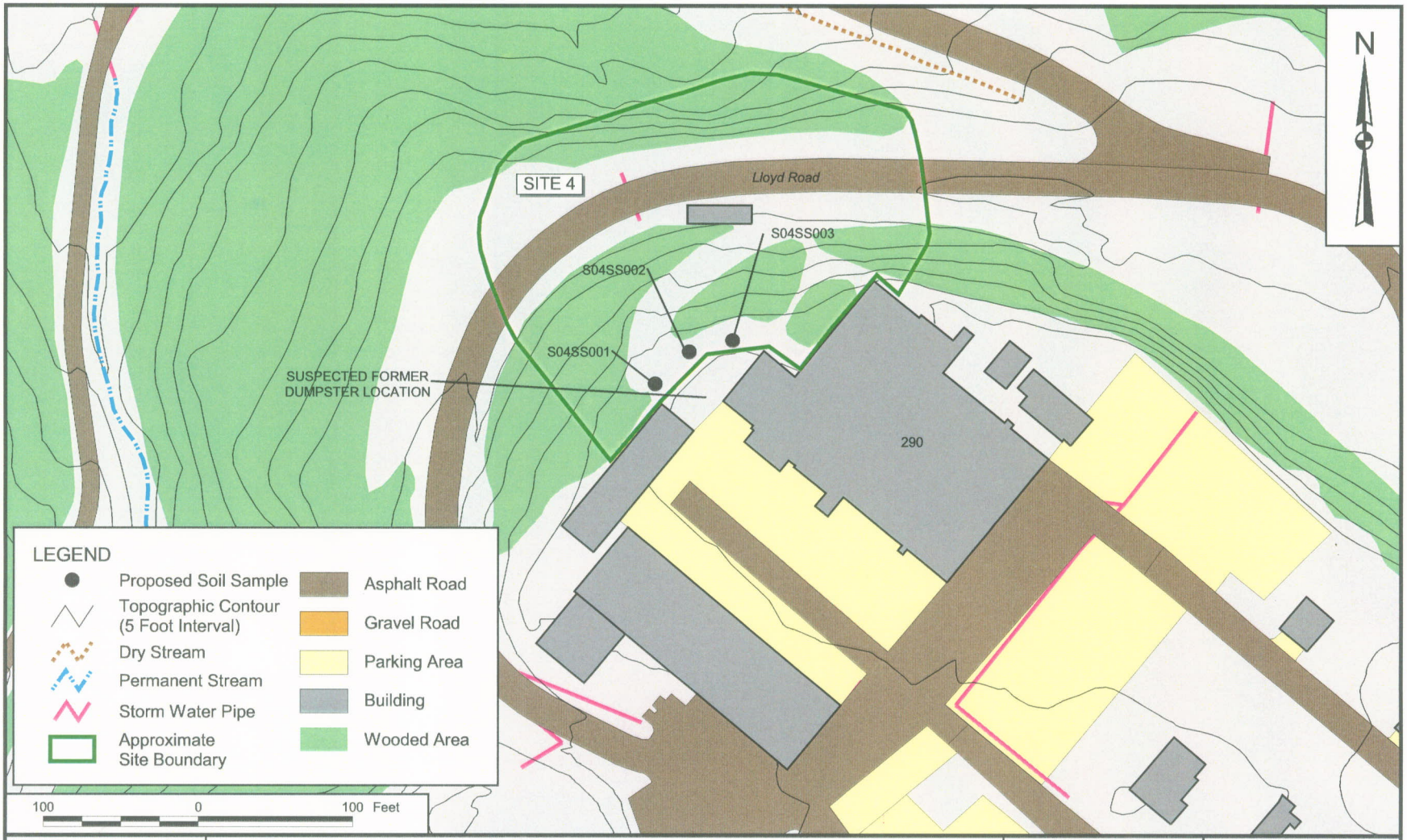
TABLE 5-5

ECOLOGICAL DATA EVALUATION
SITE 4 - LLOYD ROAD OIL SPILLS
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S04SS0010001
S04SS0010001-D
S04SS0020001
S04SS0030001

Definitions
COPC - Chemical of potential concern.
DAF - Dilution/attenuation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
NA - Not available/Not applicable.
ND - Not detected.
RBC - Risk-based concentration.
SSL - Soil screening level.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NTX - No toxicity information available
NUT - Essential nutrient



DRAWN BY K. PEILA — DATE 6/01/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2194	OWNER NUMBER 0007
CHECKED BY K. TURNBULL — DATE 10/25/05	SSP SAMPLE LOCATIONS SITE 4 - LLOYD ROAD OIL SPILLS NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY KCT	DATE 10/25/05
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 5 - 1	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SITE 04 SSP LOCATIONS LAYOUT 10/25/05 AJ

FIGURE 5-1

PAGE 2

Site 4 – Former dumpster location facing northwest. (2004)

Site 4 – Looking forward northwest. (2004)

FIGURE 5-1

PAGE 3

Site 4 – Looking toward north. (2004)

6.0 SITE SCREENING PROCESS RESULTS – SITE 23

6.1 BACKGROUND

Site 23 – Hydraulic Oil Discharges from Extrusion Plant is located in the southern portion of the Main Area near Mattawoman Creek. From approximately 1943 to 1981, an unknown amount of hydraulic oil from press lines at Buildings 560 through 566 was discharged with wastewater used to cool pumps and press dies. Wastewater from these facilities discharged to floor drains into sewer lines then discharged to Industrial Wastewater Outfall 18 (IW18). The discharge from the outfall pipe flowed through a drainage swale for approximately 150 feet before entering Mattawoman Creek. An oil/water separator for this discharge was installed in 1981. The floor drains in the press lines buildings have been sealed and no longer discharge to IW18. Industrial wastewater discharges to IW18 have ceased, and the outfall has been removed from the National Pollutant Discharge Elimination System (NPDES) permit. The quantity of hydraulic oil that was present in the wastewater is not known.

Prior to the SSP investigation, no environmental sampling had been conducted at Site 23. The site was identified in the IAS (Hart, 1983). A site reconnaissance during the IAS indicated that the oil/water separator appeared to be working effectively and that there was no evidence of oil spillage or stressed vegetation at IW18. File searches during the IAS did not indicate any environmental contamination incidents attributable to the site. Further study was not recommended in the IAS; however, the FFA designated Site 23 for the SSP to determine whether the site should proceed to an RI. In 1996, before the FFA was signed, the Navy, EPA, and MDE decided that this site will enter the SSP, which would provide for a second evaluation to confirm the presence or absence of contamination at the site and the need for further action.

6.2 SITE CHARACTERISTICS

6.2.1 Topography and Surface Features

As illustrated on Figure 6-1, the site area slopes gently toward Mattawoman Creek, with a steeper slope immediately southeast of McMahon Road near the IW18 discharge. There are many buildings in the site area; however, the key site feature is the drainage swale between the IW18 outfall and Mattawoman Creek. This is the area that would most likely be affected by releases from the press lines. The swale cannot be seen in available photographs of the site area because of the dense vegetation that is present.

6.2.2 Surface Water

Mattawoman Creek is located approximately 150 feet southeast of the IW18 outfall.

6.2.3 Geology/Soils

No subsurface investigation was conducted at Site 23. The sediment samples were described as sand, gravel, and plant roots.

6.2.4 Hydrogeology

No groundwater monitoring wells were installed at Site 23.

6.3 FIELD INVESTIGATION AND RESULTS

Sediment samples were collected from two locations (S23SD001 and S23SD002) from a depth of 0 to 6 inches bgs in the drainage swale between the IW18 outfall and Mattawoman Creek (see Figure 6-1). A field duplicate sample was collected at location S23SD001. The samples and analyses are summarized in Table 6-1. Sample log sheets are provided in Appendix A. A summary of positive results is presented in Table 6-2, and all analytical data are provided in Appendix B.

PAHs, the explosive nitrocellulose, metals, and cyanide were detected at both sample locations, and Aroclor-1260 (a PCB) was detected at one location.

6.4 HUMAN HEALTH RISK SCREENING EVALUATION

This section contains the results of the human health risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.3.

Table 6-3 is a summary of the Site 23 sediment data and includes frequencies of detection, ranges of detections, average concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares maximum concentrations to representative basewide background concentrations for surface soil and to human health screening criteria and summarizes COPC selection and rationale. The only COPC for sediment based on the soil RBCs for residential land use is benzo(a)pyrene. Although the maximum concentrations of arsenic, chromium, iron, manganese, and vanadium exceeded one or more screening criteria, all concentrations were less than basewide background concentrations.

Table 6-4 provides a human health risk evaluation for the COPC discussed above. The ILCR was estimated by dividing the maximum concentration by the respective carcinogenic RBC (based on residential exposure and a 1E-06 cancer risk). The HQ was not estimated because EPA has not established a reference dose for benzo(a)pyrene. The estimated ILCR is 3.8E-06, which is within the

EPA acceptable range of 1E-04 to 1E-06. Therefore, there are no unacceptable risks to human health associated with exposure to sediment under a residential use scenario at Site 23.

The maximum concentrations of several PAHs and metals exceeded screening levels for migration from soil to groundwater. The maximum concentrations of benzo(a)anthracene, benzo(b)fluoranthene, naphthalene, chromium, manganese, and nickel exceeded these screening levels based on a DAF of 1 but not for a DAF 20, which is more appropriate for these chemicals. The maximum concentration of arsenic exceeds this screening level based on a DAF of 20; however, the concentration is less than the basewide background concentration for surface soil. Therefore, the migration of PAHs and metals from soil to groundwater is not considered to be problematic.

6.5 ECOLOGICAL RISK SCREENING EVALUATION

This section contains the results of the ecological risk screening evaluation. The methodology used to screen for COPCs and to estimate risks is provided in Section 3.4. Information on site features is discussed elsewhere in this report and not repeated in this section.

PAHs, PCBs, explosives, and metals could have been present in the wastewater that was discharged from the press lines to Mattawoman Creek. Contaminants present in the wastewater would have been deposited in the drainage swale between the IW18 outfall and Mattawoman Creek and may have entered Mattawoman Creek.

6.5.1 Steps 1 and 2 – Preliminary Screening

Table 6-5 is a summary of the Site 23 sediment data and includes frequencies of detection, ranges of detections, samples containing the maximum detected concentrations, ranges of nondetected concentrations, and concentrations used for screening (i.e., maximum concentrations). The table also compares the maximum concentrations to representative basewide background concentrations for surface soil and ecological screening levels and summarizes COPC selection and rationale. Ecological COPCs based on exceedances of screening levels include acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, and cyanide. Nitrocellulose was retained as a COPC because there is no screening level available.

6.5.2 Step 3A – Refinement of COPCs

The methodology for refinement of COPCs is discussed in Section 3.4.5. PAHs, arsenic, cyanide, and nitrocellulose were identified as preliminary COPCs.

6.5.2.1 PAHs

Several PAHs were initially selected as COPCs because they were detected at concentrations that exceeded their respective screening levels. In Step 3A, total PAHs were evaluated instead of the individually detected PAHs because the toxicity of PAHs may be additive, and the available alternative guidelines for evaluation of sediment are based on total PAHs. The total PAH concentrations in the sediment samples were 2.8 mg/kg (in the upgradient duplicate sample) and 1.9 mg/kg (in the downgradient sample), which are slightly greater than the Region 3 BTAG screening level for total PAHs (1.61 mg/kg). The BTAG screening level is the threshold effects concentration (TEC), which is the geometric mean of sediment screening levels that represent concentrations below which impacts to sediment invertebrates are either unlikely or not expected. For that reason, the TEC is intended to identify contaminant concentrations below which harmful effects on sediment dwelling organisms are not expected. The corresponding higher effects level is the probable effects concentration (PEC), which is the geometric mean of sediment values above which harmful effects on sediment-dwelling organisms are expected to frequently occur (MacDonald et al., 2000). The PEC for total PAHs is 22.8 mg/kg. Therefore, because PAH concentrations in the sediment at Site 23 are only slightly greater than the TEC but are much lower than the PEC, risks to sediment invertebrates from PAHs are not likely.

6.5.2.2 Cyanide

Cyanide was initially selected as a COPC because it was detected at concentrations that exceeded its screening level (0.1 mg/kg). No higher effects benchmark was identified for cyanide. However, based on the relatively low concentrations of cyanide in the sediment samples (0.15 and 0.21 mg/kg) and based on the slight exceedance of the screening level, it is not likely that cyanide is related to site activities or impacting benthic organisms in the drainage ditch.

6.5.2.3 Nitrocellulose

Nitrocellulose was initially selected as a COPC because it did not have a screening level. The only toxicity information located for nitrocellulose was an abstract from a study that indicated that “studies with sediments containing nitrocellulose indicated no adverse effects among chironomid populations exposed to 540 mg nitrocellulose/kg of sediment over two generations, based on an application factor of 0.1 and an EC_{50} of 579 mg/L for the most sensitive aquatic organisms tested (*Selenastrum capicornutum*)" (Bentley et al., 1976). The maximum detected nitrocellulose concentration in the sediment at Site 23 was 16.7 mg/kg, which is much lower than the NOEC. Therefore, risks to sediment invertebrates from nitrocellulose are not likely.

6.5.3 Ecological Risk Screening Summary

Based on comparisons of chemical concentrations in sediment to various benchmarks, potential impacts to sediment invertebrates from chemicals in the sediment are not expected.

6.6 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

- The key feature of Site 23 is a drainage swale between the IW18 outfall and Mattawoman Creek. The distance between the outfall and creek is approximately 150 feet. Contaminants present in the wastewater that discharged from the outfall would have been deposited in the drainage swale and may have entered Mattawoman Creek.

- Two sediment samples were collected from the drainage swale. Surface water was present at the time of sampling; however, the swale is intermittent. All samples were analyzed for PAHs, PCBs, explosives, TAL metals, and cyanide.

- Based on the human health risk screening, benzo(a)pyrene was identified as a COPC for sediment. The risk characterization resulted in an ILCR of 3.8E-06, which is within the EPA acceptable risk range. The HI was not estimated because EPA has not established a reference dose for benzo(a)pyrene. Therefore, there are no unacceptable risks to human health under a residential use scenario.

- The potential for migration of sediment contaminants to groundwater is not considered to be problematic.

- Based on the ecological risk screening, several PAHs, nitrocellulose (an explosive), arsenic, and cyanide were identified as preliminary COPCs. Following Step 3A, potential impacts to sediment invertebrates are not expected.

- Past wastewater discharges at Site 23 have not resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern.

- Based on the nature and extent of the chemicals detected in sediment, the human health risk screening, the ecological risk screening, and risk management decisions, Site 23 does not pose a threat or potential threat to public health, welfare, or the environment. Therefore, the area should be removed from further study under the FFA.

TABLE 6-1

SSP SAMPLING AND ANALYSIS SUMMARY
SITE 23 – HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

Location	Sample Number	Sample Depth (feet bgs)	Laboratory Analysis			
			PAHs	PCBs	Explosives	TAL Metals and Cyanide
Sediment						
S23SD001	S23SD0010001	0 to 0.5	X	X	X	X
S23SD001	S23SD0010001-D	0 to 0.5	X	X	X	X
S23SD002	S23SD0020001	0 to 0.5	X	X	X	X

bgs Below ground surface.
PAHs Polynuclear aromatic hydrocarbons.
PCBs Polychlorinated biphenyls.
TAL Target Analyte List.

TABLE 6-2

SUMMARY OF POSITIVE DETECTIONS
SITE 23 - HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

LOCATION **SAMPLE NUMBER** **DEPTH RANGE (FEET)** **SAMPLE DATE**	**S23SD001** **S23SD0010001** **0 - 0.5** **05/03/05**	**S23SD001** **S23SD0010001-AVG** **0 - 0.5** **05/03/05**	**S23SD001** **S23SD0010001-D** **0 - 0.5** **05/03/05**	**S23SD002** **S23SD0020001** **0 - 0.5** **05/03/05**
Semivolatile Organics (µg/kg)				
ACENAPHTHYLENE	200 UJ	31 J	31 J	140 U
ANTHRACENE	12 J	13.5 J	15 J	11 J
BENZO(A)ANTHRACENE	110 J	180 J	250 J	160
BENZO(A)PYRENE	140 J	235 J	330 J	210
BENZO(B)FLUORANTHENE	110 J	175 J	240 J	150
BENZO(G,H,I)PERYLENE	94 J	152 J	210 J	120 J
BENZO(K)FLUORANTHENE	65 J	97.5 J	130 J	95 J
CHRYSENE	130 J	205 J	280 J	190
DIBENZO(A,H)ANTHRACENE	31 J	50 J	69 J	46 J
FLUORANTHENE	180 J	280 J	380 J	250
FLUORENE	12 J	13.5 J	15 J	12 J
INDENO(1,2,3-CD)PYRENE	110 J	175 J	240 J	150
NAPHTHALENE	200 UJ	28 J	28 J	23 J
PHENANTHRENE	120 J	135 J	150 J	140
PYRENE	230 J	355 J	480 J	340 J
PCBs (µg/kg)				
AROCLOR-1260	40 U	40.5 U	41 U	9.4 J
Explosives (mg/kg)				
NITROCELLULOSE	11.9	13.7	15.5	16.7
Inorganics (mg/kg)				
ALUMINUM	4840	5405	5970	4090
ARSENIC	3.7	7.15	10.6	2.5
BARIUM	43.7	49.9	56.1	39
CADMIUM	0.23	0.12875	0.055 U	0.89
CALCIUM	2000	1555	1110	971
CHROMIUM	16.3	16.45	16.6	12.9
COBALT	9.1	8.5	7.9	7
COPPER	8.4	10.45	12.5	7.2
IRON	10400 J	19400 J	28400 J	9230 J
LEAD	25.5	29.7	33.9	18.9
MAGNESIUM	2430	2120	1810	1350
MANGANESE	582	506	430	317
MERCURY	0.041	0.026	0.011	0.012 U
NICKEL	22	20.25	18.5	14
POTASSIUM	361 J	397 J	433 J	283 J
SODIUM	55.3	61.55 L	67.8 L	75.4
VANADIUM	15	22.15	29.3	13.3
ZINC	96.5 L	82.1 L	67.7 L	68.7 L
Miscellaneous Parameters (mg/kg)				
CYANIDE	0.21	0.195	0.18	0.15

J - Estimated.
L - Biased low.
U - Not detected above concentration noted.
UJ - Not detected; estimated detection limit.

TABLE 6-3

HUMAN HEALTH DATA EVALUATION
SITE 23 - HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Sample with Maximum Detection	Range of Nondetects[2]	Average of All Results[3]	Concentration Used for Screening[4]	Background Concentration[5]	Human Health Risk Screening[6]				Selected as a COPC?	Rationale
								Region 3 RBC Residential Soil[7]	Soil to GW DAF=1	Soil to GW DAF=20	EPA SSL Soil to Air		
Semivolatile Organics (µg/kg)													
ACENAPHTHYLENE	1/2	31 - 31	S23SD0010001-D	140 - 200	50.5	31	NA	470000	---	---	---	No	BSL
ANTHRACENE	2/2	11 - 15	S23SD0010001-D	---	12.3	15	NA	2300000[8]	23000	470000	---	No	BSL
BENZO(A)ANTHRACENE	2/2	110 - 250	S23SD0010001-D	---	170	250	NA	870	**73**	1500	---	No	BSL
BENZO(A)PYRENE	2/2	140 - 330	S23SD0010001-D	---	223	330	NA	**87**	**19**	370	---	Yes	ASL
BENZO(B)FLUORANTHENE	2/2	110 - 240	S23SD0010001-D	---	163	240	NA	870	**230**	4500	---	No	BSL
BENZO(G,H,I)PERYLENE	2/2	94 - 210	S23SD0010001-D	---	136	210	NA	230000[9]	---	---	---	No	BSL
BENZO(K)FLUORANTHENE	2/2	65 - 130	S23SD0010001-D	---	96.3	130	NA	8700	2300	45000	---	No	BSL
CHRYSENE	2/2	130 - 280	S23SD0010001-D	---	198	280	NA	87000	7300	150000	7500000	No	BSL
DIBENZO(A,H)ANTHRACENE	2/2	31 - 69	S23SD0010001-D	---	48.0	69	NA	87	70	1400	---	No	BSL
FLUORANTHENE	2/2	180 - 380	S23SD0010001-D	---	265	380	NA	310000	310000	6300000	---	No	BSL
FLUORENE	2/2	12 - 15	S23SD0010001-D	---	12.8	15	NA	310000	6800	140000	---	No	BSL
INDENO(1,2,3-CD)PYRENE	2/2	110 - 240	S23SD0010001-D	---	163	240	NA	870	640	13000	---	No	BSL
NAPHTHALENE	2/2	23 - 28	S23SD0010001-D	---	25.5	28	NA	160000	**7.7**	150	170000	No	BSL
PHENANTHRENE	2/2	120 - 150	S23SD0010001-D	---	138	150	NA	230000[9]	---	---	---	No	BSL
PYRENE	2/2	230 - 480	S23SD0010001-D	---	348	480	NA	230000	34000	680000	---	No	BSL
PCBs (µg/kg)													
AROCLOR-1260	1/2	9.4 - 9.4	S23SD0020001	40 - 41	14.8	9.4	NA	320	21	410	---	No	BSL
Explosives (mg/kg)													
NITROCELLULOSE	2/2	11.9 - 16.7	S23SD0020001	---	15.2	16.7	NA	---	---	---	---	No	NTX
Inorganics (mg/kg)													
ALUMINUM	2/2	4090 - 5970	S23SD0010001-D	---	4748	5970	19700	---	---	---	---	No	NTX, BKG
ARSENIC	2/2	2.5 - 10.6	S23SD0010001-D	---	4.83	10.6	14.9	**0.43**	**0.0013**	**0.026**	750	No	BKG
BARIUM	2/2	39 - 56.1	S23SD0010001-D	---	44.5	56.1	80.4	1600	300	6000	686000	No	BSL, BKG
CADMIUM	2/2	0.23 - 0.89	S23SD0020001	---	0.509	0.89	2.5	3.9	1.4	27	1800	No	BSL, BKG
CALCIUM	2/2	971 - 2000	S23SD0010001	---	1263	2000	2060	---	---	---	---	No	NUT
CHROMIUM	2/2	12.9 - 16.6	S23SD0010001-D	---	14.7	16.6	33.4	23	**2.1**	42	270	No	BSL, BKG
COBALT	2/2	7 - 9.1	S23SD0010001	---	7.75	9.1	22.3	160	---	---	1140	No	BSL, BKG
COPPER	2/2	7.2 - 12.5	S23SD0010001-D	---	8.83	12.5	20.3	310	530	11000	---	No	BSL, BKG
IRON	2/2	9230 - 28400	S23SD0010001-D	---	14315	28400	38500	**2300**	---	---	---	No	BKG
LEAD	2/2	18.9 - 33.9	S23SD0010001-D	---	24.3	33.9	62.5	400	---	---	---	No	BSL, BKG
MAGNESIUM	2/2	1350 - 2430	S23SD0010001	---	1735	2430	**1620**	---	---	---	---	No	NUT
MANGANESE	2/2	317 - 582	S23SD0010001	---	412	582	1390	**160**	**48**	950	68600	No	BKG
MERCURY	1/2	0.011 - 0.041	S23SD0010001	0.012 - 0.012	0.0160	0.041	0.16	2.3	0.1	2.1	2.9	No	BSL, BKG
NICKEL	2/2	14 - 22	S23SD0010001	---	17.1	22	**15.4**	160	**14**	280	13300	No	BSL
POTASSIUM	2/2	283 - 433	S23SD0010001-D	---	340	433	1470	---	---	---	---	No	NUT
SODIUM	2/2	55.3 - 75.4	S23SD0020001	---	68.5	75.4	120	---	---	---	---	No	NUT
VANADIUM	2/2	13.3 - 29.3	S23SD0010001-D	---	17.7	29.3	53.3	**7.8**	37	730	---	No	BKG
ZINC	2/2	67.7 - 96.5	S23SD0010001	---	75.4	96.5	**37.5**	2300	680	14000	---	No	BSL
Miscellaneous Parameters (mg/kg)													
CYANIDE	2/2	0.15 - 0.21	S23SD0010001	---	0.173	0.21	NA	160	7.4	150	---	No	BSL

Shaded cells indicate chemicals selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-2.
7 RBCs for noncarcinogens are divided by 10 to correspond to a target hazard quotient of 0.1.
8 The value for acenaphthene is used as a surrogate for acenaphthylene.
9 The value for pyrene is used as a surrogate for benzo*g,h,i)perylene and phenanthrene.

TABLE 6-3

HUMAN HEALTH DATA EVALUATION
SITE 23 - HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S23SD0010001
S23SD0010001-D
S23SD0020001

Definitions
COPC - Chemical of potential concern.
DAF - Dilution/attenuation factor.
EPA - United States Environmental Protection Agency.
GW - Groundwater.
NA - Not available/Not applicable.
RBC - Risk-based concentration.
SSL - Soil screening level.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NUT - Essential nutrient
NTX - No toxicity information available

TABLE 6-4

CHEMICAL-SPECIFIC HUMAN HEALTH RISKS
SITE 23 - HYDRAULIC OIL DISCHRARGES FROM EXTRUSION PLAN
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Maximum Concentration	Carcinogenic Risks		Noncarcinogenic Risks			Evaluation of Target Organ HIs	
		RBC[1]	Estimated ILCR	Primary Target Organ	RBC[1]	Estimated HQ	Target Organ	Total HI
Sediment (mg/kg)								
Benzo(a)pyrene	0.33	0.087	3.8E-06	NA[2]	NA[2]	---	NA[2]	NA[2]
		Total ILCR	3.8E-06		**Total**	---		

Abbreviations:

HI	Hazard index.
HQ	Hazard quotient.
ILCR	Incremental lifetime cancer risk.
RBC	Risk-based concentration.

Footnotes:

1 RBCs (EPA, 2005a) for residential soil.

2 NA - Not applicable. EPA has not established a cancer slope factor or oral reference dose (RfD) for this chemical.

TABLE 6-5

ECOLOGICAL DATA EVALUATION
SITE 23 - HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Sample with Maximum Detection	Range of Nondetects[2]	Average of All Results[3]	Concentration Used for Screening[4]	Background Concentration[5]	Ecological Screening Level[6]	Selected as a COPC?	Rationale
Semivolatile Organics (µg/kg)										
ACENAPHTHYLENE	1/2	31 - 31	S23SD0010001-D	140 - 200	50.5	31	NA	**5.9**	Yes	ASL
ANTHRACENE	2/2	11 - 15	S23SD0010001-D	---	12.3	15	NA	57.2	No	BSL
BENZO(A)ANTHRACENE	2/2	110 - 250	S23SD0010001-D	---	170	250	NA	**108**	Yes	ASL
BENZO(A)PYRENE	2/2	140 - 330	S23SD0010001-D	---	223	330	NA	**150**	Yes	ASL
BENZO(B)FLUORANTHENE	2/2	110 - 240	S23SD0010001-D	---	163	240	NA	**27.2**	Yes	ASL
BENZO(G,H,I)PERYLENE	2/2	94 - 210	S23SD0010001-D	---	136	210	NA	**170**	Yes	ASL
BENZO(K)FLUORANTHENE	2/2	65 - 130	S23SD0010001-D	---	96.3	130	NA	240	No	BSL
CHRYSENE	2/2	130 - 280	S23SD0010001-D	---	198	280	NA	**166**	Yes	ASL
DIBENZO(A,H)ANTHRACENE	2/2	31 - 69	S23SD0010001-D	---	48.0	69	NA	**33**	Yes	ASL
FLUORANTHENE	2/2	180 - 380	S23SD0010001-D	---	265	380	NA	423	No	BSL
FLUORENE	2/2	12 - 15	S23SD0010001-D	---	12.8	15	NA	77.4	No	BSL
INDENO(1,2,3-CD)PYRENE	2/2	110 - 240	S23SD0010001-D	---	163	240	NA	**17**	Yes	ASL
NAPHTHALENE	2/2	23 - 28	S23SD0010001-D	---	25.5	28	NA	176	No	BSL
PHENANTHRENE	2/2	120 - 150	S23SD0010001-D	---	138	150	NA	204	No	BSL
PYRENE	2/2	230 - 480	S23SD0010001-D	---	348	480	NA	**195**	Yes	ASL
PCBs (µg/kg)										
AROCLOR-1260	1/2	9.4 - 9.4	S23SD0020001	40 - 41	14.8	9.4	NA	59.8	No	BSL
Explosives (mg/kg)										
NITROCELLULOSE	2/2	11.9 - 16.7	S23SD0020001	---	15.2	16.7	NA	--	Yes	NTX
Inorganics (mg/kg)										
ALUMINUM	2/2	4090 - 5970	S23SD0010001-D	---	4748	5970	19700	---	No	BKG
ARSENIC	2/2	2.5 - 10.6	S23SD0010001-D	---	4.83	10.6	14.9	**9.8**	No	BKG
BARIUM	2/2	39 - 56.1	S23SD0010001-D	---	44.5	56.1	80.4	---	No	BKG
CADMIUM	2/2	0.23 - 0.89	S23SD0020001	---	0.509	0.89	2.5	0.99	No	BSL, BKG
CALCIUM	2/2	971 - 2000	S23SD0010001	---	1263	2000	2060	---	No	NUT
CHROMIUM	2/2	12.9 - 16.6	S23SD0010001-D	---	14.7	16.6	33.4	43.4	No	BSL, BKG
COBALT	2/2	7 - 9.1	S23SD0010001	---	7.75	9.1	22.3	50	No	BSL, BKG
COPPER	2/2	7.2 - 12.5	S23SD0010001-D	---	8.83	12.5	20.3	31.6	No	BSL, BKG
IRON	2/2	9230 - 28400	S23SD0010001-D	---	14315	28400	38500	**20000**	No	BKG
LEAD	2/2	18.9 - 33.9	S23SD0010001-D	---	24.3	33.9	62.5	35.8	No	BSL, BKG
MAGNESIUM	2/2	1350 - 2430	S23SD0010001	---	1735	2430	**1620**	---	No	NUT
MANGANESE	2/2	317 - 582	S23SD0010001	---	412	582	1390	**460**	No	BKG
MERCURY	1/2	0.011 - 0.041	S23SD0010001	0.012 - 0.012	0.0160	0.041	0.16	0.18	No	BSL, BKG
NICKEL	2/2	14 - 22	S23SD0010001	---	17.1	22	**15.4**	22.7	No	BSL
POTASSIUM	2/2	283 - 433	S23SD0010001-D	---	340	433	1470	---	No	NUT
SODIUM	2/2	55.3 - 75.4	S23SD0020001	---	68.5	75.4	120	---	No	NUT
VANADIUM	2/2	13.3 - 29.3	S23SD0010001-D	---	17.7	29.3	53.3	---	No	BKG
ZINC	2/2	67.7 - 96.5	S23SD0010001	---	75.4	96.5	**37.5**	121	No	BSL
Miscellaneous Parameters (mg/kg)										
CYANIDE	2/2	0.15 - 0.21	S23SD0010001	---	0.173	0.21	NA	**0.1**	Yes	ASL

Shaded cells indicate chemical selected as COPCs and/or exceedances of criteria.

1 Sample and duplicate are counted as one sample when determining frequency of detection and as two samples when determining range of detections.
2 Values presented are sample-specific quantitation limits.
3 Averages are calculated using 1/2 the detection limit for nondetect samples.
4 The maximum detected concentration is used for screening purposes.
5 Table 3-1.
6 Table 3-4.

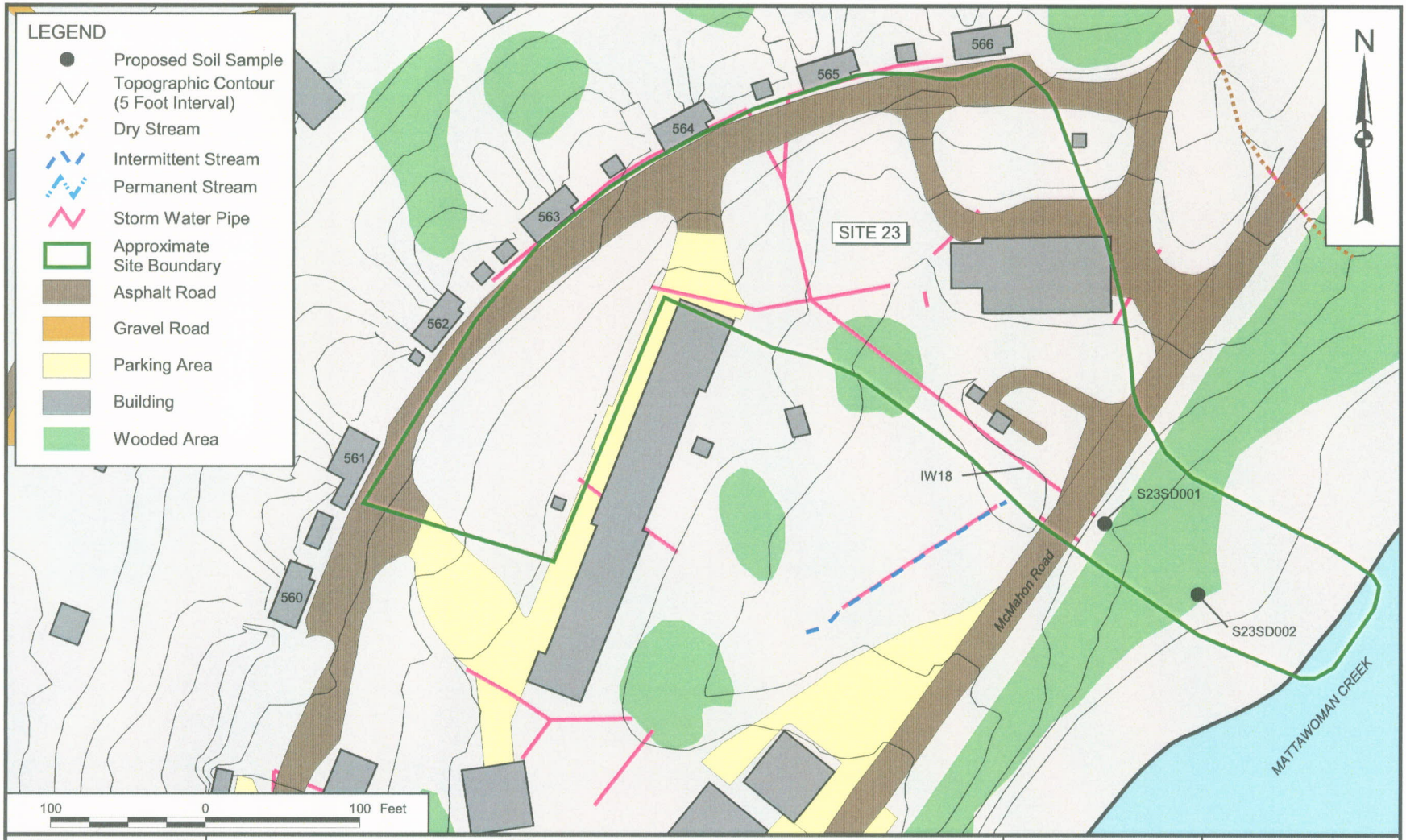
TABLE 6-5

ECOLOGICAL DATA EVALUATION
SITE 23 - HYDRAULIC OIL DISCHARGES FROM EXTRUSION PLANT
NSF-IH, INDIAN HEAD, MARYLAND

Associated Samples
S23SD0010001
S23SD0010001-D
S23SD0020001

Definitions
COPC - Chemical of potential concern.
NA - Not available/Not applicable.

Rationale Codes
ASL - Above screening level
BKG - Below background
BSL - Below screening level
NTX - No toxicity information available
NUT - Essential nutrient



DRAWN BY K. PEILA	DATE 6/01/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2194 / OWNER NUMBER 0007
CHECKED BY K. TURNBULL	DATE 10/25/05	SSP SAMPLE LOCATIONS SITE 23 - HYRAULIC OIL DISCHARGES FROM EXTRUSION PLANT NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY KCT / DATE 10/25/05
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 6 - 1 / REV 0

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SITE 23 SSP LOCATIONS LAYOUT 10/25/05 AJ

REFERENCES

Allen, Herbert E., 2002. Bioavailability of Metals in Terrestrial Ecosystems: Importance of Partitioning for Bioavailability to Invertebrates, Microbes, and Plants. Society of Environmental Toxicology and Chemistry.

B&R (Brown & Root) Environmental, 1997. Background Investigation Report for Indian Head and Stump Neck Annex, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland. Prepared for Engineering Field Activity Chesapeake, Naval Facilities Engineering Command, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

Bentley, R.E., G.A. LeBlanc, T.A. Hollister, and B.H. Sleight III, 1976. Laboratory Evaluation of the Toxicity of Nitrocellulose to Aquatic Organisms. EG and G Bionomics, Wareham, MA. 1976:40. (As referenced in U.S. Army Corps of Engineers, Waterways Experiment Station Technical Report IRRP-98-4, April 1998, Toxicity of Military Unique Compounds in Aquatic Organisms: An Annotated Bibliography).

CH2MHILL, 2005. Draft Baseline Ecological Risk Assessment, Site 47, Naval District Washington, Indian Head, Maryland. Department of the Navy, Naval Facilities Engineering Command, Washington. Herndon, Virginia.

DoN (United States Department of the Navy), 1999. Navy Policy for Conducting Ecological Risk Assessments. Memo from Chief of Naval Operations to Commander, Naval Facilities Engineering Command, 05 April 1999, Department of the Navy, Washington, D.C.

Dragun, J., 1991. Elements in North American Soils. HMCRI, Greenbelt, Maryland.

EC (Environment Canada), 1999a. Canadian Soil Quality Guidelines for Benzo(a)pyrene. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 1999b. Canadian Soil Quality Guidelines for Chromium. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 1999c. Canadian Soil Quality Guidelines for Mercury. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 1999d. Canadian Soil Quality Guidelines for Copper. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 1999e. Canadian Soil Quality Guidelines for Nickel. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 1999f. Canadian Soil Quality Guidelines for Zinc. Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

EC, 2001. Canadian Soil Quality Guidelines for Polychlorinated Biphenyls (PCBs): Environmental Health, Scientific Supporting Document. National Guidelines and Standards Office, Environmental Quality Branch, Environment Canada. Ottawa, Ontario.

Efroymson, D.D., M.E. Will, G.W. Suter II, and A.C. Wooten, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. ES/ER/TM-85/R3. Oak Ridge National Laboratory, Tennessee.

EPA (United States Environmental Protection Agency), 1993. Region 3 Modifications to National Functional Guidelines for Inorganic Data Review, Multi-Media, Multi-Concentration. Philadelphia, Pennsylvania.

EPA, 1994a. Region 3 Modifications to National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration. Philadelphia, Pennsylvania.

EPA, 1994b. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1995. Region 3 BTAG Screening Levels. Region 3 Biological Technical Assistance Group (BTAG), Philadelphia, Pennsylvania.

EPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1998. Final Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F, Risk Assessment Forum, Washington, D.C.

EPA, 2003. EPA Region 3 Risk-Based Concentration Table: Technical Background Information, Revised April 16, 2003. Philadelphia, Pennsylvania.

EPA, 2004. Soil Screening Guidance for Chemicals. Calculations from EPA Internet Site http://risk.lsd.ornl.gov/calc_start.shtml. Washington, D.C.

EPA, 2005a. Region 3 Risk-Based Concentrations (October update). Hazardous Waste Management Division, Philadelphia, Pennsylvania.

EPA, 2005b. EPA Ecological Soil Screening Levels (http://www.epa.gov/ecotox/ecossl/). Washington, D.C.

EPA, 2005c. Region 3 BTAG Freshwater Sediment Screening Values. Philadelphia, Pennsylvania.

EPA, 2005d. Ecological Soil Screening Levels for Antimony, Interim Final. OSWER Directive 9285.7-61, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 2005e. Ecological Soil Screening Levels for Lead, Interim Final. OSWER Directive 9285.7-70, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA Region 3 and DoN, 2000. Federal Facility Agreement. U.S. Department of the Navy, Naval Surface Warfare Center, Indian Head Division, Indian Head, Maryland. Docket Number: III-FCA-CERC-018.

Hart (Fred C. Hart Associates), 1983. Initial Assessment Study, Naval Ordnance Station, Indian Head, Maryland. New York, New York.

IHIRT (Indian Head Installation Restoration Team), 2002. Desk-Top Decision Document, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicity, Vol. 39, pp. 20-31.

Shacklette, Hansord T. and Josephine G. Boerngen, 1984. Element Concentrations in Soils and other Surficial Materials in the Conterminous United States. United States Geological Survey Professional Paper 1270, Washington, D.C.

TtNUS (Tetra Tech NUS, Inc.), 2002. Background Soil Investigation Report for Indian Head and Stump Neck Annex, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland. Prepared for Engineering Field Activity Chesapeake, Naval Facilities Engineering Command, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

TtNUS, 2005. Work Plan for Site Screening Process Investigation at Site 2 – Waste Crankcase Oil Applied to Torrense Road, Site 4 – Lloyd Road Oil Spills, Site 23 – Hydraulic Oil Discharges from Extrusion Plant, Naval District Washington, Indian Head, Maryland. Prepare for Naval Facilities Engineering Command Washington, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

APPENDIX A

SAMPLE LOG SHEETS AND CHAIN OF CUSTODY FORMS

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0010001
Sample Location: S02SS001
Sampled By: PR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1445 Method: TROWEL Monitor Reading (ppm): NM	0-1'	DK BRN	SAND + SILT + GRAVEL MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

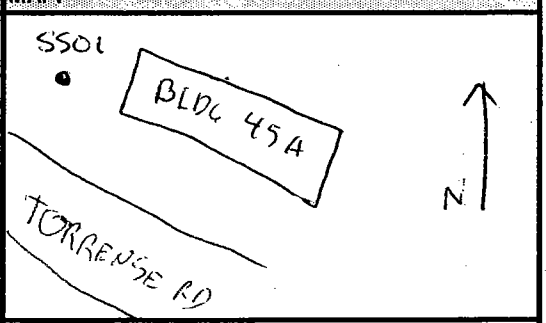
Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

-8' FROM RD

-7' FROM BLDG 45A

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Ullauser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0020001
Sample Location: S02SS002
Sampled By: [illegible]
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1530 Method: TROWEL Monitor Reading (ppm): NM	0-1'	LLT BRN	SAND + GRAVELS DRY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

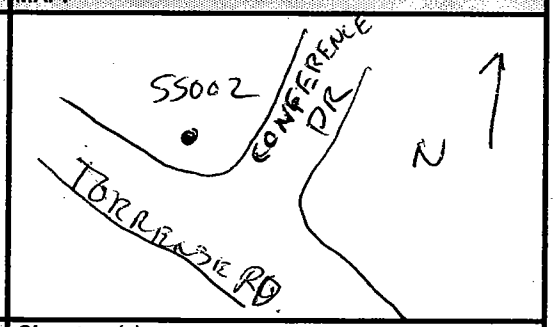
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	—
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	—

OBSERVATIONS / NOTES:

- GRAVEL SURFACE
- SORT OUT GRAVELS
- 8' FROM TORRENCE RD

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0030001
Sample Location: S02SS003
Sampled By: [illegible]
C.O.C. No.: 4317

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1605 Method: TROWEL Monitor Reading (ppm): NM	0-1	BRN	SAND + GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

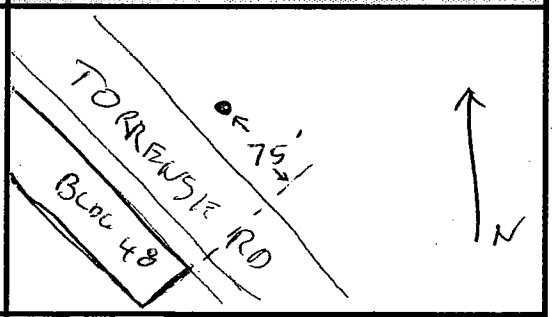
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- SORTED OUT GRAVEL
- 5' OFF ROAD

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0040001
Sample Location: S02SS004
Sampled By: RWR
C.O.C. No.: 4317

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1640 Method: TROWEL Monitor Reading (ppm): NM	0-1	BRN	SAND + GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

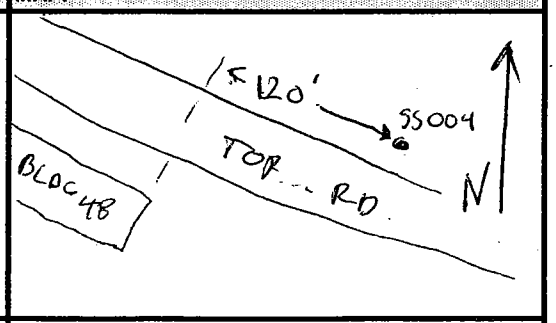
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

3' OFF TORENNSE RD
SORTED OUT GRAVEL

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0050001
Sample Location: S02SS005
Sampled By: RWR
C.O.C. No.: 4317

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1715 Method: TROWEL Monitor Reading (ppm): NM	0-1	BRN	SAND+GRA.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

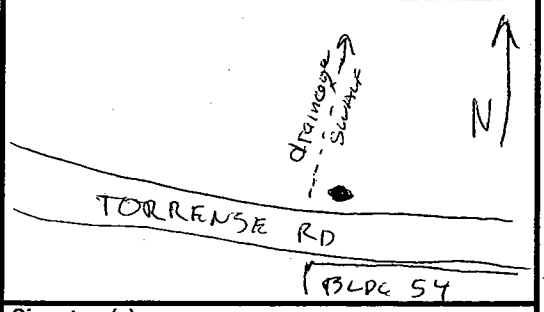
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

-10' FROM THE ROAD
- SORTED GRAVEL OUT OF SPL.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: **S02SS0060001**
Sample Location: **S02SS006**
Sampled By: FWR
C.O.C. No.: 4317

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1700 Method: TROWEL Monitor Reading (ppm): NM	0 - 1'	DKBRN	SAND + GRAVEL MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

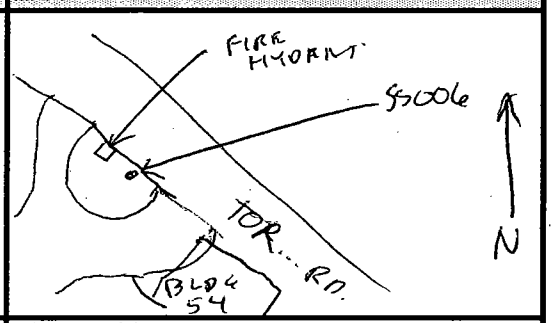
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- 6' FROM ROAD
- 13' FROM FIRE HYDRATE (AWAY FROM MARINA)
- SORTED OUT GRAVEL

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Parsons

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0070001
Sample Location: S02SS007
Sampled By: SWR
C.O.C. No.: 4317

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5-4-05	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1620	0-1	DK BRN	SAND + SILT
Method: TROWEL			
Monitor Reading (ppm): NM			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

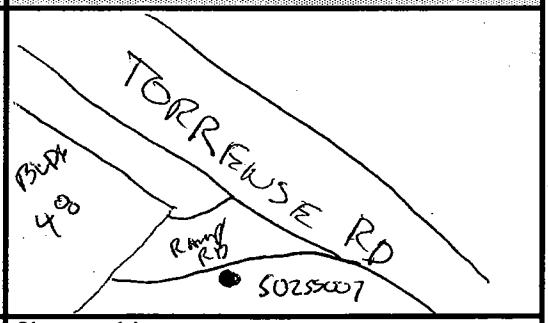
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- 1ST HOLE SELECTED NEAR RD
FILLED w/ H_2O
- MOVED TO DRIVE WAY LEADING INTO BLDG. 48.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓	S02SSDUP0101

Signature(s): Fred M Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0080001
Sample Location: S02SS008
Sampled By: FWR 4315 PR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1550 Method: TROWEL Monitor Reading (ppm): NM	0-1'	DK BRN	GRAVEL + SAND

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

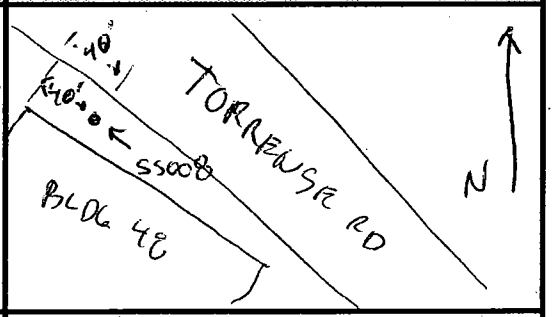
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

-2' OFF TORRENSE RD
-4' FROM BLDG 48

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0090001
Sample Location: S02SS009
Sampled By: FURANSER
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1505 Method: TROWEL Monitor Reading (ppm): NM	0'-1'	DK BRN	SAND+SILT MOIST TO WET

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

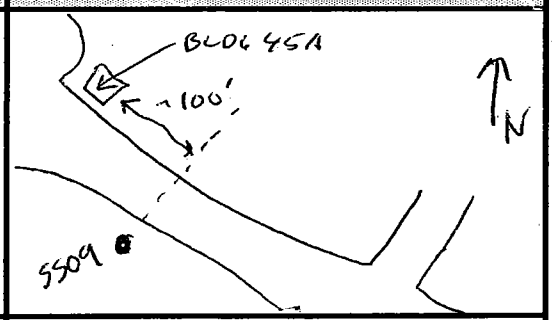
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- GROOMED GRASS AREA
- 12' FROM ROAD

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 2
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S02SS0100001
Sample Location: S02SS010
Sampled By: KR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: Ø 1435 Method: TROWEL Monitor Reading (ppm): NM	0-1'	BRN	SAND, SILT + GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

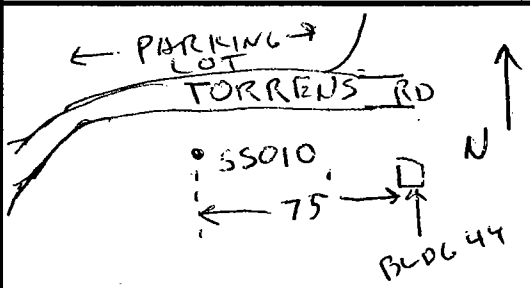
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- LANDSCAPED GRASS AREA
- 12' FROM ROAD

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Rauser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 4
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S04SS0010001
Sample Location: S04SS001
Sampled By: FREDERICK RAMSER
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-3-05 Time: 915 Method: PLASTIC TROWEL Monitor Reading (ppm): nm	0'-1'	DK BRN VARIEGATED	SAND, SILT + GRAVEL MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

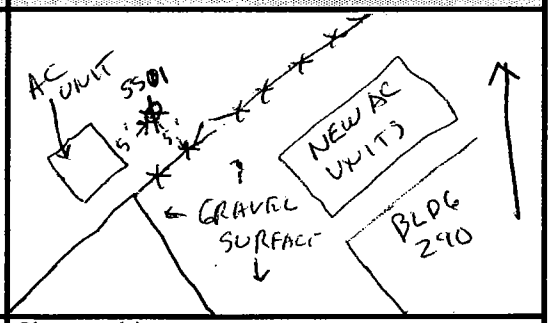
Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz	✓	

OBSERVATIONS / NOTES:

COLLECTED 4-4oz CONTAINERS FOR SAMPLE + DUP.

- REMOVED GRAVEL FROM TOP 3" AND SORTED OUT GRAVEL

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	S04SSDUP0101

Signature(s): Fred U Ramser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 4
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S04SS0020001
Sample Location: S04SS002
Sampled By: RWR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-3-05 Time: 0945 Method: PLASTIC TROWEL Monitor Reading (ppm): nm	0-1'	DK BRN VARIEGATED	SAND, SILT + GRAVEL

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

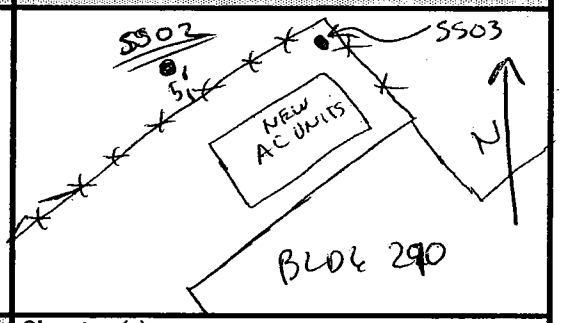
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz	✓	

OBSERVATIONS / NOTES:

- COLLECTED ~ 5' FROM THE FENCE
- CLEARED ~ 3' GRAVEL OFF TOP
- SORTED GRAVEL OUT OF SPL.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 4
Project No.: CTO 0007 JOB # N2194

[x] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S04SS0030001
Sample Location: S04SS003
Sampled By: RWR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-3-05 Time: 1010 Method: PLASTIC TROWEL Monitor Reading (ppm): nm	0'-1'	DK BRN	SAND, SILT + GRAVEL MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

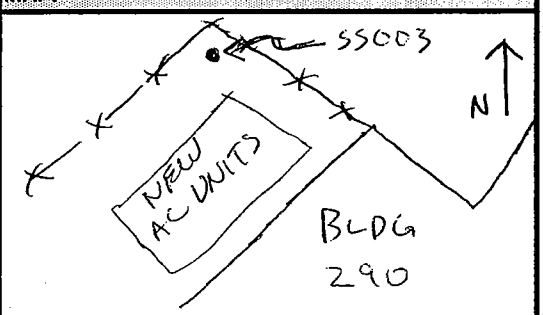
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz	✓	

OBSERVATIONS / NOTES:

- COLLECTED ~3' FROM THE FENCE
- CLEARED OFF ~3' GRAVEL OFF TOP
- SORTED GRAVEL OUT OF SPL
- ~~REQUESTED MS/MSD W/NO ADDITIONAL VOL~~ RWR

MAP:



Circle if Applicable:

MS/MSD (RWR)

Duplicate ID No.:

Signature(s):

Fred W Ranser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 23
Project No.: CTO 0007 JOB # N2194

[] Surface Soil
[] Subsurface Soil
[x] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S23SD0010001
Sample Location: S23SD001
Sampled By: FWR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 5-3-05	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1235	0-6"	BRN	SAND, GRAVEL + PLANT MATL. WET
Method: TROWEL			
Monitor Reading (ppm): nm			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

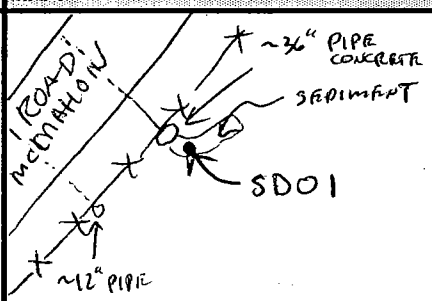
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	
Explosives 8330 plus Nitroguanidine and Nitroglycerin	1 x 4oz glass	✓	
Nitrocellulose 353.2	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- RUNNING WATER
- SAMPLE COLLECTED ~ 5' FROM FENCE
- REQUESTED MS/MSD NO EXTRA VOL.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
	S23SDDUP0101

Signature(s): Fred Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 23
Project No.: CTO 0007 JOB # N2194

[] Surface Soil
[] Subsurface Soil
[x] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: S23SD0020001
Sample Location: S23SD002
Sampled By: FWR
C.O.C. No.: 4315

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-3-05 Time: 1225 Method: TROWEL Monitor Reading (ppm): nm	0-6"	BRN	SAND W/ GRAVEL AND PLANT ROOTS WET

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

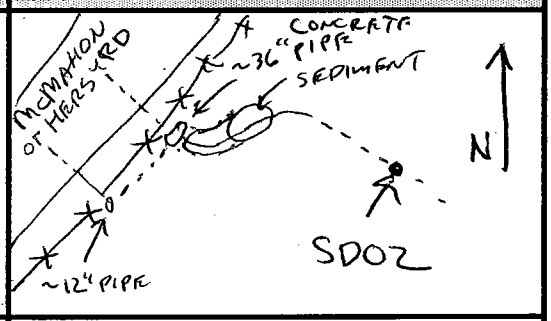
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL 8082 PCBs and 8310 PAHs	1 x 4oz glass	✓	
Total ILMO4.0 TAL Metals and cyanide	1 x 4oz glass	✓	
Explosives 8330 plus Nitroguanidine and Nitroglycerin	1 x 4oz glass	✓	
Nitrocellulose 353.2	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- RUNNING WATER
- SAMPLE COLLECT ~75' FROM FENCE
- TIDE SEEMS LOW
- ~~REQUESTED LAB TO DO MS/MSD VOL.~~ ~~NO WATER~~ RUN

MAP:



Circle if Applicable:

MS/MSD
NO MSD

Duplicate ID No.: —

Signature(s): Fred W Manser

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 4315 | PAGE 1 OF 2

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
2194 CTO 0007	INDIAN HEAD	KIM TURNBULL		STL VERONICA BORTOT
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W. RAMSER	X 8838	301 ALPHA DR RIDC PARK
		CARRIER/WAYBILL NUMBER		CITY, STATE
				PITTSBURGH, PA 15238

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

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G G
PRESERVATIVE USED: 4° 4° 4°

DATE YEAR 2005	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	8082 PCBs	8310 PAHs	TAL METALS + TUNO4.0	8310 PAHs	8082 PCBs	EXPLOSIVES + NITROGLY + NITROCELLULOSE	TAL METALS	CN	COMMENTS
5/3	0815	S02RB0010001	—	—	—	AQ	G	9			2	1	2	2	1	1	
	0915	S04SS0010001	—	0	1	SO	G	2	1	1							~~RUN MS/MSD~~ RUN 5-9-05
	0000	S04SSDUP0101	—	0	1	SO	G	2	1	1							
	0945	S04SS0020001	—	0	1	SO	G	2	1	1							
	1010	S04SS0030001	—	0	1	SO	G	2	1	1							
	1225	S23SD0020001	—	0	0.5	SD	G	4	1	1			1	1			
	1235	S23SD0010001	—	0	0.5	SD	G	4	1	1			1	1			RUN MS/MSD
5/3	0000	S23SDDUP0101	—	0	0.5	SD	G	4	1	1			1	1			
5/4	1435	S02SS0100001	—	0	1	SO	G	2	1	1							
	1445	S02SS0010001	—	0	1	SO	G	2	1	1							
	1505	S02SS0090001	—	0	1	SO	G	2	1	1							
	1530	S02SS0020001	—	0	1	SO	G	2	1	1							
5/4	1550	S02SS0080001	—	0	1	SO	G	2	1	1							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY: Fred W Ramser	5-5-05	1435	1. RECEIVED BY: Patrick Jones	5/5/05	1435
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

TETRA TECH NUS, INC. | CHAIN OF CUSTODY | NUMBER 4317 | PAGE 2 OF 2

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
2194 CTO 0007	INDIAN HEAD	KIM TURNBULL		STL VERONICA BORTOT
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
Fred Ulamser		FRED W. RAMSER	X 8838	301 ALPHA DR RIDC PARK
		CARRIER/WAYBILL NUMBER		CITY, STATE
				PITTSBURGH PA 15238

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

CONTAINER TYPE PLASTIC (P) or GLASS (G): G G
PRESERVATIVE USED: 4° 4°

DATE YEAR 2005	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	TYPE OF ANALYSIS: 8082 PCBS	8310 PAHS	TAL METALS + CN	TLM04.0						COMMENTS
5/4	1605	S02SS0030001	—	0	1	SO	G	2	1	1								
	1620	S02SS0070001	—	0	1	SO	G	2	1	1								RUN MS/MSD
	0000	S02SSDUP0101	—	0	1	SO	G	2	1	1								
	1640	S02SS0040001	—	0	1	SO	G	2	1	1								
	1700	S02SS00~~X~~0001 (G Pur)	—	0	1	SO	G	2	1	1								
5/4	1715	S02SS0050001	—	0	1	SO	G	2	1	1								

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Fred Ulamser	5-5-05	1430	1. RECEIVED BY Patrick R. Faust	5/5/05	1430
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 B

ANALYTICAL DATA

site 2
indian head
full appendix results

order	**002**	**003**	**004**	**005**	**006**	**007**	**008**
site	02	02	02	02	02	02	02
location	S02SS001	S02SS002	S02SS003	S02SS004	S02SS005	S02SS006	S02SS007
nsample	S02SS0010001	S02SS0020001	S02SS0030001	S02SS0040001	S02SS0050001	S02SS0060001	S02SS0070001
sample	S02SS0010001	S02SS0020001	S02SS0030001	S02SS0040001	S02SS0050001	S02SS0060001	S02SS0070001
matrix	SS	SS	SS	SS	SS	SS	SS
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
gis_date	20050504	20050504	20050504	20050504	20050504	20050504	20050504
qc_type	NM	NM	NM	NM	NM	NM	NM
sample_dat	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05
validated	Y	Y	Y	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194	2194	2194	2194
proj_manag	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K
sort	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**
Semivolatile Organics (ug/kg)							
ACENAPHTHENE	210 U	38 U	230 U	570 U	39 UJ	38 UJ	38 UJ
ACENAPHTHYLENE	20 J	38 U	230 U	570 U	39 UJ	9 J	38 UJ
ANTHRACENE	16 J	6.3 J	100	120	15 J	2.7 J	2.7 J
BENZO(A)ANTHRACENE	130 J	47 J	470	420	67 J	37 J	23 J
BENZO(A)PYRENE	120	43	400	400	76 J	42 J	24 J
BENZO(B)FLUORANTHENE	120 J	41	360	330	75 J	38 J	24 J
BENZO(G,H,I)PERYLENE	180	30 J	250 J	240 J	57 J	27 J	22 J
BENZO(K)FLUORANTHENE	55 J	26 J	240	230	48 J	23 J	14 J
CHRYSENE	120	43	400	370	130 J	43 J	22 J
DIBENZO(A,H)ANTHRACENE	21 J	8.4 J	78 J	68 J	18 J	8.7 J	5.5 J
FLUORANTHENE	220	73	910	820	90 J	7.8 UJ	39 J
FLUORENE	15 J	7.6 U	57	75 J	7.8 UJ	7.8 UJ	7.7 UJ
INDENO(1,2,3-CD)PYRENE	78 J	28	300	290	63 J	29 J	21 J
NAPHTHALENE	210 U	6.2 J	28 J	570 U	39 UJ	7.7 J	38 UJ
PHENANTHRENE	120	36	610	480	32 J	41 J	18 J
PYRENE	200 J	71 J	770 J	730 J	130 J	65 J	61 J
PCBs (ug/kg)							
AROCLOR-1016	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1221	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1232	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1242	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1248	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1254	43 U	38 U	45 U	38 U	39 U	38 U	38 U
AROCLOR-1260	43 U	38 U	45 U	38 U	39 U	38 U	38 U

from _02sam.dbf
rom _02res.dbf
from _02res.xls
from q:\sql_server\indian_head\upload

site 2
indian head
full appendix results

order	**002**	**003**	**004**	**005**	**006**	**007**	**008**
site	02	02	02	02	02	02	02
location	S02SS001	S02SS002	S02SS003	S02SS004	S02SS005	S02SS006	S02SS007
nsample	S02SS0010001	S02SS0020001	S02SS0030001	S02SS0040001	S02SS0050001	S02SS0060001	S02SS0070001
sample	S02SS0010001	S02SS0020001	S02SS0030001	S02SS0040001	S02SS0050001	S02SS0060001	S02SS0070001
matrix	SS	SS	SS	SS	SS	SS	SS
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
gis_date	20050504	20050504	20050504	20050504	20050504	20050504	20050504
qc_type	NM	NM	NM	NM	NM	NM	NM
sample_dat	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05
validated	Y	Y	Y	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194	2194	2194	2194
proj_manag	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K
sort	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**
Inorganics (mg/kg)							
ALUMINUM	8340	7070	13100	6750	7830	6890	6550
ANTIMONY	0.67 UL	0.59 L	0.71 UL	0.6 UL	0.61 UL	0.61 UL	0.6 UL
ARSENIC	5.4	3.6	8.3	2.7	4	2.6	5.6
BARIUM	59.5	26.9	64.9	32.9	42	50.4	41.4
BERYLLIUM	0.95 B	0.65 B	1.2 B	0.89 B	0.8 B	0.86 B	0.87 B
CADMIUM	0.51	0.052	0.06 U	0.27	0.051 U	0.051 U	0.05 U
CALCIUM	6520 J	2620 J	2330 J	1520 J	5700 J	1420 J	714 J
CHROMIUM	78.1 J	18.7 J	29.9 J	16 J	17.9 J	22.5 J	31.8 J
COBALT	10.1	4.4	4.9	3	4.4	4.1	2.7
COPPER	113 J	17.9 J	56.7 J	70.3 J	38.4 J	78.4 J	7.2 J
IRON	21900 J	12700 J	25700 J	21100 J	16700 J	26400 J	16700 J
LEAD	411 J	74.6 J	309 J	74.2 J	62.2 J	153 J	40.8 J
MAGNESIUM	10100	2090	1560	769	2610	2980	1460
MANGANESE	226 K	77.8 K	71.5 K	79.1 K	95.9 K	67.3 K	110 K
MERCURY	4.4	0.045	0.38	0.11	0.28	0.62	0.025
NICKEL	161	29.5	28.3	12.6	19.9	41.2	6.4
POTASSIUM	419 J	374 J	609 J	356 J	534 J	359 J	2510 J
SELENIUM	0.44 UL	0.4 B	0.88 B	0.39 UL	0.65 B	0.81 B	0.39 U
SILVER	0.56 B	0.17 B	0.41 B	0.39 B	0.23 B	0.16 B	0.2 B
SODIUM	441	200	1420	645	216	232	24.1 U
THALLIUM	0.57 UL	0.5 U	0.6 UL	0.51 UL	0.51 U	0.51 UL	0.5 U
VANADIUM	33	23.1	50	38.4	29.3	37.1	25.7
ZINC	247 J	30.5 J	113 J	88.9 J	60.2 J	137 J	41 J
Miscellaneous Parameters (mg/kg)							
CYANIDE	0.22 J	0.13 J	0.33 J	0.58 UJ	0.15 J	0.13 J	0.14 J
PERCENT SOLIDS	77.5 %	87.7 %	73.3 %	86.6 %	85.5 %	85.7 %	87.2 %

from _02sam.dbf
rom _02res.dbf
from _02res.xls
from q:\sql_server\indian_head\upload

site 2
indian head
full appendix results

order	**009**	**010**	**011**	**012**	**013**
site	02	02	02	02	02
location	S02SS007	S02SS007	S02SS008	S02SS009	S02SS010
nsample	S02SS0070001-AVG	S02SS0070001-D	S02SS0080001	S02SS0090001	S02SS0100001
sample	S02SS0070001-AVG	S02SSDUP0101	S02SS0080001	S02SS0090001	S02SS0100001
matrix	SS	SS	SS	SS	SS
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
gis_date	20050504	20050504	20050504	20050504	20050504
qc_type	NM	FD	NM	NM	NM
sample_dat	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05
validated	Y	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194	2194
proj_manag	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K
sort	**c_009**	**c_010**	**c_011**	**c_012**	**c_013**
Semivolatile Organics (ug/kg)					
ACENAPHTHENE	38 UJ	38 U	36 UJ	210 U	39 U
ACENAPHTHYLENE	38 UJ	38 U	36 UJ	210 U	39 U
ANTHRACENE	2.35 J	2 J	6.3 J	8.9 J	7.9 U
BENZO(A)ANTHRACENE	28 J	33 J	53 J	89	4.1 J
BENZO(A)PYRENE	30.5 J	37	49 J	100	3.7 J
BENZO(B)FLUORANTHENE	31 J	38	46 J	91	5.5 J
BENZO(G,H,I)PERYLENE	27 J	32 J	32 J	70 J	8.3 J
BENZO(K)FLUORANTHENE	18 J	22 J	30 J	54	2.4 J
CHRYSENE	27 J	32	48 J	100	4.8 J
DIBENZO(A,H)ANTHRACENE	7.55 J	9.6 J	9.1 J	28 J	7.9 U
FLUORANTHENE	45.5 J	52	79 J	150	8.4
FLUORENE	7.65 UJ	7.6 U	7.3 UJ	43 U	7.9 U
INDENO(1,2,3-CD)PYRENE	26.5 J	32	35 J	86	3.8 J
NAPHTHALENE	5.7 J	5.7 J	6 J	210 U	39 U
PHENANTHRENE	21 J	24	35 J	79	8.2
PYRENE	59.5 J	58 J	78 J	170 J	7 J
PCBs (ug/kg)					
AROCLOR-1016	38 U	38 U	36 U	42 U	39 U
AROCLOR-1221	38 U	38 U	36 U	42 U	39 U
AROCLOR-1232	38 U	38 U	36 U	42 U	39 U
AROCLOR-1242	38 U	38 U	36 U	42 U	39 U
AROCLOR-1248	38 U	38 U	36 U	42 U	39 U
AROCLOR-1254	38 U	38 U	36 U	42 U	39 U
AROCLOR-1260	38 U	38 U	36 U	42 U	39 U

from _02sam.dbf
rom _02res.dbf
from _02res.xls
from q:\sql_server\indian_head\upload

site 2
indian head
full appendix results

order	**009**	**010**	**011**	**012**	**013**
site	02	02	02	02	02
location	S02SS007	S02SS007	S02SS008	S02SS009	S02SS010
nsample	S02SS0070001-AVG	S02SS0070001-D	S02SS0080001	S02SS0090001	S02SS0100001
sample	S02SS0070001-AVG	S02SSDUP0101	S02SS0080001	S02SS0090001	S02SS0100001
matrix	SS	SS	SS	SS	SS
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
gis_date	20050504	20050504	20050504	20050504	20050504
qc_type	NM	FD	NM	NM	NM
sample_dat	05/04/05	05/04/05	05/04/05	05/04/05	05/04/05
validated	Y	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194	2194
proj_manag	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K
sort	**c_009**	**c_010**	**c_011**	**c_012**	**c_013**
Inorganics (mg/kg)					
ALUMINUM	6310	6070	2320	4850	6160
ANTIMONY	0.595 UL	0.59 UL	0.57 UL	0.67 UL	0.62 UL
ARSENIC	4.7	3.8	1.5	13.7	1.3
BARIUM	38.55	35.7	14	76.6	36
BERYLLIUM	0.79 B	0.71 B	0.47 B	0.82 B	0.83 B
CADMIUM	0.05 U	0.05 U	0.048 U	0.48	0.052 U
CALCIUM	681.5 J	649 J	1700 J	1200 J	626 J
CHROMIUM	24.8 J	17.8 J	16.7 J	74.4 J	19 J
COBALT	2.75	2.8	2.9	5.6	2.9
COPPER	7.3 J	7.4 J	19.4 J	91.9 J	42.5 J
IRON	13450 J	10200 J	6680 J	26800 J	13000 J
LEAD	41.4 J	42 J	32.3 J	153 J	53.3 J
MAGNESIUM	1221	982	2060	2090	551
MANGANESE	111 K	112 K	47.3 K	101 K	46.5 K
MERCURY	0.0235	0.022	0.027	0.23	0.025
NICKEL	6.65	6.9	31.7	219	68.9
POTASSIUM	1666 J	822 J	183 J	302 J	340 J
SELENIUM	0.39 U	0.39 U	0.37 U	0.46 B	0.4 U
SILVER	0.195 B	0.19 B	0.27 B	0.29 B	0.15 B
SODIUM	24 U	23.9 U	31	27 UL	24.8 U
THALLIUM	0.5 U	0.5 U	0.48 U	0.56 UL	0.52 U
VANADIUM	21.8	17.9	9	23.9	26.3
ZINC	44.1 J	47.2 J	26.4 J	141 J	23.4 J
Miscellaneous Parameters (mg/kg)					
CYANIDE	0.145 J	0.15 J	1.3 J	0.13 J	0.74 J
PERCENT SOLIDS	87.5 %	87.8 %	91.2 %	77.9 %	84.5 %

from _02sam.dbf
rom _02res.dbf
from _02res.xls
from q:\sql_server\indian_head\upload

site 4
indian head
full appendix results

order	001	002	003	004	005
site	04	04	04	04	04
location	S04SS001	S04SS001	S04SS001	S04SS002	S04SS003
nsample	S04SS0010001	S04SS0010001-AVG	S04SS0010001-D	S04SS0020001	S04SS0030001
sample	S04SS0010001	S04SS0010001-AVG	S04SSDUP0101	S04SS0020001	S04SS0030001
depth_rang	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
gis_date	20050503	20050503	20050503	20050503	20050503
sample_dat	05/03/05	05/03/05	05/03/05	05/03/05	05/03/05
validated	Y	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194	2194
proj_manag	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K	TURNBULL,K
sort	**c_001**	**c_002**	**c_003**	**c_004**	**c_005**
Semivolatile Organics (ug/kg)					
ACENAPHTHENE	39 UJ	38 UJ	37 UJ	170 UJ	41 UJ
ACENAPHTHYLENE	39 UJ	38 UJ	37 UJ	170 UJ	41 UJ
ANTHRACENE	7.9 UJ	7.7 UJ	7.5 UJ	5.8 J	8.3 UJ
BENZO(A)ANTHRACENE	15 J	14 J	13 J	26 J	8.3 J
BENZO(A)PYRENE	18 J	16.5 J	15 J	21 J	10 J
BENZO(B)FLUORANTHENE	21 J	19.5 J	18 J	49 J	11 J
BENZO(G,H,I)PERYLENE	25 J	22.5 J	20 J	130 J	19 J
BENZO(K)FLUORANTHENE	9.4 J	9.55 J	9.7 J	27 J	6.4 J
CHRYSENE	16 J	15 J	14 J	30 J	9.9 J
DIBENZO(A,H)ANTHRACENE	7.9 UJ	7.7 UJ	7.5 UJ	35 UJ	8.3 UJ
FLUORANTHENE	7.9 UJ	7.7 UJ	7.5 UJ	64 J	18 J
FLUORENE	7.9 UJ	7.7 UJ	7.5 UJ	35 UJ	8.3 UJ
INDENO(1,2,3-CD)PYRENE	22 J	20 J	18 J	58 J	6.2 J
NAPHTHALENE	7.1 J	7.75 J	8.4 J	38 J	41 UJ
PHENANTHRENE	22 J	20.5 J	19 J	66 J	11 J
PYRENE	26 J	24 J	22 J	66 J	18 J
PCBs (ug/kg)					
AROCLOR-1016	39 U	38 U	37 U	43 U	41 U
AROCLOR-1221	39 U	38 U	37 U	43 U	41 U
AROCLOR-1232	39 U	38 U	37 U	43 U	41 U
AROCLOR-1242	39 U	38 U	37 U	43 U	41 U
AROCLOR-1248	39 U	38 U	37 U	43 U	41 U
AROCLOR-1254	39 U	38 U	37 U	43 U	41 U
AROCLOR-1260	78	99	120	210	120
Inorganics (mg/kg)					
ALUMINUM	6510	6270	6030	13400	7380
ANTIMONY	0.62 UL	0.6 UL	0.58 UL	0.67 UL	0.65 UL
ARSENIC	3.8	3.75	3.7	9.2	3.5
BARIUM	40.1	39.75	39.4	133	38
BERYLLIUM	0.67 B	0.635 B	0.6 B	1.5 B	0.64 B
CADMIUM	1.3	1.35	1.4	12.4	0.84
CALCIUM	14200 J	16600 J	19000 J	6310 J	2950 J
CHROMIUM	12.7 J	14.5 J	16.3 J	130 J	21 J
COBALT	5.5	5.05	4.6	8.4	6.5
COPPER	62.5 J	55.15 J	47.8 J	379 J	36.3 J
IRON	12600 J	12500 J	12400 J	25800 J	33300 J
LEAD	100 J	105.5 J	111 J	1030 J	95 J
MAGNESIUM	2860	3210	3560	7570	1750
MANGANESE	136 K	132 K	128 K	284 K	200 K
MERCURY	0.074	0.068	0.062	0.31	0.11
NICKEL	9.3	9.85	10.4	28.6	14.6
POTASSIUM	375 J	390.5 J	406 J	1010 J	448 J
SELENIUM	0.4 U	0.39 U	0.38 U	0.44 UL	0.42 UL
SILVER	0.37 B	0.9925 K	1.8 K	8.2	0.45 B
SODIUM	189	175.5	162	161 L	61.2 L
THALLIUM	0.52 U	0.505 U	0.49 U	0.63 B	0.55 UL
VANADIUM	26.3	24.5	22.7	35.8	21.9
ZINC	191 J	160.5 J	130 J	346 J	181 J
Miscellaneous Parameters (mg/kg)					
CYANIDE	0.18 J	0.165 J	0.15 J	0.31 J	0.3 J
PERCENT SOLIDS	84.4 %	86.8 %	89.2 %	77.6 %	80.4 %

from _04sam.dbf
from _04res.dbf
from _04res.xls
from q:\sql_server\indian_head\upload

site 23
indian head
full appendix results

order	001	002	003	004
site	23	23	23	23
location	S23SD001	S23SD001	S23SD001	S23SD002
nsample	S23SD0010001	S23SD0010001-AVG	S23SD0010001-D	S23SD0020001
sample	S23SD0010001	S23SD0010001-AVG	S23SDDUP0101	S23SD0020001
matrix	SD	SD	SD	SD
submatrix	SD	SD	SD	SD
depth_rang	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
sample_dat	05/03/05	05/03/05	05/03/05	05/03/05
validated	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194
proj_manag	TURNBULL K	TURNBULL K	TURNBULL K	TURNBULL K
sort	**c_001**	**c_002**	**c_003**	**c_004**
Semivolatile Organics (µg/kg)				
ACENAPHTHENE	200 UJ	205 UJ	210 UJ	140 U
ACENAPHTHYLENE	200 UJ	31 J	31 J	140 U
ANTHRACENE	12 J	13.5 J	15 J	11 J
BENZO(A)ANTHRACENE	110 J	180 J	250 J	160
BENZO(A)PYRENE	140 J	235 J	330 J	210
BENZO(B)FLUORANTHENE	110 J	175 J	240 J	150
BENZO(G,H,I)PERYLENE	94 J	152 J	210 J	120 J
BENZO(K)FLUORANTHENE	65 J	97.5 J	130 J	95 J
CHRYSENE	130 J	205 J	280 J	190
DIBENZO(A,H)ANTHRACENE	31 J	50 J	69 J	46 J
FLUORANTHENE	180 J	280 J	380 J	250
FLUORENE	12 J	13.5 J	15 J	12 J
INDENO(1,2,3-CD)PYRENE	110 J	175 J	240 J	150
NAPHTHALENE	200 UJ	28 J	28 J	23 J
PHENANTHRENE	120 J	135 J	150 J	140
PYRENE	230 J	355 J	480 J	340 J
PCBs (µg/kg)				
AROCLOR-1016	40 U	40.5 U	41 U	47 U
AROCLOR-1221	40 U	40.5 U	41 U	47 U
AROCLOR-1232	40 U	40.5 U	41 U	47 U
AROCLOR-1242	40 U	40.5 U	41 U	47 U
AROCLOR-1248	40 U	40.5 U	41 U	47 U
AROCLOR-1254	40 U	40.5 U	41 U	47 U
AROCLOR-1260	40 U	40.5 U	41 U	9.4 J
Explosives (mg/kg)				
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.5 U	0.5 U	0.5 U	0.5 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U
NITROCELLULOSE	11.9	13.7	15.5	16.7
NITROGLYCERIN	2.5 U	2.5 U	2.5 U	2.5 U
NITROGUANIDINE	0.1 U	0.1 U	0.1 U	0.1 U
RDX	0.5 U	0.5 U	0.5 U	0.5 U
TETRYL	0.65 U	0.65 U	0.65 U	0.65 U

from_23sam.dbf
from_23res.dbf
from_23res.xls
from q:\sql_server\indian_head\upload

site 23
indian head
full appendix results

order	001	002	003	004
site	23	23	23	23
location	S23SD001	S23SD001	S23SD001	S23SD002
nsample	S23SD0010001	S23SD0010001-AVG	S23SD0010001-D	S23SD0020001
sample	S23SD0010001	S23SD0010001-AVG	S23SDDUP0101	S23SD0020001
matrix	SD	SD	SD	SD
submatrix	SD	SD	SD	SD
depth_rang	0 - 0.5	0 - 0.5	0 - 0.5	0 - 0.5
sample_dat	05/03/05	05/03/05	05/03/05	05/03/05
validated	Y	Y	Y	Y
cto_proj	2194	2194	2194	2194
proj_manag	TURNBULL K	TURNBULL K	TURNBULL K	TURNBULL K
sort	**c_001**	**c_002**	**c_003**	**c_004**
Inorganics (mg/kg)				
ALUMINUM	4840	5405	5970	4090
ANTIMONY	0.63 UR	0.64 UR	0.65 UR	0.74 UR
ARSENIC	3.7	7.15	10.6	2.5
BARIUM	43.7	49.9	56.1	39
BERYLLIUM	0.71 B	0.695 B	0.68 B	0.74 B
CADMIUM	0.23	0.12875	0.055 U	0.89
CALCIUM	2000	1555	1110	971
CHROMIUM	16.3	16.45	16.6	12.9
COBALT	9.1	8.5	7.9	7
COPPER	8.4	10.45	12.5	7.2
IRON	10400 J	19400 J	28400 J	9230 J
LEAD	25.5	29.7	33.9	18.9
MAGNESIUM	2430	2120	1810	1350
MANGANESE	582	506	430	317
MERCURY	0.041	0.026	0.011	0.012 U
NICKEL	22	20.25	18.5	14
POTASSIUM	361 J	397 J	433 J	283 J
SELENIUM	0.41 U	0.415 UL	0.42 UL	0.48 U
SILVER	0.31 B	0.325 B	0.34 B	0.98 B
SODIUM	55.3	61.55 L	67.8 L	75.4
THALLIUM	0.69 B	0.705 B	0.72 B	0.62 U
VANADIUM	15	22.15	29.3	13.3
ZINC	96.5 L	82.1 L	67.7 L	68.7 L
Miscellaneous Parameters (mg/kg)				
CYANIDE	0.21	0.195	0.18	0.15

from_23sam.dbf
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APPENDIX C

DATA VALIDATION MEMORANDA

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	[redacted]	**DATE:**	**JULY 25, 2005**
FROM:	**D. SCHLOER**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – PAH/PCB/EXP**
CTO 007, NSWC INDIAN HEAD
SDG C5E050319

SAMPLES: 1/Aqueous/PAH/PCB/EXP

S02RB0010001

3/Solid/PAH/PCB/EXP

S23SD0010001	S23SD0020001	S23SDDUP0101

15/Solid/PAH/PCB

S02SS0010001	S02SS0020001	S02SS0030001
S02SS0040001	S02SS0050001	S02SS0060001
S02SS0070001	S02SS0080001	S02SS0090001
S02SS0100001	S02SSDUP0101	S04SS0010001
S04SS0020001	S04SS0030001	S04SSDUP0101

OVERVIEW

The sample set for CTO 007; SDG C5E050319, NSWC Indian Head consists of one (1) aqueous rinse blank and eighteen (18) solid environmental samples including three (3) field duplicates. As indicated above the samples were analyzed for select Polynuclear Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs) and Explosives (EXP) including nitroguanidine and nitroglycerin. The data evaluation and laboratory results for nitrocellulose may be found in the corresponding inorganics data validation memoranda. Three field duplicate pairs were included in this SDG: S04SS0010001/S04SSDUP0101 and S02SS0070001/S02SSDUP0101 and S23SD0010001/S23SDDUP0101.

The samples were collected by TetraTech NUS on May 3rd and 4th, 2005 and analyzed by Severn Trent Laboratories, Inc. The primary contractor Southern University subcontracted the chemical analyses to Severn Trent Inc. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Methods 8310, 8082 and 8330 analytical and reporting protocol.

The findings in this report are based upon a general review of all available data including: data completeness, system performance, holding times, initial / continuing calibrations, laboratory method blank contamination, surrogate spike, blank spike results (if applicable), matrix spike/matrix spike duplicate results, field duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed 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.

Major Problems

- No major problems were noted during the data evaluation.

Minor Problems

- The PAH surrogate p-terphenyl was recovered below the 54%-126% quality control limit on both analytical detectors for the analysis of samples S04SS0010001, S04SSDUP0101, S02SSDUP0101, S02SS0080001, and S04SS0020001. Positive and nondetected results were reported for target PAHs and these were qualified as estimated (J) and (UJ), respectively. The direction of bias cannot be determined.

- The PAH surrogate p-terphenyl was not recovered (0%) and/or less than the 54%-126% quality control limit on both analytical detectors; and, the recovery of benzo(e)pyrene was less than the 49%-129% quality control limit on one analytical detector for the analysis of samples S02SS0070001, S02SS0060001, S02SS0050001 and S04SS0030001. Positive and nondetected results were reported for target PAHs and these were qualified as estimated (J) and (UJ), respectively. The direction of bias cannot be determined.

- The percent Difference (%D) between analytical detectors exceeded the 25% quality control limit the target PAH compounds detected in the following samples:

Sample	Compound	%D
S02RB0010001	Fluorene	323.1
	Fluoranthene	36.9
	Benzo(a)anthracene	63.6
	Chrysene	56.0
	Benzo(a)pyrene	36.4
S02SS0010001	Fluorene	30.2
	Pyrene	70.9
	Benzo(a)anthracene	30.6
	Benzo(b)fluoranthene	26.6
	Benzo(k)fluoranthene	48.5
	Dibenzo(a,h)anthracene	694.5
	Indeno(1,2,3-cd)pyrene	45.9
S02SS0020001	Naphthalene	56.3
	Pyrene	53.0
	Benzo(a)anthracene	56.3
	Benzo(k)fluoranthene	26.6
	Dibenzo(a,h)anthracene	237.1
	Benzo(g,h,i)perylene	149.6
S02SS0030001	Benzo(g,h,i)perylene	144.6
	Dibenzo(a,h)anthracene	184.3
	Pyrene	58.0
S02SS0040001	Benzo(g,h,i)perylene	151.3
	Dibenzo(a,h)anthracene	224.5
	Fluorene	39.4
	Pyrene	49.7
S02SS0050001	Benzo(g,h,i)perylene	139.9

	Dibenzo(a,h)anthracene	179.6
	Pyrene	32.9
S02SS0060001	Benzo(g,h,i)perylene	165.3
	Dibenzo(a,h)anthracene	194.3
	Pyrene	150.0
S02SS0070001	Benzo(g,h,i)perylene	113.4
	Dibenzo(a,h)anthracene	230.5
	Pyrene	30.2
S02SS0080001	Benzo(g,h,i)perylene	136.4
	Dibenzo(a,h)anthracene	210.1
	Pyrene	57.9
S02SS0090001	Benzo(g,h,i)perylene	159.1
	Dibenzo(a,h)anthracene	133.4
	Pyrene	50.1
S02SS0100001	Indeno(1,2,3-cd)pyrene	56.9
	Pyrene	236.8
S02SSDUP0101	Benzo(a)anthracene	26.3
	Benzo(g,h,i)perylene	130.2
	Benzo(k)fluoranthene	27.1
	Dibenzo(a,h)anthracene	194.9
	Naphthalene	31.6
	Pyrene	42.2
S04SS0010001	Benzo(b)fluoranthene	26.6
	Benzo(g,h,i)perylene	56.7
	Naphthalene	44.1
	Pyrene	189.4
S04SS0020001	Benzo(a)anthracene	36.3
	Benzo(a)pyrene	137.4
	Benzo(b)fluoranthene	47.5
	Fuoranthene	67.3
	Naphthalene	37.1
	Pyrene	192.5
S04SS0030001	Benzo(g,h,i)perylene	26.4
	Fluoranthene	50.3
	Indeno(1,2,3-cd)pyrene	64.6
	Pyrene	72.0
S04SSDUP0101	Benzo(g,h,i)perylene	60.6
	Pyrene	423.0
S23SD0010001	Benzo(g,h,i)perylene	148.3
	Dibenzo(a,h)anthracene	195.3
	Fluorene	64.1
	Indeno(1,2,3-cd)pyrene	27.4

	Pyrene	45.7
S23SD0020001	Benzo(g,h,i)perylene	178.1
	Benzo(k)fluoranthene	34.2
	Dibenzo(a,h)anthracene	104.2
	Fluorene	59.0
	Naphthalene	37.9
	Pyrene	43.5
S23SDDUP0101	Benzo(g,h,i)perylene	143.0
	Dibenzo(a,h)anthracene	164.9
	Fluorene	90.0
	Naphthalene	101.1
	Pyrene	42.2

Positive results for the compounds in the samples listed above were qualified as estimated (J), due to variance between analytical detectors. The direction of bias cannot be determined.

- As indicated on the Chain of Custody (COC) documentation, the laboratory performed Matrix Spike / Matrix Spike Duplicate (MS/MSD) analysis on the PAH fraction of sample S04SS0010001. The target compounds chrysene, indeno(1,2,3-cd)pyrene and benzo(a)pyrene were recovered above their respective quality control limits for the MS and MSD analysis. Positive results were reported for chrysene, indeno(1,2,3-cd)pyrene and benzo(a)pyrene and these were qualified as estimated (J), in the native sample S04SS0010001 only.

- Field duplicate precision was evaluated for three duplicate pair analyzed and reported in this SDG: S04SS0010001/S04SSDUP0101 and S02SS0070001/S02SSDUP0101 and S23SD0010001/S23SDDUP0101. Field duplicate precision is measured by calculating the Relative Percent Difference (RPD) between positive results in the field duplicate pair. Precision is evaluated by comparing the calculated RPD against the quality control limit of 30% for aqueous matrices and 50% for solid matrices. Target PAHs were detected in the field duplicate pair S02SS0070001/S02SSDUP0101 at concentrations that resulted in acceptable RPDs. Naphthalene was detected in the duplicate sample S02SSDUP0101 but not in the original sample S02SS0070001; therefore, the positive and nondetected results for naphthalene were qualified as estimated (J) and (UJ), respectively. Target PAHs were detected in the field duplicate pair S04SS0010001/S04SSDUP0101 at concentrations that resulted in acceptable RPDs. Target PAHs were detected in the field duplicate pair S23SD0010001/S23SDDUP0101 at concentrations that resulted in acceptable RPDs. Acenaphthylene and naphthalene were not detected in the original sample S23SD0010001 but were detected in the duplicate sample S23SDDUP0101; therefore, the positive and nondetected results were qualified as estimated (J) and (UJ), respectively. The target PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene and pyrene were detected in the field in the field duplicate pair S23SD0010001/S23SDDUP0101 at concentrations that resulted in RPDs that exceeded the 50% quality control limit. Positive results for the aforementioned compounds were qualified as estimated (J) in the field duplicate pair S23SD0010001/S23SDDUP0101. The affected compounds and the calculated RPD are presented in tables provided in Attachment C, support documentation.

- Positive results reported below the sample Reporting Limit (RL) but above the Method Detection Limit (MDL) were qualified as estimated (J), due to uncertainty near the detection limit. The direction of bias cannot be determined.

Notes

The laboratory conducted the extraction of the PAH and EXP fractions of all soil samples between 9 and 14-days from sample collection. This exceeds the recommended EPA Region 3 technical holding time of 7-days for collection to extraction of solid samples. No data validation action was taken because the target semivolatile compounds are not expected to be impacted by the sample extraction holding times.

The laboratory conducted the extraction of the following PCB soil samples 8-days from sample collection: S23SDDUP0101, S23SD0020001, S23SD0010001, S04SSDUP0101, S04SS0010001, S04SS0020001 and S04SS0030001. This exceeds the recommended EPA Region 3 technical holding time of 7-days for collection to extraction of solid samples. No data validation action was taken because the target semivolatile compounds are not expected to be impacted by the sample extraction holding times.

The following compounds were detected in the aqueous laboratory method blank at the maximum concentrations as indicated below:

Compound	Maximum Concentration (µg/L)	Action Level (ug/L)
Naphthalene	0.59	2.95
Acenaphthylene	0.14	0.7

Blank Actions:

- Value < Action level and < reporting limit (RL); report value, followed by a B.
- Value < Action level and > RL; report value, followed by a B.
- Value > Action level; report value unqualified.

An action level of 5X the maximum contaminant concentration was established for evaluating method blank contamination for naphthalene and acenaphthylene. Sample aliquots were taken into consideration during the application of all action levels. Positive results for naphthalene and acenaphthylene were detected in the aqueous rinse blank sample (S02RB0010001) above the established blank action levels. Rinse blanks were qualified based on laboratory method blank contamination.

Results for the aqueous equipment rinse blank S02RB0010001 were reported in this SDG. The target PAHs acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene and pyrene were detected at concentrations ranging from 0.05 to 7.4 µg/L. Rinse blank contamination was not used to qualify field environmental samples reported in this SDG.

The PAH surrogate p-terphenyl was recovered below the 54%-126% quality control limit on both analytical detectors for the analysis of samples S02SS0010001 and S02SS0090001. No data validation action was taken because the sample required a 5X dilution for analysis.

The PAH surrogate p-terphenyl was not recovered (0%) on both analytical detectors and the recovery of benzo(e)pyrene was greater than the 49%-129% quality control limit on both analytical detectors for the analysis of samples S23SDDUP0101 and S02SS0030001. No data validation action was taken because the sample required a 5X dilution for analysis.

The PAH surrogate p-terphenyl was not recovered (0%) on one detector and recovered below the 54%-126% quality control limit on one detector; and, benzo(e)pyrene was recovered greater than the 49%-129% quality control limit for the analysis of sample S23SD0010001. No data validation action was taken because the sample required a 5X dilution for analysis.

The PAH surrogate p-terphenyl was not recovered (0%) on one analytical detector and benzo(e)pyrene was recovered greater than the 49%129% quality control limit for the analysis of sample S23SD0020001. Review of sample chromatography and associated raw data indicates that p-terphenyl and benzo(e)pyrene are present on both detectors and were manually integrated due to sample matrix interference. However, laboratory reported the p-terphenyl recovery from the fluorescence detector and did not complete quantitation of p-terphenyl on the ultraviolet detector. This accounts for the 0% recovery for p-terphenyl. In the opinion of the reviewer the noncompliance does not impact data quality but is noted as a data completeness issue.

The PAH surrogate p-terphenyl was recovered less than the 54%126% quality control limit on one analytical detector for the analysis of sample S02SS0020001. Review of sample chromatography indicated that p-terphenyl was identified by both detectors within the required retention time window. No data validation action was taken based on this noncompliance because the noncompliance was marginal (52%) in nature and limited to one detector.

As indicated on the COC documentation, the laboratory performed MS/MSD analysis on the PAH fraction of sample S04SS0010001. MS/MSD recovery of the target compound fluoranthene resulted in a Relative Percent Difference greater than the 25% quality control limit. No data validation action was taken based on this noncompliance.

As indicated on the COC, additional aliquots of sample S02SS0070001 were collected and submitted to the laboratory for MS/MSD analysis. However, the laboratory did not perform the requested QC analysis for the PAH fraction of sample S02SS0070001. This was not addressed in the laboratory case narrative and is noted as a data completeness issue.

As indicated on the COC documentation, the laboratory performed MS/MSD analysis on the PCB fraction of samples S04SS0010001 and S02SS0070001. All spiked target compound recoveries and RPD were acceptable.

As indicated on the COC documentation, the laboratory performed MS/MSD analysis on the EXP fraction of sample S23SD0010001. All spiked target compound recoveries and RPD were acceptable.

Due to the presence of target PAHs at elevated concentrations, the laboratory analyzed and reported the following samples at the dilution factors indicated below:

Sample	Dilution Factor
S02SS0010001	5X
S02SS0030001	5X
S02SS0040001	15X
S02SS0090001	5X
S04SS0020001	4X
S23SD0010001	5X
S23SD0020001	3X
S23SDDUP0101	5X

The laboratory noted that the dilutions were necessary, due to sample matrix effects and the presence of target compounds at elevated concentrations. The samples were not reanalyzed at lower dilutions. This accounts for the elevated reporting limits for these samples.

It should be noted for data completeness that the Laboratory Control Sample (LCS) and MS/MSD spike compound list for the PAH fraction was limited to 6 of the target compounds.

The laboratory did not perform dual column analysis for the PCB fraction of all samples reported in this SDG as required by the analytical Statement of Work (SOW). Therefore, this is noted as a data completeness issue.

As noted in the overview section, the evaluation and laboratory results for the explosive compound nitrocellulose are provided in the corresponding inorganics data validation memorandum.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Several target PAHs were detected in the aqueous laboratory method blank. No data were qualified on this basis. The laboratory analyzed and reported results for eight PAH samples that required dilutions of 3X or more, resulting in elevated reporting limits. No data were qualified on this basis. Various PAH results were qualified as estimated due to variance between analytical detectors. Several data completeness issues were noted.

Other Factors Affecting Data Quality: Several target PAHs were detected in the rinse blank. The technical holding time of 7-days was exceeded for collection to extraction of solid samples in the PAH, PCB and EXP fractions. All affected data were estimated due to holding time noncompliance. Surrogate recovery noncompliances were noted in fourteen of 18 PAH samples, resulting in the qualification of analytical data as estimated. Field duplicate imprecision was noted in two of 3 field duplicate pairs, resulting in the qualification of data as estimated. Results were qualified as estimated due to uncertainty near the detection limit.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "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)."

TetraTech NUS

Douglas S. Schloer
Chemist/Data Validator

TetraTech NUS

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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**

TO:	**K. TURNBULL**	**DATE:**	**JULY 19, 2005**
FROM:	**ETHAN G. LEE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
NSWC INDIAN HEAD – CTO 007
SAMPLE DELIVERY GROUP (SDG) – C5E050319

SAMPLES: 15/SOIL/

S02SS0010001	S02SS0020001	S02SS0030001
S02SS0040001	S02SS0050001	S02SS0060001
S02SS0070001	S02SS0080001	S02SS0090001
S02SS0100001	S02SSDUP0101	S04SS0010001
S04SS0020001	S04SS0030001	S04SSDUP0101

3/SEDIMENT/

S23SD0010001	S23SD0020001	S23SDDUP0101

1/AQUEOUS/

S02RB0010001

Overview

The sample set for NSWC Indian Head, CTO 007, SDG C5E050319, consists of fifteen (15) soil environmental samples, three (3) sediment environmental samples, and one (1) aqueous rinse blank. Three (3) field duplicate pairs (S02SSDUP0101 / S02SS0070001; S04SSDUP0101 / S04SS0010001; S23SDDUP0101 / S23SD0010001) are included in this SDG.

All samples were analyzed for target analyte list (TAL) metals and cyanide. The sediment and aqueous samples were also analyzed for nitrocellulose. The samples were collected by Tetra Tech NUS on May 3-4, 2005 and analyzed by Severn Trent Laboratories-Pittsburgh under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Nitrocelluose analyses were subcontracted to Severn Trent Laboratories-Sacramento. Metals and cyanide analyses were conducted using CLP method ILM04.0. Nitrocellulose analyses were conducted using EPA method 353.2.

Summary

All analytes were successfully analyzed, with the exception of antimony in the sediment samples. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory method/preparation blanks, interference check sample (ICS) results, matrix spike results, laboratory duplicate precision, laboratory control sample (LCS) results, ICP serial dilution results, field duplicate precision, detection limits, and analyte quantitation.

All metals analyses, with the exception of mercury, were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) methodology.

Major Problems

- The sediment matrix spike (MS) performed on sample S23SD0010001 had a percent recovery (%R) <30% for antimony. The nondetected results reported for antimony were qualified as rejected (UR) in the sediment samples only.

Minor Problems

- The contract required detection limit (CRDL) standards run on 5/24/05 at 3:47 PM, 5:59 PM, and 8:06 PM had %Rs >110% for beryllium. The positive result reported for beryllium <2X the CRDL in sample S02RB0010001 was qualified as biased high (K). No qualification action was required in the other associated samples because all results were previously qualified for laboratory blank contamination.

- The CRDL standards run on 5/24/05 at 5:59 PM and 8:06 PM had %Rs >110% for silver. The positive result reported for silver <2X the CRDL in sample S04SSDUP0101 was qualified as biased high (K).

- The CRDL standards run on 5/26/05 at 10:17 AM, 12:24 PM, 2:14 PM, 4:55 PM, and 5:07 PM had %Rs >110% for zinc. The positive result reported for zinc <2X the CRDL in sample S02RB0010001 was qualified as biased high (K). No qualification action was required in the other associated samples because all results were >2X the CRDL.

- The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Aluminum	61.5 ug/L	61.5 mg/kg
Barium[1]	0.11 mg/kg	0.55 mg/kg
Beryllium	1.6 ug/L	1.6 mg/kg
Calcium[1]	23.5 mg/kg	117.5 mg/kg
Chromium	0.4 ug/L	0.4 mg/kg
Iron[1]	3.8 mg/kg	19 mg/kg
Magnesium	47.8 ug/L	47.8 mg/kg
Potassium[1]	27.0 mg/kg	135 mg/kg
Selenium	2.1 ug/L	2.1 mg/kg
Silver	0.9 ug/L	0.9 mg/kg
Thallium	2.7 ug/L	2.7 mg/kg
Vanadium	0.7 ug/L	0.7 mg/kg
Zinc	3.0 ug/L	3.0 mg/kg
Nitrocellulose	0.76 mg/kg	3.8 mg/kg

[1] Maximum concentration present in solid preparation blank from batch 5143245.

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. Positive results less than the action level for beryllium, selenium, silver, and thallium were qualified (B) as a result of blank contamination. The remaining analytes were not qualified for blank contamination because the results were either greater than the action level or they were

nondetects. It should be noted that the rinse blank was not qualified for laboratory blank contamination and was not considered when applying blank action levels.

- The interfering analyte iron was present in samples S02SS0010001 and S02SS0040001 at concentrations comparable to the concentration of iron in the interference check sample (ICS) solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the instrument detection limit (IDL). Interference effects exist for antimony, selenium, and thallium in the affected samples. The nondetected results reported for antimony, selenium, and thallium were qualified as biased low (UL).

- The interfering analyte iron was present in samples S02SS0030001 and S02SS0060001 at concentrations comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the IDL. Interference effects exist for antimony and thallium in the affected samples. The nondetected results reported for antimony and thallium were qualified as biased low (UL).

- The interfering analyte iron was present in sample S02SS0090001 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the IDL. Interference effects exist for antimony, sodium, and thallium in the affected sample. The nondetected results reported for antimony, sodium, and thallium were qualified as biased low (UL).

- The interfering analyte iron was present in sample S04SS0020001 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the IDL. Interference effects exist for antimony, selenium, and sodium in the affected sample. The nondetected results reported for antimony and selenium were qualified as biased low (UL). The positive result reported for sodium was qualified as biased low (L).

- The interfering analyte iron was present in sample S04SS0030001 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the IDL. Interference effects exist for antimony, selenium, sodium, and thallium in the affected sample. The nondetected results reported for antimony, selenium, and thallium were qualified as biased low (UL). The positive result reported for sodium was qualified as biased low (L).

- The interfering analyte iron was present in sample S23SDDUP0101 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, barium, beryllium, chromium, copper, lead, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc were present in the ICS solution at concentrations that exceeded the absolute value of the IDL. Interference effects exist for selenium and sodium in the affected sample. The nondetected result reported for selenium was qualified as biased low (UL). The positive result reported for sodium was qualified as biased low (L).

- The soil matrix spike (MS) performed on sample S04SS0010001 had %Rs <75% for antimony and calcium and >125% for copper and manganese. The soil MS performed on sample S02SS0070001 had %Rs <75% for antimony and chromium and >125% for manganese. The positive and nondetected results reported for antimony were qualified as biased low, (L) and (UL), respectively in the soil samples only. The positive results reported for calcium, chromium, and copper were qualified as estimated (J) due to conflicting directional bias in the soil samples only. The positive results reported for manganese were qualified as biased high (K) in the soil samples only.

- The sediment MS performed on sample S23SD0010001 had a %R <75% for zinc. The positive results reported for zinc were qualified as biased low (L) in the sediment samples only.

- Laboratory duplicate imprecision (RPD >35%) was noted for calcium, copper, lead, and zinc for laboratory duplicate sample S04SS0010001. Laboratory duplicate imprecision (RPD >35%) was noted for chromium, iron, and lead for laboratory duplicate sample S02SS0070001. Laboratory duplicate imprecision (Difference >2X the CRDL) was noted for potassium for laboratory duplicate sample S02SS0070001. Positive results reported for calcium, chromium, copper, iron, lead, potassium, and zinc were qualified as estimated (J) in the soil samples only.

- Laboratory duplicate imprecision (RPD >35%) was noted for cyanide for laboratory duplicate sample S02SS0070001. Positive and nondetected results reported for cyanide were qualified as estimated, (J) and (UJ), respectively in the soil samples only.

- The ICP serial dilution performed on sample S04SS0010001 had a percent difference (%D) >10% and an initial sample concentration >50X the IDL for potassium. The ICP serial dilution performed on sample S23SD0010001 had a %D >10% and an initial sample concentration >50X the IDL for potassium. Positive results reported for potassium were qualified as estimated (J) in all soil and sediment samples.

- Field duplicate imprecision (RPD >50%) was noted for chromium for field duplicate pair S02SSDUP0101 / S02SS0070001. Positive results reported for chromium were qualified as estimated (J) in this field duplicate pair only.

- Field duplicate imprecision (RPD >50%) was noted for iron for field duplicate pair S23SDDUP0101 / S23SD0010001. Positive results reported for iron were qualified as estimated (J) in all sediment samples.

Notes

The CRDL standard run on 5/24/05 at 1:34 PM had a %R >110% for lead. No qualification action was required because the lead result in the associated sample was a nondetect.

The CRDL standard run on 5/24/05 at 5:59 PM had %Rs >110% for chromium and <90% for iron. No qualification action was required for chromium and iron because the results were >2X the CRDL.

The CRDL standards run on 5/26/05 at 10:17 AM and 12:24 PM had %Rs >110% for selenium. No qualification action was required because the results for selenium in the associated samples were either nondetects or they were previously qualified for laboratory blank contamination.

The MS %Rs were not calculated for aluminum, iron, and lead in the soil MS samples because the initial sample concentrations were >4X the spike added.

The MS %Rs were not calculated for aluminum, iron, lead, and manganese in the sediment MS sample because the initial sample concentrations were >4X the spike added.

Nitrocellulose results are included in the explosives fraction in the database.

Executive Summary

Laboratory Performance: Several analytes were qualified due to calibration noncompliance. Several analytes were present in the laboratory method/preparation blanks. Several analytes were qualified due to laboratory duplicate imprecision.

Other Factors Affecting Data Quality: Several analytes were qualified due to ICP interference. Several analytes were qualified due to matrix spike noncompliance. Several analytes were qualified due to ICP serial dilution noncompliance. Several analytes were qualified due to field duplicate imprecision.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Review", April 1993 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)."

Tetra Tech NUS
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Data Qualifier Key:

U	-	Value is a nondetect as reported by the laboratory.
UJ	-	Nondetect is considered estimated as a result of technical noncompliance.
UL	-	Nondetect is considered biased low as a result of technical noncompliance.
B	-	Positive result is considered to be an artifact of blank contamination and should not be considered present.
J	-	Positive result is considered estimated as a result of technical noncompliance.
K	-	Positive result is considered biased high as a result of technical noncompliance.
L	-	Positive result is considered biased low as a result of technical noncompliance.