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Site Screening Process Report

Site 7 – HMX Spill, Slurry Mix Building

Naval Support Facility,
Indian Head
Indian Head, Maryland

Naval Facilities Engineering Command
Washington

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

December 2005

SITE SCREENING PROCESS REPORT

SITE 7 – HMX SPILL, SLURRY MIX BUILDING

NAVAL DISTRICT WASHINGTON, INDIAN HEAD
INDIAN HEAD, MARYLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS AND ABBREVIATIONS

B&R	Brown & Root
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	United States Department of the Navy
EC	Environment Canada
EEQ	ecological effects quotient
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
FFA	Federal Facility Agreement
FS	feasibility study
HI	hazard index
HMX	high melting point explosive
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
IW10	Industrial Wastewater Discharge 10
LOEC	lowest observable effects concentration
NOEC	no observable effects concentration
NSA	Naval Support Activity
NSF-IH	Naval Support Facility, Indian Head
PEC	probable effect concentration
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
TEC	threshold effect concentration
TtNUS	Tetra Tech NUS, Inc.
UTL	upper tolerance limit

EXECUTIVE SUMMARY

INTRODUCTION

This Site Screening Process (SSP) Report for Naval Support Facilty, 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 N62472-03-D-0057. NSF-IH is a Naval Support Activity (NSA), South Potomac facility within the Naval District Washington Region. Until October 1, 2005, NSF-IH was referred to as Naval District Washington, Indian Head. The report describes the SSP for Site 7 – HMX Spill, Slurry Mix Building.

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 investigation leading to this report was outlined in a site-specific work plan (TtNUS, 2005) that detailed the environmental samples and analytical methods needed to make a decision.

Site 7, located in the west-central portion of the Main Area at NSF-IH, is the location of the Slurry Mix Building (Building 682) that was constructed in 1948. Facility processing procedures included dewatering of HMX, which was purchased in slurry form and dewatered in an eductor vacuum filter. Wastewater was discharged into the floor drain and from there to an open storm ditch located approximately 100 feet northeast of Building 682 that flowed to Industrial Wastewater Discharge (IW10) into Mattawoman Creek. Lead was also present in the discharge. Between 1964 and 1968, this ditch received periodic discharges from the eductor. During facility operations, average waste discharges into the ditch were 2,870 gallons per day. A mixture of alcohol contaminated with HMX was periodically spilled onto the concrete platform floor of Building 682 and washed out onto nearby ground surfaces.

Site 7 is a relatively small site that includes the area surrounding Building 682 (less than 0.1 acre). Chemicals could have released to soil surrounding the building and/or to a drainage ditch that received discharges from the building via an underground pipe. The length of the open drainage ditch between this pipe and where the flow enters a downstream pipe is approximately 150 feet.

FIELD INVESTIGATION AND DATA EVALUATION

Prior to the SSP investigation, no environmental sampling had been conducted at Site 7. The FFA designated Site 7 for an SSP to determine whether the site should proceed to a remedial investigation.

For the SSP investigation, four surface soil samples were collected from a depth of 0 to 1 foot below ground surface. One sample was collected from each side of the building. Two sediment samples were collected from the drainage ditch at a depth of 0 to 6 inches. Quality control samples (duplicates and blanks) were also collected. All samples were analyzed for HMX and Target Analyte List (TAL) metals. HMX was detected at one surface soil sample location and one sediment sample location. Metals were detected at all soil and sediment sample locations.

Human health and ecological risk screening evaluations were conducted on the analytical data from the soil and sediment samples. The human risk screening assumed residential use of the site. Based on these evaluations and consideration of risk management decisions, there are no unacceptable risks to human health or the environment.

CONCLUSIONS AND RECOMMENDATIONS

- Based on the human health risk screening, no chemicals of potential concern (COPCs) were identified for surface soil and sediment. Therefore, there are no unacceptable risks to human health under a residential use scenario.

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

- Based on the ecological risk screening, HMX, lead, and zinc were identified as preliminary COPCs for surface soil. Following Step 3A of the risk screening process (refinement of COPCs), none of these chemicals were retained as COPCs. Based on the ecological risk screening, HMX, mercury, and zinc were identified as preliminary COPCs for sediment. Following Step 3A, none of these chemicals were retained as COPCs.

- Past operations at Site 7 have not resulted in the release of hazardous substances, pollutants, contaminants, hazardous waste, 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, Site 7 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.

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. Until October 1, 2005, NSF-IH was referred to as Naval District Washington, Indian Head. The report describes the SSP for Site 7 - HMX Spill, Slurry Mix Building.

1.1 PURPOSE AND REPORT ORGANIZATION

The purpose of the SSP is to determine whether operations at Site 7 have resulted in the release of hazardous substances, pollutants, contaminants, hazardous wastes, or hazardous constituents at concentrations of potential environmental concern. Site 7 is 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. Section 4.0 provides the results of the Site 7 SSP.

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 this SSP investigation 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 as related to the operations at Site 7. Surface soil and sediment samples were collected. 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 location of Site 7 is shown on Figure 1-2.

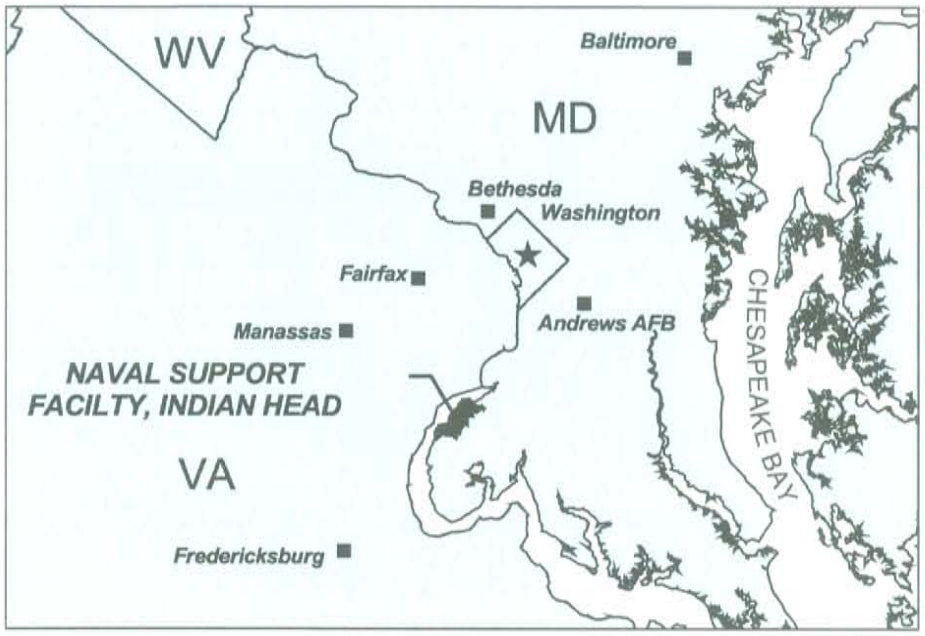
The primary mission of the Indian Head Division, Naval Surface Warfare Center (IHDIV-NSWC), the main tenant of NSF-IH, is as follows:

- 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.

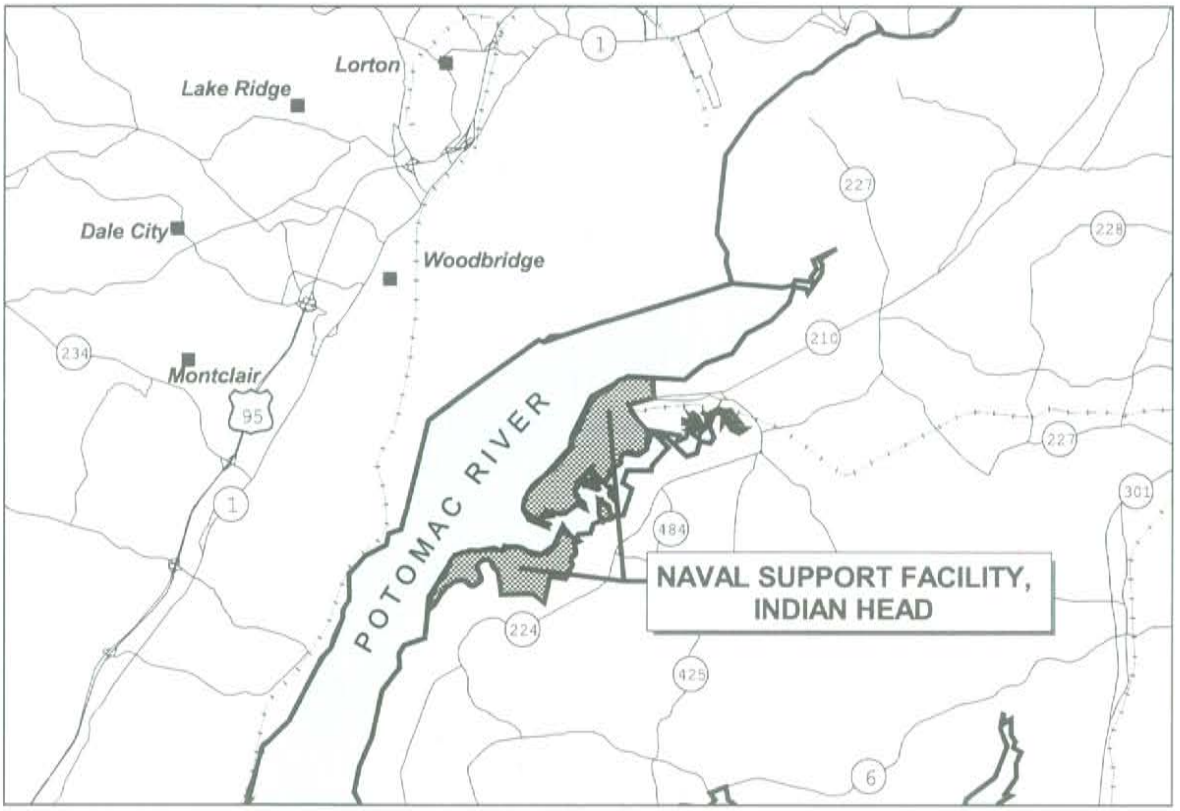
- To provide support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

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



LEGEND

- City
- Highway
- Railroad
- River



DRAWN BY K. PEILA — DATE 3/17/05	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2193	OWNER NO. 0006
CHECKED BY G. LATULIPPE — DATE 3/17/05	FACILITY LOCATION MAP 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 - 1	REV 0

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DRAWN BY K. PEILA — DATE 6/1/04	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2193	OWNER NUMBER 0006
CHECKED BY J. MAGILSON — DATE 8/12/04	SITE LOCATION MAP SSP SITE 7 NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY —	DATE —
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SCALE AS NOTED		DRAWING NO. FIGURE 1-2	REV 0

2.0 GENERAL INVESTIGATIVE PROCEDURES

Investigation of Site 7 was conducted in accordance with the SSP Work Plan (TtNUS, 2005). This plan was developed to identify the presence or absence of contaminants at Site 7. Surface soil and sediment samples were collected.

2.1 FIELD SAMPLING

2.1.1 Surface Soil Sampling

Four surface soil samples were collected from a depth interval of 0 to 1 foot from locations around Building 682 (Slurry Mix Building). 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 below ground surface. 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 the drainage ditch located northeast of Building 682. 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. 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 and matrix spike duplicate samples. One field duplicate sample was collected for each medium (i.e., surface soil and sediment). One rinsate blank was generated by pouring reagent grade water over an unused trowel. One matrix spike and matrix spike duplicate sample was collected for each medium.

2.2 LABORATORY ANALYSES

The surface soil and sediment samples were analyzed for Target Analyte List (TAL) metals and the explosive cyclotetramethylenetetranitramine, also known as high melting point explosive (HMX), by the following methods:

- TAL metals via Contract Laboratory Program (CLP) Statement of Work (SOW) ILM04.0
- HMX via SW-846 Method 8330

2.3 INVESTIGATION-DERIVED WASTE HANDLING

The sampling trowels and miscellaneous trash generated during the 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 soil samples were collected from around Building 682, and the sampling locations were measured from fixed points associated with the building. The sediment samples were collected from a drainage ditch that flows into a storm water pipe, and the sampling locations were measured from the pipe.

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

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

The inorganic data review was based on data completeness, holding times, calibration data, field and laboratory blanks, interference check sample results, matrix spike 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 blank analyses 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. No major problems were noted.

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 the data qualifiers to analytical results signifies the occurrence of quality control noncompliances. The data qualifiers assigned to the analytical results for Site 7 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.

- 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.

- 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.

- UL – Indicates that the chemical was not detected. However, the detection limit is considered to be biased low based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.

The preceding data qualifiers may be categorized as indicative of minor problems. Minor problems are defined as issues resulting in the estimation of data. Analytical results qualified as estimated or biased low are suitable for risk screening analysis and decision-making purposes. There were no major problems that resulted in the rejection of data. Rejected data are considered invalid and would not be used for risk screening or decision making.

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 soil 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 a threshold background concentration. This approach is somewhat conservative because it may lead to false positives. Chemicals detected in surface soil samples at concentrations less than background values were not considered as chemicals of potential concern (COPCs).

Surface soil background concentrations are also used to represent background sediment concentration because the sediment samples were 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 is 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 used 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 will also be 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, one-tenth of the RBC for noncarcinogenic effects was used as the risk screening level. Some chemicals impact the same target organs or exhibit similar mechanisms of action.

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 (generic) 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 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 or magnitude of human exposure to the COPCs. Potential human exposure to environmental media at Site 7 is expected to be limited. Based on the current and anticipated future land use and location of the site, military personnel, civilian employees, contractors, and trespassers are the most likely individuals exposed. However, to evaluate the site on a conservative basis, the risks will be estimated based on a hypothetical future residential exposure scenario.

For purposes of this 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) under residential land use 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 Site 7. 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 Site 7 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 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 Site 7 needs 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 an 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 in 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 the chemicals 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 Assessment Group (BTAG) screening levels for soil, when necessary. Table 3-3 summarizes the ecological screening levels used to evaluate Site 7 surface soil concentrations.

Region 3 BTAG screening levels for freshwater sediment (EPA, 2005c) were used to screen for sediment COPCs. Table 3-4 summarizes the ecological screening levels used to evaluate Site 7 sediment concentrations.

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 higher 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 a screening level 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 Contaminants of Potential Concern

Step 3 of the eight-step EPA 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. Step 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 3-1

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
SITE 7 - HMX SPILL, SLURRY MIX BUILDING
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
Explosives (mg/kg)					
HMX	3,900	N	---	---	---
Inorganics (mg/kg)					
Aluminum	---		---	---	---
Antimony	31	N	0.66	13	---
Arsenic	0.43	C	0.0013	0.026	745
Barium	16,000	N	300	6,000	686,000
Beryllium	160	N	58	1,200	1,330
Cadmium	39[3]	N	1.4[3]	27[3]	1,780
Calcium	---	N	---	---	---
Chromium	230[4]	N	2.1[4]	42[4]	267[4]
Cobalt	---		---	---	1,140
Copper	3,100	N	530	11,000	---
Iron	23,000	N	---	---	---
Lead	400[5]	N	---	---	---
Magnesium	---	N	---	---	---
Manganese	1,600[6]	N	48[6]	950[6]	68,600
Mercury	23[7]	N	0.1[2]	2[2]	2.9
Nickel	1,600	N	7[2]	130[2]	13,300
Potassium	---	N	---	---	---
Selenium	390	N	0.95	1.9	---
Silver	390	N	1.6	31.0	---
Sodium	---	N	---	---	---
Thallium	5.5	N	0.18	3.6	---
Vanadium	78	N	37	730	---
Zinc	23,000	N	680	14,000	---

1 EPA, 2005a.
2 EPA, 2004.
3 Based on the 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.

---: No screening level available
C - Carcinogen.
DAF - Dilution attenuation 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 - SURFACE SOIL
SITE 7 - HMX SPILL, SLURRY MIX BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Screening Value	Source
Explosives (mg/kg)		
HMX	---	
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

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

---: No screening value 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 7 - HMX SPILL, SLURRY MIX BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	EPA Region 3 BTAG Freshwater Sediment Screening Benchmarks
Explosives (mg/kg)	
HMX	---
Inorganics (mg/kg)	
Aluminum	---
Antimony	2
Arsenic	9.8
Barium	---
Beryllium	---
Cadmium	0.99
Calcium	---
Chromium	43.4
Cobalt	50
Copper	31.6
Iron	20,000
Lead	35.8
Magnesium	---
Manganese	460
Mercury	0.18
Nickel	22.7
Potassium	---
Selenium	2
Silver	1
Sodium	---
Thallium	---
Vanadium	---
Zinc	121

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

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

4.0 SITE SCREENING PROCESS RESULTS

4.1 BACKGROUND

Site 7, located in the west-central portion of the Main Area, is the location of the Slurry Mix Building (Building 682) that was constructed in 1948. Facility processing procedures at Building 682 included dewatering of HMX, which was purchased in slurry form and dewatered in an eductor vacuum filter. Wastewater was discharged into the floor drain and from there to an open storm ditch located approximately 100 feet northeast of Building 682 that flowed to Industrial Waste Water Discharge 10 (IW10) into Mattawoman Creek. Between 1964 and 1968, this ditch received periodic discharges from the eductor. A mixture of alcohol contaminated with HMX was periodically spilled onto the concrete platform floor of Building 682 and washed out onto nearby ground surfaces. During facility operations, average wastewater discharges into the ditch were 2,870 gallons per day. Lead was also present in the discharge. The HMX dewatering operation at Building 682 was terminated around 1968. IW10 is a permitted discharge. Current sources of water in the drainage ditch upgradient of the former Building 682 discharge include storm water, condensate, and noncontact cooling and heating water.

Prior to the SSP investigation, no environmental sampling had been conducted at Site 7. The site was identified in the Initial Assessment Study (IAS) (Hart, 1983). A site reconnaissance during the IAS did not identify the presence of any stressed vegetation. Further study was not recommended in the IAS because the site hydrology was not conducive to groundwater migration. However, the FFA designated Site 7 for the site screening process to determine whether the site should proceed to a remedial investigation.

4.2 SITE CHARACTERISTICS

4.2.1 Topography and Surface Features

As illustrated on Figure 4-1, the land surface is relatively flat but slopes slightly toward drainage ditches located northwest, northeast, and southeast of Building 682.

Building 682 is relatively small (approximately 30 feet by 30 feet). The nearby areas surrounding Building 682 are mostly covered with mowed grasses. Concrete sidewalks, a gravel road, and a parking lot are also located nearby. Wooded areas are located across the drainage ditch northeast of the site. Site photographs are included at the end of this section.

4.2.2 Surface Water

Precipitation at Site 7 either infiltrates into the soil or runs off into the surrounding drainage ditches. The runoff flows through a series of storm water pipes and open ditches and eventually discharges to Mattawoman Creek, approximately 2,000 feet south of the site.

4.2.3 Geology/Soils

No subsurface investigation was conducted at Site 7. The surface soil samples were described as sand and gravel or sand and silt.

4.2.4 Hydrogeology

No groundwater monitoring wells were installed at Site 7.

4.3 FIELD INVESTIGATION AND RESULTS

Surface soil and sediment samples were collected and analyzed to evaluate the potential presence of contaminants. The samples and analyses are summarized in Table 4-1.

4.3.1 Surface Soil Sampling

Four surface soil samples (S07SS001 through S07SS004) were collected from a depth of 0 to 1 foot below ground surface. One sample was collected near each side of Building 682 (see Figure 4-1). A field duplicate was collected at location S07SS001. 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.

HMX was detected at one location (S07SS001), and metals were detected at all locations.

4.3.2 Sediment Sampling

Two sediment samples (S07SD001 and S07SD002) were collected from a depth of 0 to 6 inches below the bottom of the drainage ditch north of the site. Flowing water was present in the drainage ditch at the time of sample collection. S07SD001 was collected downstream of the suspected discharge from the floor drain. S07SD002 was collected approximately 75 feet downstream of S07SD001 and before the ditch enters a storm water pipe. A field duplicate was collected at location S07SD001. Sample log sheets are provided in Appendix A. A summary of positive results is presented in Table 4-3, and all analytical data are provided in Appendix B.

HMX was detected at a concentration just above the detection limit at one location (S07SD002), and metals were detected at all locations.

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 4-4 is a summary of Site 7 surface soil data and includes frequencies of detection, ranges of positive 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. No COPCs were identified for surface soil. Although maximum concentrations of arsenic, chromium, iron, manganese, and vanadium exceeded one or more screening criteria, all concentrations were less than the basewide background concentrations. Therefore, there are no unacceptable risks to human health under a residential use scenario.

The maximum concentrations of a few metals in surface soil exceed screening levels for migration from soil to groundwater (Table 4-4). The maximum concentrations of arsenic, chromium, and manganese are higher than these screening levels but are less than the basewide background concentrations. Therefore, migration of metals from soil to groundwater is not considered to be problematic.

Table 4-5 is a summary of Site 7 sediment data and includes frequencies of detection, ranges of positive 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. No COPCs were identified for sediment. Although maximum concentrations of arsenic, chromium, iron, manganese, and vanadium exceeded one or more screening criteria, all concentrations were less than basewide background concentrations for surface soil. Therefore, there are no unacceptable risks to human health under a residential use scenario.

The maximum concentrations of several metals in sediment exceed screening levels for migration from soil to groundwater (Table 4-5). The maximum concentration of mercury is higher than 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 maximum concentration is close to the background concentration. The maximum concentrations of arsenic, chromium, and manganese exceed these screening levels but are less than basewide

background concentrations. Therefore, migration of metals from sediment to groundwater 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 is not repeated in this section.

As discussed in Section 4.1, HMX and lead would be expected to have been present in the wastewater discharge from Building 682. Contaminants in the wastewater discharge to floor drains could have migrated to the drainage ditch located northeast of the building. Contaminants spilled on the concrete platform floor of the building could have migrated to soil surrounding the building. Soil contaminants could migrate to the drainage ditch via overland flow.

The areas that may have been directly affected by releases from the site are areas adjacent to the building and the open area of the drainage ditch that received wastewater from building floor drains. The building is relatively small, and the portion of the open drainage ditch from the floor drain discharge to the next downstream storm water pipe is approximately 150 feet.

The ecological risk screening is not an in-depth evaluation because of the relatively small size of the site (less than 0.1 acre) and the site setting (semi-industrial area). Likely receptors for exposure to surface soil contaminants would be soil invertebrates and plants rather than wildlife. However, the lowest available screening level was used for the preliminary screening.

4.5.1 Steps 1 and 2 - Preliminary Screening

Table 4-6 is a summary of Site 7 surface soil data and includes frequencies of detection, ranges of positive 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 are HMX, lead, and zinc. HMX was retained as a COPC because there are no screening levels. The maximum concentrations of lead and zinc exceeded screening levels and background concentrations. Although the maximum concentrations of iron, nickel, and vanadium exceeded screening levels, the concentrations were less than basewide background concentrations.

Table 4-7 is a summary of the sediment data and includes frequencies of detection, ranges of positive 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 to ecological screening levels. Surface soil background concentrations are considered to be representative for sediment because the sediment samples were collected from an intermittent drainage ditch. The table also summarizes COPC selection and rationale. Ecological COPCs for sediment are HMX, mercury, and zinc. HMX was retained as a COPC because there are no screening levels. The maximum concentrations of mercury and zinc exceeded screening levels and background concentrations.

4.5.2 Step 3A – Refinement of COPCs

The methodology for refinement of COPCs was discussed in Section 3.4.5.

4.5.2.1 Surface Soil

HMX, lead, and zinc were identified as preliminary COPCs for surface soil.

HMX

HMX was initially selected as a COPC because a screening level is not available. The following alternate toxicity information was located:

- Lowest observable effects concentration (LOEC) of 280 mg/kg for earthworm reproduction (Robidoux et al., 2001)

The LOEC was based on the number of juveniles hatching per cocoon being significantly reduced by HMX at 280 mg/kg in soil; a no observable effects concentration (NOEC) was not generated from the study. Also, productivity of cocoons and juveniles as well as total biomass of juveniles were significantly reduced by HMX at concentrations higher than 280 mg/kg in soil.

The maximum HMX concentration (270 mg/kg) is less than this alternate guideline. In addition, HMX was only detected at one of four soil sample locations (S07SS001). Therefore, HMX was not retained as a soil COPC.

Lead

Lead was initially selected as a COPC because the maximum soil concentration of 185 mg/kg exceeded the EPA SSL of 11 mg/kg for birds. Because the SSL used in the conservative COPC screening is based on risks to wildlife and not risks to plants and invertebrates, lead concentrations were compared to the following SSLs for soil invertebrates and plants:

- SSL for soil invertebrates – 1,700 mg/kg (EPA, 2005c)
- SSL for plants – 120 mg/kg (EPA, 2005c)

The maximum lead concentration is less than the SSL for soil invertebrates but higher than the SSL for plants. However, the SSL for plants was only exceeded at the location of the maximum concentration (S07SS001), which would only indicate an isolated area of potential risk. All other detected concentrations were less than the SSL for plants and the basewide background concentration. In addition, the average lead concentration (26.2 mg/kg) is less than the SSL for plants. It should be noted that the SSL for plants is less than the background concentration (149 mg/kg), and adverse effects on vegetation were not observed during sampling. Therefore, the potential risk is acceptable, and lead was not retained as a soil COPC.

Zinc

Zinc was initially selected as a COPC because the maximum concentration (86.3 mg/kg) exceeded the Region 3 BTAG screening level of 10 mg/kg. However, even though the screening level is based on risks to plants, the following alternate benchmark was used to further evaluate risks to plants and soil invertebrates based on more recent data:

- Canadian Soil Quality Guideline (SQG) – 200 mg/kg (EC, 1999)

The maximum zinc concentration is less than the Canadian SQG, which is based on risks to plants and invertebrates. Therefore, zinc was not retained as a soil COPC.

4.5.2.2 Sediment

HMX, mercury, and zinc were identified as preliminary COPCs for sediment. Alternate benchmarks for these chemicals are based on consensus-based sediment quality guidelines provided in MacDonald, et al, (2000).

HMX

HMX was initially selected as a COPC because a screening level is not available. HMX was only detected in one sediment sample at a concentration of 0.1 mg/kg, which is just above the detection limit. Also, the single HMX concentration was much lower than the LOEC value (39.3 mg/kg) and NOEC value (22.1 mg/kg) based on growth of *Chironomus tentans* exposed to HMX (Steevens, et al., 2002). It was also found in the same study that survival of *Chironomus tentans* was not statistically different from control samples at concentrations as high as 146 mg/kg. Therefore, HMX was not retained as a sediment COPC.

Mercury

Mercury was initially selected as a COPC because the maximum sediment concentration (0.41 mg/kg) exceeded the BTAG screening benchmark (0.18 mg/kg). The consensus-based threshold effect concentration (TEC) is 0.18 mg/kg, and the consensus-based probable effect concentration (PEC) is 1.06 mg/kg (MacDonald, et al., 2000). The maximum sediment concentration is between the TEC and PEC but is closer to the TEC and the average concentration (0.21 mg/kg) is barely higher than the TEC. In addition, mercury was only detected at one of the two sediment sample locations (S07SD002), which would only indicate an isolated area of potential risk. Therefore, the potential risk is acceptable, and mercury was not retained as a sediment COPC.

Zinc

Zinc was initially selected as a COPC because the maximum sediment concentration (136 mg/kg) exceeded the BTAG screening benchmark (121 mg/kg). The consensus-based TEC is 121 mg/kg, and the consensus-based PEC is 459 mg/kg (Macdonald, et al., 2000). The maximum sediment concentration is between the TEC and PEC but is closer to the TEC and the average concentration (107 mg/kg) is less than the TEC. In addition, the zinc concentration exceeded the screening benchmark at one of two locations (S07SD002), which would only indicate an isolated area of potential risk. Therefore, the potential risk is acceptable, and zinc was not retained as a sediment COPC.

4.5.3 Ecological Risk Screening Summary

HMX, lead, and zinc were identified as preliminary COPCs for surface soil based on comparisons of the maximum detected concentration to conservative screening levels. For Step 3A, the maximum concentrations were then compared to alternate guidelines. The frequency of detection and the distribution of the COPCs were also evaluated. The maximum concentrations of the COPCs were detected at one location (S07SS001). HMX was only detected at one location, and the concentration was less than the alternate guideline. The maximum concentrations of lead and zinc exceeded one of the

alternate guidelines; all other detected concentrations were less than basewide background concentrations. Therefore, these chemicals were not retained as COPCs.

HMX, mercury, and zinc were identified as preliminary COPCs for sediment based on comparisons of the maximum detected concentrations to conservative screening levels. For Step 3A, the maximum concentrations were then compared to alternate guidelines. The frequency of detection and the distribution of the COPCs were also evaluated. The maximum concentrations of the COPCs were detected at one location (S07SD002). HMX was detected at a concentration just above the detection limit but less than the LOEC and NOEC values. The concentrations of mercury and zinc were between the TEC and PEC but were closer to the TEC. Therefore, these chemicals were not retained as COPCs.

4.6 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

- Site 7 is a relatively small site that includes the area surrounding Building 682 (less than 0.1 acre). Chemicals could have been released to soil surrounding the building and/or to a drainage ditch that received discharges from the building via an underground pipe. The length of the open drainage ditch between this pipe and the next downstream pipe is approximately 150 feet.

- Four surface soil samples were collected (one on each side of the building), and two sediment samples were collected from the open drainage ditch. Surface water was present at the time of sampling; however, the ditch is intermittent. All samples were analyzed for HMX and TAL metals.

- Based on the human health risk screening, no COPCs were identified for surface soil or sediment. Therefore, there are no unacceptable risks to human health under a residential use scenario.

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

- Based on the ecological risk screening, HMX, lead, and zinc were identified as preliminary COPCs for surface soil. Following Step 3A, none of these chemicals were retained as COPCs.

- Based on the ecological risk screening, HMX, mercury, and zinc were identified as preliminary COPCs for sediment. Following Step 3A, none of these chemicals were retained as COPCs.

- Past operations at Site 7 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, Site 7 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 7 – HMX SPILL, SLURRY MIX BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Location	Sample Number	Sample Depth (feet bgs)	Laboratory Analysis	
			HMX	TAL Metals
Soil				
S07SS001	S07SS0010001	0 to 1	X	X
S07SS002	S07SS0020001	0 to 1	X	X
S07SS003	S07SS0030001	0 to 1	X	X
S07SS004	S07SS0040001	0 to 1	X	X
Sediment				
S07SD001	S07SD0010001	0 to 0.5	X	X
S07SD002	S07SD0020001	0 to 0.5	X	X

bgs Below ground surface.
SSP Site Screening Process.
TAL Target Analyte List.

TABLE 4-2

SUMMARY OF POSITIVE DETECTIONS - SURFACE SOIL
SITE 7 - HMX SPILL, SLURRY MIX BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

LOCATION SAMPLE NUMBER SAMPLE DATE DEPTH RANGE (FEET)	S07SS001 S07SS0010001 05/04/05 0 - 1	S07SS001 S07SS0010001-AVG 05/04/05 0 - 1	S07SS001 S07SS0010001-D 05/04/05 0 - 1	S07SS002 S07SS0020001 05/04/05 0 - 1	S07SS003 S07SS0030001 05/04/05 0 - 1	S07SS004 S07SS0040001 05/04/05 0 - 1
Explosives (mg/kg)						
HMX	270	240	210	0.5 U	0.5 U	0.5 U
Inorganics (mg/kg)						
ALUMINUM	5690	5660	5630	6900	7900	4690
ARSENIC	3.6	4.3	5	3.8	10.2	3.8
BARIUM	29.3	28.9	28.5	45.4	29.4	18.6
CALCIUM	189	184	179	758	391	215
CHROMIUM	8.9	10.2	11.5	11.4	16.2	9.8
COBALT	3.2	3.6	4	5.7	5	3.4
COPPER	8.5	8.55	8.6	7	8.5	6.7
IRON	10800 J	18650 J	26500 J	15000 J	17600 J	7690 J
LEAD	185	155.5	126	10.7	13	82.9
MAGNESIUM	308	301	294	467	513	329
MANGANESE	133 L	141 L	149 L	270 L	128 L	151 L
MERCURY	0.011 U	0.00925	0.013	0.0095 U	0.0099 U	0.025
NICKEL	3.1	3.2	3.3	4.2	4.5	2.7
POTASSIUM	280 J	276.5 J	273 J	430 J	443 J	361 J
SELENIUM	0.42 U	0.415 UL	0.41 UL	0.38 U	0.43 L	0.37 U
SODIUM	25.9 U	25.65 UL	25.4 UL	23.5 U	53.4 L	48.1
VANADIUM	18.7	21.3	23.9	21.7	26.8	22
ZINC	86.3 J	72.95 J	59.6 J	21.6 J	18.2 J	37.9 J

J - Estimated.
L - Biased low.
U - Not detected above concentration noted.

TABLE 4-3

SUMMARY OF POSITIVE DETECTIONS - SEDIMENT
SITE 7 - HMX SPILL, SLURRY MIX BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

SAMPLE NUMBER	**S07SD0010001**	**S07SD0010001-AVG**	**S07SD0010001-D**	**S07SD0020001**
LOCATION	**S07SD001**	**S07SD001**	**S07SD001**	**S07SD002**
SAMPLE DATE	**05/04/05**	**05/04/05**	**05/04/05**	**05/04/05**
DEPTH RANGE (FEET)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Explosives (mg/kg)				
HMX	0.5 U	0.5 U	0.5 U	0.1 J
Inorganics (mg/kg)				
ALUMINUM	2830 J	2040 J	1250 J	2510 J
ARSENIC	8.4 J	4.65 J	0.9 J	5 J
BARIUM	25.2	19.2	13.2	20.9
CALCIUM	348	305.5	263	478
CHROMIUM	8.7 J	6.45 J	4.2 J	11.9 J
COBALT	6.6	4.45	2.3	5.8
COPPER	5.7	4.75	3.8	8.5
IRON	18600 J	11715 J	4830 J	15600 J
LEAD	10.4 J	8.05 J	5.7 J	23.7 J
MAGNESIUM	147	129	111	202
MANGANESE	307 J	205.5 J	104 J	179 J
MERCURY	0.012 U	0.0115 U	0.011 U	0.41
NICKEL	4.7	3.55	2.4	4.9
SODIUM	48.8 L	48.05 L	47.3	101 L
VANADIUM	31.9 J	20.7 J	9.5 J	25.1 J
ZINC	114 J	78.25 J	42.5 J	136 J

J - Estimated.
L - Biased low.
U - Not detected above concentration noted.

TABLE 4-4

HUMAN HEALTH DATA EVALUATION - SURFACE SOIL
SITE 7 - HMX SPILL, SLURRY BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Location of 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		
Explosives (mg/kg)													
HMX	1/4	210 - 270	S07SS0010001	0.5	60.2	270	ND	390	---	---	---	NO	BSL
Inorganics (mg/kg)													
ALUMINUM	4/4	4690 - 7900	S07SS0020001	---	6290	7900	19700	---	---	---	---	NO	NTX, BKG
ARSENIC	4/4	3.6 - 10.2	S07SS0030001	---	5.5	10.2	14.9	**0.43**	**0.0013**	**0.026**	745	NO	BKG
BARIUM	4/4	18.6 - 45.4	S07SS0020001	---	30.6	45.4	80.4	1600	300	6000	68,600	NO	BSL, BKG
CALCIUM	4/4	179 - 758	S07SS0020001	---	387	758	2060	---	---	---	---	NO	NUT
CHROMIUM	4/4	8.9 - 16.2	S07SS0030001	---	11.9	16.2	33.4	23	**2.1**	42	267	NO	BSL, BKG
COBALT	4/4	3.2 - 5.7	S07SS0020001	---	4.4	5.7	22.3	---	---	---	1140	NO	NTX, BKG
COPPER	4/4	6.7 - 8.6	S07SS0010001-D	---	7.7	8.6	20.3	310	530	11000	---	NO	BSL, BKG
IRON	4/4	7690 - 26500	S07SS0010001-D	---	14700	26500	38500	**2300**	---	---	---	NO	BKG
LEAD	4/4	10.7 - 185	S07SS0010001	---	26.2	185	**62.5**	400	---	---	---	NO	BSL
MAGNESIUM	4/4	294 - 513	S07SS0030001	---	402.5	513	1620	---	---	---	---	NO	NUT
MANGANESE	4/4	128 - 270	S07SS0020001	---	172.5	270	1390	**160**	**48**	950	68600	NO	BKG
MERCURY	2/4	0.013 - 0.025	S07SS0040001	0.0095 - 0.011	0.011	0.025	0.16	2.3	0.1	2	2.9	NO	BSL, BKG
NICKEL	4/4	2.7 - 4.5	S07SS0030001	---	3.65	4.5	15.4	160	7	130	13,300	NO	BSL, BKG
POTASSIUM	4/4	273 - 443	S07SS0030001	---	378	443	1470	---	---	---	---	NO	NUT
SELENIUM	1/4	0.43	S07SS0030001	0.37 - 0.43	0.25	0.43	1.2	39	0.95	1.9	---	NO	BSL, BKG
SODIUM	2/4	48.1 - 53.4	S07SS0030001	23.5 - 25.9	31.5	53.4	120	---	---	---	---	NO	NUT
VANADIUM	4/4	18.7 - 26.8	S07SS0030001	---	22.95	26.8	53.3	**7.8**	37	730	---	NO	BKG
ZINC	4/4	18.2 - 86.3	S07SS0010001	---	37.7	86.3	**37.5**	2300	680	14000	---	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 3-2
7 RBCs for noncarcinogens are divided by 10 to correspond to a target hazard quotient of 0.1.

Associated Samples
S07SS0010001
S07SS0010001-D
S07SS0020001
S07SS0030001
S07SS0040001

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

TABLE 4-5

HUMAN HEALTH DATA EVALUATION - SEDIMENT
SITE 7 - HMX SPILL, SLURRY BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Location of 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		
Explosives (mg/kg)												
HMX	1/2	0.1	S07SD0020001	0.5	0.175	0.1	ND	390	---	---	NO	BSL
Inorganics (mg/kg)												
ALUMINUM	2/2	1250 - 2830	S07SD0010001	---	2275	2830	19700	---	---	---	NO	NTX, BKG
ARSENIC	1/2	0.9 - 8.4	S07SD0010001	---	4.8	8.4	14.9	**0.43**	**0.0013**	**0.026**	NO	BKG
BARIUM	2/2	13.2 - 25.2	S07SD0010001	---	20.05	25.2	80.4	1600	300	6000	NO	BSL, BKG
CALCIUM	2/2	263 - 478	S07SD0020001	---	392	478	2060	---	---	---	NO	NUT
CHROMIUM	2/2	4.2 - 11.9	S07SD0020001	---	9.2	11.9	33.4	23	**2.1**	42	NO	BSL, BKG
COBALT	2/2	2.3 - 6.6	S07SD0010001	---	5.1	6.6	22.3	---	---	---	NO	NTX, BKG
COPPER	2/2	3.8 - 8.5	S07SD0020001	---	6.6	8.5	20.3	310	530	11000	NO	BSL, BKG
IRON	2/2	4830 - 18600	S07SD0010001	---	13700	18600	38500	**2300**	---	---	NO	BKG
LEAD	2/2	5.7 - 23.7	S07SD0020001	---	15.9	23.7	62.5	400	---	---	NO	BSL, BKG
MAGNESIUM	2/2	111 - 202	S07SD0020001	---	165.5	202	1620	---	---	---	NO	NUT
MANGANESE	2/2	104 - 307	S07SD0010001	---	192	307	1390	**160**	**48**	950	NO	BKG
MERCURY	1/2	0.41	S07SD0020001	0.011 - 0.012	0.21	0.41	**0.16**	2.3	**0.1**	2	NO	BSL
NICKEL	2/2	2.4 - 4.9	S07SD0020001	---	4.2	4.9	15.4	160	7	130	NO	BSL, BKG
SODIUM	2/2	47.3 - 101	S07SD0020001	---	74.5	101	120	---	---	---	NO	NUT
VANADIUM	2/2	9.5 - 31.9	S07SD0010001	---	22.9	31.9	53.3	**7.8**	37	730	NO	BKG
ZINC	2/2	42.5 - 136	S07SD0020001	---	107	136	**37.5**	2300	680	14000	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 3-2
7 RBCs for noncarcinogens are divided by 10 to correspond to correspond to a target hazard quotient of 0.1.

Associated Samples
S07SD0010001
S07SD0010001-D
S07SD0020001

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

TABLE 4-6

ECOLOGICAL DATA EVALUATION - SURFACE SOIL
SITE 7 - HMX SPILL, SLURRY BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Location of 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
Explosives (mg/kg)										
HMX	1/4	210 - 270	S07SS0010001	0.5	60.2	270	ND	---	YES	NTX
Inorganics (mg/kg)										
ALUMINUM	4/4	4690 - 7900	S07SS0020001	---	6290	7900	19700	[7]	NO	BKG
ARSENIC	4/4	3.6 - 10.2	S07SS0030001	---	5.5	10.2	14.9	18	NO	BSL, BKG
BARIUM	4/4	18.6 - 45.4	S07SS0020001	---	30.6	45.4	80.4	330	NO	BSL, BKG
CALCIUM	4/4	179 - 758	S07SS0020001	---	387	758	2060	---	NO	NUT
CHROMIUM	4/4	8.9 - 16.2	S07SS0030001	---	11.9	16.2	33.4	26	NO	BSL, BKG
COBALT	4/4	3.2 - 5.7	S07SS0020001	---	4.4	5.7	22.3	13	NO	BSL, BKG
COPPER	4/4	6.7 - 8.6	S07SS0010001-D	---	7.7	8.6	20.3	15	NO	BSL, BKG
IRON	4/4	7690 - 26500	S07SS0010001-D	---	14700	26500	38500	**12**	NO	BKG
LEAD	4/4	10.7 - 185	S07SS0010001	---	26.2	185	**62.5**	**11**	YES	ASL
MAGNESIUM	4/4	294 - 513	S07SS0030001	---	402.5	513	1620	---	NO	NUT
MANGANESE	4/4	128 - 270	S07SS0020001	---	172.5	270	1390	330	NO	BSL, BKG
MERCURY	2/4	0.013 - 0.025	S07SS0040001	0.0095 - 0.011	0.011	0.025	0.16	0.058	NO	BSL, BKG
NICKEL	4/4	2.7 - 4.5	S07SS0030001	---	3.65	4.5	15.4	**2**	NO	BKG
POTASSIUM	4/4	273 - 443	S07SS0030001	---	378	443	1470	---	NO	NUT
SELENIUM	1/4	0.43	S07SS0030001	0.37 - 0.43	0.25	0.43	1.2	1.8	NO	BSL, BKG
SODIUM	2/4	48.1 - 53.4	S07SS0030001	23.5 - 25.9	31.5	53.4	120	---	NO	NUT
VANADIUM	4/4	18.7 - 26.8	S07SS0030001	---	22.95	26.8	53.3	**7.8**	NO	BKG
ZINC	4/4	18.2 - 86.3	S07SS0010001	---	37.7	86.3	**37.5**	**10**	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 3-3
7 Only a COPC if pH is less than 5.5.

Associated Samples
S07SS0010001
S07SS0010001-D
S07SS0020001
S07SS0030001
S07SS0040001

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

TABLE 4-7

ECOLOGICAL DATA EVALUATION - SEDIMENT
SITE 7 - HMX SPILL, SLURRY BUILDING
NSF-IH, INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection[1]	Range of Detections[1]	Location of 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
Explosives (mg/kg)										
HMX	1/2	0.1	S07SD0020001	0.5	0.175	0.1	ND	---	YES	NTX
Inorganics (mg/kg)										
ALUMINUM	2/2	1250 - 2830	S07SD0010001	---	2275	2830	19700	---	NO	BKG
ARSENIC	1/2	0.9 - 8.4	S07SD0010001	---	4.8	8.4	14.9	9.8	NO	BSL, BKG
BARIUM	2/2	13.2 - 25.2	S07SD0010001	---	20.05	25.2	80.4	---	NO	BKG
CALCIUM	2/2	263 - 478	S07SD0020001	---	392	478	2060	---	NO	NUT
CHROMIUM	2/2	4.2 - 11.9	S07SD0020001	---	9.2	11.9	33.4	43.4	NO	BSL, BKG
COBALT	2/2	2.3 - 6.6	S07SD0010001	---	5.1	6.6	22.3	50	NO	BSL, BKG
COPPER	2/2	3.8 - 8.5	S07SD0020001	---	6.6	8.5	20.3	31.6	NO	BSL, BKG
IRON	2/2	4830 - 18600	S07SD0010001	---	13700	18600	38500	20000	NO	BSL, BKG
LEAD	2/2	5.7 - 23.7	S07SD0020001	---	15.9	23.7	62.5	35.8	NO	BSL, BKG
MAGNESIUM	2/2	111 - 202	S07SD0020001	---	165.5	202	1620	---	NO	NUT
MANGANESE	2/2	104 - 307	S07SD0010001	---	192	307	1390	460	NO	BSL, BKG
MERCURY	1/2	0.41	S07SD0020001	0.011 - 0.012	0.21	0.41	**0.16**	**0.18**	YES	ASL
NICKEL	2/2	2.4 - 4.9	S07SD0020001	---	4.2	4.9	15.4	22.7	NO	BSL, BKG
SODIUM	2/2	47.3 - 101	S07SD0020001	---	74.5	101	120	---	NO	NUT
VANADIUM	2/2	9.5 - 31.9	S07SD0010001	---	22.9	31.9	53.3	---	NO	BKG
ZINC	2/2	42.5 - 136	S07SD0020001	---	107	136	**37.5**	**121**	YES	ASL

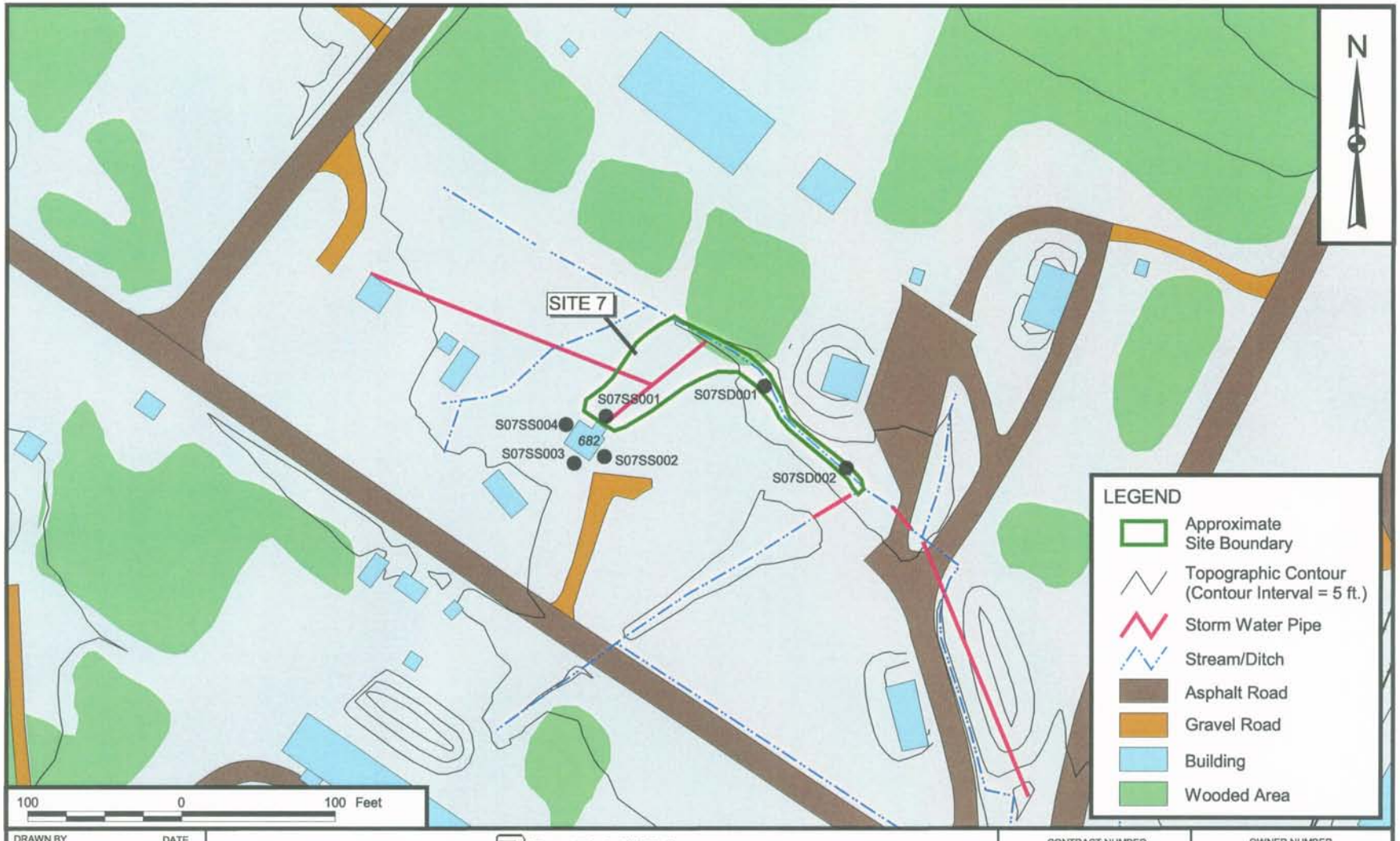
Shaded cells indicate chemical selected as COPCs and/or exceedances of criteria.

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

Associated Samples
S07SD0010001
S07SD0010001-D
S07SD0020001

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 8/7/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2193	OWNER NUMBER 0006
CHECKED BY J. MAGILSON — DATE 8/12/04	SSP SAMPLING LOCATIONS SITE 7 - HMX SPILL, SLURRY MIX BUILDING NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY — DATE —	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 4-1	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SITE 07 SSP 11/2/05 KMP

Site 7 – Looking west at tank and Building 682 from grassy area near stream channel. (1995)

Site 7 – Looking north from grassy area at tank, sign, and stream channel in background. (1995)

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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 7
Project No.: CTO 0805 JOB # N4020

Sample ID No.: S07SS0010001
Sample Location: S07SS001
Sampled By: FUR
C.O.C. No.: 4316

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

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 0900 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):				

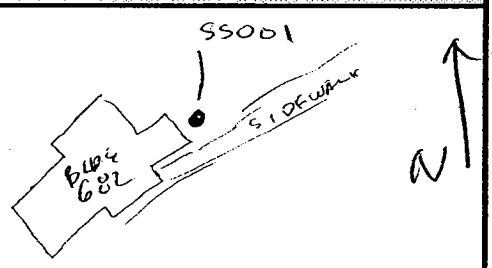
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass	✓	
ILMO4.0 TAL Metals	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- 5' FROM CONCRETE PAD AROUND BLDG 682, 4' FROM SIDEWALK
- SOME RUSTY METAL (2 PCS) FOUND IN DIG (NOT SAMPLED)

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓	S07SS DUP0101

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 7
Project No.: CTO 0805 JOB # N4020

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

Sample ID No.: S07SS0020001
Sample Location: S07SS002
Sampled By: RWR
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 920 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):				

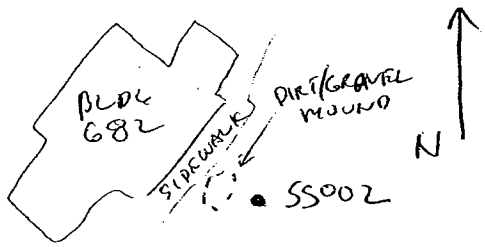
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass		
ILMO4.0 TAL Metals	1 x 4oz glass		

OBSERVATIONS / NOTES:

9' FROM CONCRETE SIDEWALK
- 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 7
Project No.: CTO 0805 JOB # N4020

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

Sample ID No.: S07SS0030001
Sample Location: S07SS003
Sampled By: [illegible]
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 940 Method: TROWEL Monitor Reading (ppm): nm	0 - 1'	MOD. BRN	SAND + GRAVEL TR SILT MOIST

COMPOSITE SAMPLE DATA:

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

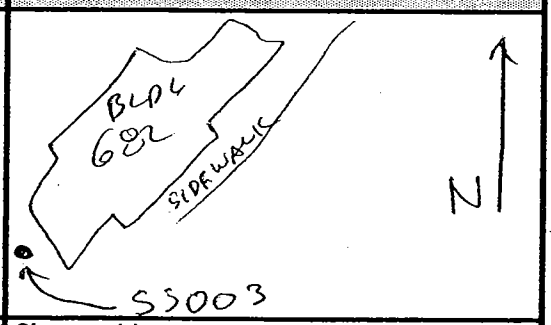
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass	✓	
ILMO4.0 TAL Metals	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

4' FROM CONCRETE PAD AROUND BLDG

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 7
Project No.: CTO 0805 JOB # N4020

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

Sample ID No.: S07SS0040001
Sample Location: S07SS004
Sampled By: PWR
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 1010 Method: TROWEL Monitor Reading (ppm): nm	0-1'	BRN	SAND + SILT TR GRA

COMPOSITE SAMPLE DATA:

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

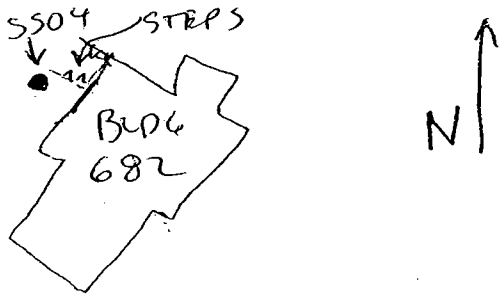
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass	✓	
ILMO4.0 TAL Metals	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- 5' FROM BLDG 682 FOUNDATION
- 3' FROM STAIRS

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 7
Project No.: CTO 0805 JOB # N4020

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

Sample ID No.: S07SD0010001
Sample Location: S07SD001
Sampled By: FMR
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

Date: 5-4-05	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 0820			
Method: DIRECT FILL	0-6"	BRN	SAND TR PLANT MATL. SATURATED
Monitor Reading (ppm): nm			

COMPOSITE SAMPLE DATA:

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

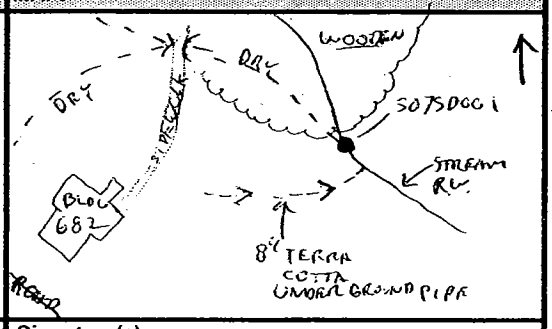
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass	✓	
ILMO4.0 TAL Metals	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- COLLECTED @ ~1"-3" DEEP (BELOW WATER SURFACE)
-

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	S07SDDUP0101

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: SSP Investigation Site 7
Project No.: CTO 0805 JOB # N4020

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

Sample ID No.: S07SD0020001
Sample Location: S07SD002
Sampled By: FWR
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05 Time: 0800 Method: DIRECT FILL Monitor Reading (ppm): nm	0-6"	BRN	SAND TR PLANT MATL.

COMPOSITE SAMPLE DATA:

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

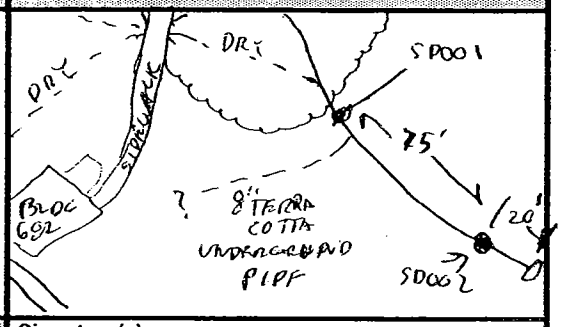
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
8330 HMX	1 x 4oz glass	✓	
ILMO4.0 TAL Metals	1 x 4oz glass	✓	

OBSERVATIONS / NOTES:

- COLLECTED FROM BELOW 1"-3" DEEP RUNNING WATER

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: Indian Head NDW
Project No.: CTO 805 Job # 4020

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

Sample ID No.: S07RB0010001
Sample Location: RINSATE BLANK
Sampled By: FWR
C.O.C. No.: 4316

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

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 5-4-05			
Time: 1100			
Method: —			— FR
Monitor Reading (ppm): —			

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
HMX 8330	2 x 1 l AMB GLASS	✓	
Tal Metals ILMO 4.0	1 x 500 ml HDPE		

OBSERVATIONS / NOTES:

POURED REAGENT GRADE H_2O
OVER PLASTIC TROWEL (UN-USED)
INTO SAMPLE CONTAINERS

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred McKamey

TETRA TECH NUS, INC.

CHAIN OF CUSTODY | NUMBER 4316 | PAGE 1 OF 1

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
4020 CTO 805	INDIANHEAD	KIM TURNBULL		STL VERONICA BORTOT
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
Fred W Ramser		FRED W RAMSER	412-921-8838	301 ALPHA DR RIDGE 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)

PRESERVATIVE USED

TYPE OF ANALYSIS

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	8330 HMX	ILM04.0 TAL METALS							COMMENTS
5/4	0820	S07SD001000 1	—	0	0.5	SD	G	2	1	1							RUN MS/MSD
	0000	S07SDDUP0101	—	0	0.5	SD	G	2	1	1							
	0800	S07SD002000 1	—	0	0.5	SD	G	2	1	1							
	0900	S07SS001000 1	—	0	1	SO	G	2	1	1							
	0000	S07SSDUP0101	—	0	1	SO	G	2	1	1							
	0920	S07SS002000 1	—	0	1	SO	G	2	1	1							
	0940	S07SS003000 1	—	0	1	SO	G	2	1	1							
	1010	S07SS004000 1	—	0	1	SO	G	2	1	1							RUN MS/MSD
5/4	1100	S07RB001000 1	—	—	—	QC/AQ	G	3	2	1							

	DATE	TIME		DATE	TIME
1. RELINQUISHED BY Fred W Ramser	5-5-05	1427	1. RECEIVED BY Patrick R Lamb	5/5/05	1427
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. TINUS-001

APPENDIX B

ANALYTICAL DATA

site 07
full appendix results
qc/sd/ss data

order	002	003	004	005	006	007	008	009	010	011
site	07	07	07	07	07	07	07	07	07	07
round	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2	2005Q2
location	S07SD001	S07SD001	S07SD001	S07SD002	S07SS001	S07SS001	S07SS001	S07SS002	S07SS003	S07SS004
nsample	S07SD0010001	S07SD0010001-AVG	S07SD0010001-D	S07SD0020001	S07SS0010001	S07SS0010001-AVG	S07SS0010001-D	S07SS0020001	S07SS0030001	S07SS0040001
sample	S07SD0010001	S07SD0010001-AVG	S07SDDUP0101	S07SD0020001	S07SS0010001	S07SS0010001-AVG	S07SSDUP0101	S07SS0020001	S07SS0030001	S07SS0040001
matrix	SD	SD	SD	SD	SS	SS	SS	SS	SS	SS
top_depth	0	0	0	0	0	0	0	0	0	0
bottom_dep	0.5	0.5	0.5	0.5	1	1	1	1	1	1
gis_date	20050504	20050504	20050504	20050504	20050504	20050504	20050504	20050504	20050504	20050504
qc_type	NM	NM	FD	NM	NM	NM	FD	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	05/04/05	05/04/05	05/04/05
validated	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
sort	**c_002**	**c_003**	**c_004**	**c_005**	**c_006**	**c_007**	**c_008**	**c_009**	**c_010**	**c_011**
Explosives (mg/kg)										
HMX	0.5 U	0.5 U	0.5 U	0.1 J	270	240	210	0.5 U	0.5 U	0.5 U
Inorganics (mg/kg)										
ALUMINUM	2830 J	2040 J	1250 J	2510 J	5690	5660	5630	6900	7900	4690
ANTIMONY	0.7 UL	0.69 UL	0.68 UL	0.74 UL	0.64 UL	0.635 UL	0.63 UL	0.58 UL	0.6 UL	0.57 UL
ARSENIC	8.4 J	4.65 J	0.9 J	5 J	3.6	4.3	5	3.8	10.2	3.8
BARIUM	25.2	19.2	13.2	20.9	29.3	28.9	28.5	45.4	29.4	18.6
BERYLLIUM	1.2 B	0.78 B	0.36 B	0.91 B	0.43 B	0.45 B	0.47 B	0.44 B	0.61 B	0.37 B
CADMIUM	0.06 UL	0.059 UL	0.058 U	0.063 UL	0.054 U	0.0535 UL	0.053 UL	0.049 U	0.051 UL	0.048 U
CALCIUM	348	305.5	263	478	189	184	179	758	391	215
CHROMIUM	8.7 J	6.45 J	4.2 J	11.9 J	8.9	10.2	11.5	11.4	16.2	9.8
COBALT	6.6	4.45	2.3	5.8	3.2	3.6	4	5.7	5	3.4
COPPER	5.7	4.75	3.8	8.5	8.5	8.55	8.6	7	8.5	6.7
IRON	18600 J	11715 J	4830 J	15600 J	10800 J	18650 J	26500 J	15000 J	17600 J	7690 J
LEAD	10.4 J	8.05 J	5.7 J	23.7 J	185	155.5	126	10.7	13	82.9
MAGNESIUM	147	129	111	202	308	301	294	467	513	329
MANGANESE	307 J	205.5 J	104 J	179 J	133 L	141 L	149 L	270 L	128 L	151 L
MERCURY	0.012 U	0.0115 U	0.011 U	0.41	0.011 U	0.00925	0.013	0.0095 U	0.0099 U	0.025
NICKEL	4.7	3.55	2.4	4.9	3.1	3.2	3.3	4.2	4.5	2.7
POTASSIUM	145 B	135 B	125 B	176 B	280 J	276.5 J	273 J	430 J	443 J	361 J
SELENIUM	0.46 UL	0.45 UL	0.44 U	0.48 UL	0.42 U	0.415 UL	0.41 UL	0.38 U	0.43 L	0.37 U
SILVER	0.17 B	0.165 B	0.16 B	0.19 B	0.11 B	0.12 B	0.13 B	0.09 U	0.093 B	0.088 U
SODIUM	48.8 L	48.05 L	47.3	101 L	25.9 U	25.65 UL	25.4 UL	23.5 U	53.4 L	48.1
THALLIUM	0.6 UL	0.59 UL	0.58 U	0.63 UL	0.54 U	0.6 U	0.66 B	0.49 U	0.51 UL	0.48 U
VANADIUM	31.9 J	20.7 J	9.5 J	25.1 J	18.7	21.3	23.9	21.7	26.8	22
ZINC	114 J	78.25 J	42.5 J	136 J	86.3 J	72.95 J	59.6 J	21.6 J	18.2 J	37.9 J
Miscellaneous Parameters (%)										
PERCENT SOLIDS	73.9 %	75.2 %	76.5 %	70.2 %	81 %	81.8 %	82.6 %	89.2 %	86 %	91 %

from ih7_sam.dbf
from ih7_res.dbf
from ih7_res.xls
from q:\sql_server\indian_head\upload

APPENDIX C

DATA VALIDATION MEMORANDA

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**K. TURNBULL**	**DATE:**	**JULY 7, 2005**
FROM:	**ETHAN G. LEE**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
NSWC INDIAN HEAD – CTO 805
SAMPLE DELIVERY GROUP (SDG) – C5E050333

SAMPLES: 3/SEDIMENT/

S07SD0010001 S07SD0020001 S07SDDUP0101

5/SOIL/

S07SS0010001 S07SS0020001 SS07SS0030001
S07SS0040001 S07SSDUP0101

1/AQUEOUS/

S07RB0010001

Overview

The sample set for NSWC Indian Head, CTO 805, SDG C5E050333, consists of three (3) sediment environmental samples, five (5) soil environmental samples, and one (1) aqueous rinse blank. Two (2) field duplicate pairs (S07SDDUP0101 / S07SD0010001; S07SSDUP0101 / S07SS0010001) are included in this SDG.

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

Summary

All analytes were successfully analyzed. 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.

Minor Problems

- 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]	0.058 mg/kg	0.29 mg/kg
Beryllium	1.5 ug/L	1.5 mg/kg
Calcium[1]	18.6 mg/kg	93.0 mg/kg
Chromium[1]	0.096 mg/kg	0.48 mg/kg
Copper[1]	0.29 mg/kg	1.45 mg/kg
Magnesium	47.8 ug/L	47.8 mg/kg
Nickel[1]	0.12 mg/kg	0.60 mg/kg
Potassium[1]	24.8 mg/kg	124 mg/kg
Silver	0.8 ug/L	0.8 mg/kg
Thallium	2.7 ug/L	2.7 mg/kg
Vanadium	0.7 ug/L	0.7 mg/kg
Zinc	2.8 ug/L	2.8 mg/kg

[1] Maximum concentration present in solid preparation blank from batch 5143242.

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, potassium, 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 S07SD0010001 and S07SD0020001 at concentrations comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, 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, cadmium, selenium, sodium, and thallium, in the affected samples. The nondetected results reported for antimony, cadmium, selenium, and thallium were qualified as biased low (UL). The positive results reported for sodium were qualified as biased low (L).

- The interfering analyte iron was present in sample S07SS0030001 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, 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, cadmium, selenium, sodium, and thallium in the affected sample. The nondetected results reported for antimony, cadmium, and thallium were qualified as biased low (UL). The positive results reported for selenium and sodium were qualified as biased low (L).

- The interfering analyte iron was present in sample S07SSDUP0101 at a concentration comparable to the concentration of iron in the ICS solution. Several analytes, namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, 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, cadmium, selenium, and sodium in the affected sample. The nondetected results reported for antimony, cadmium, selenium, and sodium were qualified as biased low (UL).

- The sediment matrix spike (MS) had percent recoveries (%Rs) <75% for antimony and arsenic and <30% for lead and manganese. The nondetected results reported for antimony were qualified as biased low (UL) and the positive results reported for arsenic, lead, and manganese were qualified as estimated (J) due to conflicting directional bias in sediment samples only.

- The soil MS had %Rs <75% for antimony and <30% for manganese. The nondetected results reported for antimony were qualified as biased low (UL) and the positive results reported for manganese were qualified as biased extremely low (L) in soil samples only.

- Sediment laboratory duplicate imprecision (Difference >2X the CRDL) was noted for arsenic. Positive results reported for arsenic were qualified as estimated (J) in sediment samples only.

- Sediment laboratory duplicate imprecision (RPD >35%) was noted for iron and lead. Positive results reported for iron and lead were qualified as estimated (J) in sediment samples only.

- Soil laboratory duplicate imprecision (RPD >35%) was noted for zinc. Positive results reported for zinc were qualified as estimated (J) in soil samples only.

- The soil ICP serial dilution had percent differences (%Ds) >10% and initial sample concentrations >50X the IDL for potassium and zinc. Positive results reported for potassium and zinc were qualified as estimated (J) in the soil samples only.

- Field duplicate imprecision (RPD >50%) was noted for aluminum, iron, lead, manganese, and zinc in field duplicate pair S07SDDUP0101 / S07SD0010001. Positive results reported for these analytes were qualified as estimated (J) in the sediment samples only.

- Field duplicate imprecision (Difference >4X the CRDL) was noted for arsenic, chromium, and vanadium in field duplicate pair S07SDDUP0101 / S07SD0010001. Positive results reported for these analytes were qualified as estimated (J) in the sediment samples only.

- Field duplicate imprecision (RPD >50%) was noted for iron in field duplicate pair S07SSDUP0101 / S07SS0010001. Positive results reported for iron were qualified as estimated (J) in the soil samples only.

Notes

The results for antimony, arsenic, lead, and manganese were reported incorrectly in the electronic data deliverable (EDD) for sample S07SD0010001. The data reviewer corrected the database for these analytes in this sample.

The contract required detection limit (CRDL) standard run on 5/24/05 at 1:34 PM had a %R >110% for lead. No qualification action was required because all results were either >2X the CRDL or they were nondetected in the associated samples.

The CRDL standards run on 5/24/05 at 3:47 PM and 5:59 PM had %Rs >110% for beryllium. No qualification action was required because the associated sample results were >2X the CRDL or were previously qualified for laboratory blank contamination.

The CRDL standard run on 5/24/05 at 5:59 PM had %Rs >110% for chromium and silver. No qualification action was required for chromium because the result in the associated sample was

>2X the CRDL. No qualification action was required for silver because the associated sample was previously qualified for laboratory blank contamination.

The CRDL standards run on 5/26/05 at 10:17 AM, 12:24 PM, 2:14 PM, 4:55 PM, and 7:07 PM had %Rs >110% for zinc. No qualification action was required because the results were all >2X the CRDL.

The CRDL standard run on 5/26/05 at 10:17 AM and 12:24 PM had %Rs >110% for lead. No qualification action was required because the associated samples did not have results reported for lead.

The sediment ICP serial dilution had a %D >10% and an initial sample concentration >50X the IDL for potassium. No qualification action was required because all potassium results in the sediment samples were previously qualified for laboratory blank contamination.

Executive Summary

Laboratory Performance: 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
Ethan G. Lee
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

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

Data Qualifier Key:

U	-	Value is a nondetect as reported by the laboratory.
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.
L	-	Positive result is considered biased low as a result of technical noncompliance.

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**KIM TURNBULL**	**DATE:**	**JULY 7, 2005**
FROM:	**KELLY CARPER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION- HMX CTO 805, NSWC INDIAN HEAD SDG C5E050333**		
SAMPLES:	1/Aqueous/ S07RB0010001		

8/Solid/

S07SD0010001	S07SD0020001	S07SDDUP0101	S07SS0040001
S07SSDUP0101	S07SS0010001	S07SS0020001	S07SS0030001

Overview

The sample set for CTO 805, NSWC Indian Head, SDG C5E050333 consists of eight (8) environmental soil and sediment samples and one (1) rinsate blank. Two field duplicate pairs were included in this sample set S07SD0010001/S07SDDUP0101 and S07SS0010001/S07SSDUP0101. All samples were analyzed for HMX.

The samples were collected by Tetra Tech NUS on May 4, 2005 and analyzed by Severn Trent Laboratory. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Method 8330 analytical and reporting protocols.

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 results, surrogate spike/internal standard recoveries, blank spike results, field duplicate precision, 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.

No major problems were noted.

Minor

- Positive results below the reporting limit were qualified as estimated (J) due to uncertainty near the detection limit.

Notes

Samples S07SS0010001 and S07SSDUP0101 were performed at a 50 fold dilution. As a result, the surrogates were diluted from these samples and extraction efficiency could not be evaluated in these samples.

Executive Summary

Laboratory Performance: Positive results below the reporting limit were qualified as estimated (J) due to uncertainty near the detection limit.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to Region III modifications to U.S. EPA National Functional Guidelines for Data Validation (9/94) and the NFESC guidelines entitled Navy IRCDQM (Sept. 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

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

Tetra Tech NUS
Kelly Carper
Chemist/Data Validator

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:
Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation