10/1/08 - 02282

Final

Work Plan for Site Investigation Various Areas of Concern

Naval Weapons Station Yorktown Cheatham Annex Williamsburg, Virginia

NAVFAC
Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Contract No N62470-02-D-3052
CTO-0174

October 2008

Prepared by

CH2MHILL

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Acronyms and Abbreviations

AOC	area of concern
AVS/SEM	acid volatile sulfate/simultaneously extracted metals
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CAX	Cheatham Annex
CLEAN	Comprehensive Long-Term Environmental Action—Navy
CLP	Contract Laboratory Program
COC	chain-of-custody
CSM	conceptual site model
CTO	Contract Task Order
DD	Decision Document
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DPT	direct-push technology
EOD	explosive ordnance disposal
FFA	Federal Facilities Agreement
FISC	Fleet and Industrial Supply Center
FSP	Field Sampling Plan
ft	foot/feet
FTL	Field Team Leader
GIS	geographic information system
GPS	Global Positioning System
HASP	Health and Safety Plan
ICP	inductively coupled plasma
IDW	investigation-derived waste
µg/kg	micrograms per kilogram
MCL	maximum contaminant levels
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MIDLANT	Mid-Atlantic Division
mm	millimeter
MRS	Munitions Response Site
NAVFAC	Naval Facilities Engineering Command
Navy	Department of the Navy
NOSSA	Naval Ordnance Safety and Security Activity

NPL	National Priorities List
NPS	National Park Service
ORP	oxidation reduction potential
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PPE	personal protective equipment
ppm	parts per million
PSLP	Penniman Shell Loading Plant
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	regional screening level
SCS	Soil Conservation Service
SI	Site Investigation
SOP	standard operating procedure
SVOC	semivolatile organic compound
TAL	target analyte list
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TNT	trinitrotoluene
TOC	total organic compound
UCL	upper confidence limit
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit
UUUE	Unlimited Use and Unrestricted Exposure
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
WP	Work Plan
WPNSTA	Naval Weapons Station
yd^3	cubic yard

SECTION 1

Introduction

This Work Plan (WP) presents the technical approach for the Site Investigation (SI) of various Areas of Concern (AOCs) at Naval Weapons Station (WPNSTA) Yorktown Cheatham Annex (CAX), Williamsburg, Virginia. The WP is prepared for submittal to the Department of the Navy (Navy), Naval Facilities Engineering Command, Mid-Atlantic Division (NAVFAC MIDLANT), under the Comprehensive Long-term Environmental Action—Navy (CLEAN) III Program, Contract Number N62470-02-D-3052, Contract Task Order (CTO) 174. The WP represents SI objectives and technical approach for review and concurrence by the United States Environmental Protection Agency (USEPA) Region III, and the Virginia Department of Environmental Quality (VDEQ).

This WP was prepared in accordance with the *Intergovernmental Data Quality Task Force, Uniform Federal Policy for Quality Assurance Project Plans*, *Final Version 1* (IDQTF, 2005) to provide a systematic data collection and analysis structure for conducting the CAX AOCs SI. The Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) worksheets (Appendix B) detail the environmental investigation process and provide guidelines for collection of environmental data of known and documented quality consistent with data quality objectives.

1.1 Project Objectives and Approach

The objective of the SI for the AOCs at CAX is to determine whether a release has occurred that has the potential to adversely affect human health or the environment. The project objective will be accomplished through a review of previous site data and additional data collection, as necessary, to:

- Further characterize the AOCs
- Determine if there have been any releases
- Eliminate from further consideration any AOCs that pose no unacceptable threat to human health or the environment
- Determine the need to quantify potential risk, as appropriate
- Determine the need for interim removal actions, as appropriate

The following CAX AOCs are included in this SI:

- AOC 1—Scrap Metal Dump
- AOC 2—Dextrose Dump
- AOC 6—Penniman AOC
- AOC 7—Drum and Can Disposal Area
- Unnamed AOC south of Site 7, herein referred to as AOC 8

Soil and groundwater sampling will be conducted at AOC 1, AOC 6, AOC 7, and AOC 8. In addition, test pitting will be conducted at AOC 7 and AOC 8 along with sediment and surface water sampling at AOC 6. The samples collected will be analyzed for the parameters described in Section 3. As detailed in Section 2.3, media will not be sampled at AOC 2 due to the available existing data; this data will be used in a risk evaluation for this AOC.

Prior to analyzing the SI data, background upper tolerance limits (UTLs) will be distributed to the Yorktown Partnering Team for review. Upon team consensus of the UTLs, a comparison of AOC data with the accepted UTLs will be conducted to identify whether a potential release has occurred at the AOCs. If a background UTL is not available for a specified constituent, the data will be compared to applicable human health and ecological screening criteria. A release of potential concern will be identified by an exceedance of a background UTL and applicable human health and ecological screening criteria. If a release is not identified no further consideration will be recommended for the AOC. If a release of potential concern is identified a qualitative risk evaluation will be completed to determine if the release poses a potential risk to human health and the environment. The qualitative risk evaluation would involve screening the data against appropriate screening criteria (regional screening levels for residential soil, industrial soil, and/or groundwater, as discussed in Section 3.2.5 [USEPA, May 20, 2008]), and if the data exceeds the criteria, a risk-ratio calculation would be conducted. The risk ratio calculation will follow the methodology in U.S. Navy's Overview of Screening, Risk Ratio, and Toxicological Evaluation (U.S. Navy, May 2000). If the qualitative risk evaluation indicates a potential risk (i.e. chemicals of potential concern are identified following a risk-ratio evaluation, meaning the cumulative hazard index exceeds 0.5 or the cumulative cancer risk exceeds 5×10^{-5} for a given medium for an AOC, and the chemicals contributing to the hazard/risk are identified as chemicals of potential concern), further remedial investigation (RI) with quantitative risk assessments and/or removal actions warrant consideration. SI findings and recommendations will be documented in a single Supplemental SI Report to the *Final Site Inspection Report, Site 4 and AOC 1* (Baker, 2001a) and a separate SI Report for AOCs 2, 6, 7, and 8. The decision tree for data evaluation is presented as Figure 1-1. Specifics of the sampling, analytical screening, and reporting processes are discussed in Sections 3 and 4.

1.2 WP Scope and Organization

This WP is organized into five sections. Section 2 provides background information for the CAX installation and AOCs. Section 3 describes the technical approach for the SI field investigation and subsequent data analysis and documentation. Section 4 provides information on project staffing, scheduling, and deliverables. Section 5 lists references used to complete this WP. Tables and figures are provided at the end of each section. The Health and Safety Plan (HASP) is included in Appendix A, the UFP-QAPP worksheets are included in Appendix B, and available historic analytical data are provided in Appendix C. Appendixes are provided at the end of the WP.

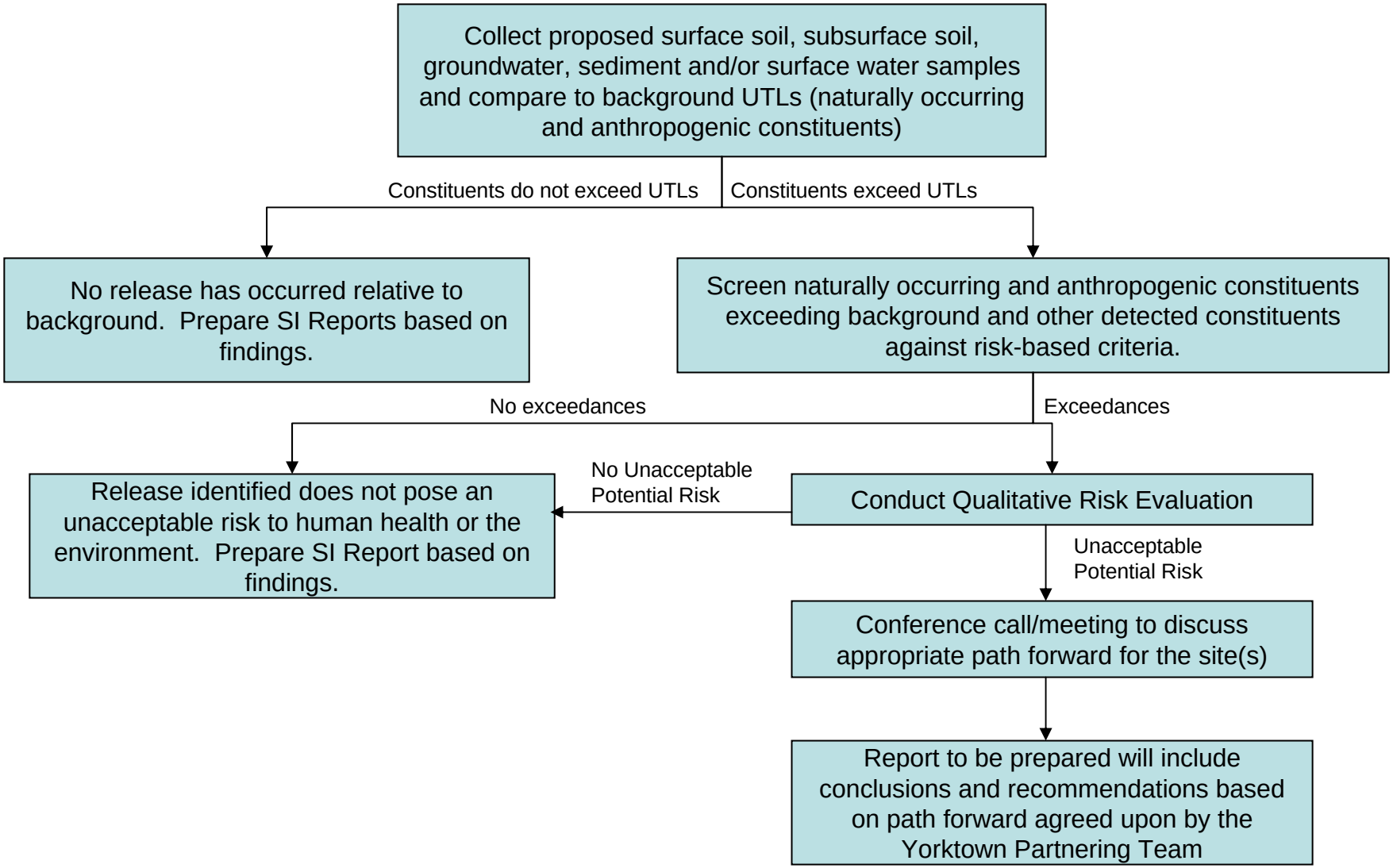


Figure 1-1
SI Decision Tree
Areas of Concern (AOCs) 1, 6, 7 and 8, Cheatham Annex
Williamsburg, Virginia

SECTION 2

Background

This section provides a brief description of CAX, the site-specific history and physical setting of the CAX AOCs, and a summary of previous investigations conducted at the AOCs.

2.1 CAX Location and History

CAX consists of 2,300 acres of land on the York-James Peninsula, northwest of WPNSTA Yorktown (Figure 2-1). CAX had been the location of the former Penniman Shell Loading Plant (PSLP), a large powder and shell loading facility operated by DuPont during World War I. The facility closed in 1918, and the property was used for farming or remained idle until CAX was commissioned in 1943 as a satellite unit of the Naval Supply Depot. From 1943 to the present, CAX has performed services in support of Naval ordnance missions that include packing and shipping materials, warehousing, inventory management, local delivery, fuel management and distribution, technical support, customer service, and care of sponsor-owned material. In 1987, CAX was designated the Hampton Roads Navy Recreational Complex. Today, the mission of CAX includes recreational opportunities to military and civilian personnel, with outdoor recreational facilities including cabins, camp sites, an 18-hole golf course, swimming pool, ball fields, freshwater and saltwater fishing areas, boating, wildlife watching, and hunting. The future land use at CAX is expected to remain unchanged.

CAX is bordered by Colonial National Historical Park on the northwest and east, Queens Lake subdivision to the west, and the city of Williamsburg to the south and southwest. Fifty-five percent of CAX is undeveloped and heavily wooded. Surface water features at CAX consists of Cheatham Pond (located to the east and northeast of AOC 7), Jones Mill Pond (located to the west of AOC 1), Penniman Lake (located in the vicinity of AOC 6), and the York River (located east of AOC 8). Potable water at CAX is provided by Newport News Waterworks.

In October 1998, control of CAX was transferred from Fleet and Industrial Supply Center (FISC) to WPNSTA Yorktown. On December 1, 2000, CAX was included on the National Priorities List (NPL). The Federal Facilities Agreement (FFA) for CAX was signed March 2005 and identified a total of 12 sites and seven AOCs (Baker, 2006). The AOCs addressed in the SI (AOC 1, AOC 2, AOC 6, AOC 7, and AOC 8) are shown in Figure 2-2. All of the AOCs, with the exception of AOC 1, are located within the PSLP area of CAX.

2.1.1 Hydrogeologic Setting

Beginning with the uppermost soils, each of the CAX AOCs included in this SI fall under one of the four soil association groups identified at CAX during a 1985 soil survey report for CAX was prepared by the Soil Conservation Service (SCS). Based on this survey, the soil at AOC 2, AOC 6, AOC 7, and AOC 8 is of the Dogue, Pamunkey, and Uchee Association (Soil Association Group 2). The soils of this classification are formed on river terraces and are

deep, moderately to well, and poorly drained soils with clayey and loamy subsoils (Baker, 2003). The soil at AOC 1 is of the Emporia, Slagle, and Craven-Uchee Complex Soils Association (Soil Association Group 3). The soils of this classification are deep, well- to moderately well-drained soils that have loamy and clayey subsoils, formed on the Coastal Plan Upland with medium to narrow ridges and gentle to very steep side slopes (Baker, 2003). A more detailed description of the soils within Soil Association Group 2 and Group 3 can be found in the *Final Background Investigation, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site, Williamsburg, Virginia* (Baker, 2003).

With regard to the subsurface geology, CAX lies within the Atlantic Coastal Plain physiographic province, which is underlain by unconsolidated sediment of the Quaternary, Tertiary, and Cretaceous ages. These sediments dip to the southeast, with a combined thickness of 1,900 feet (ft) in the vicinity of CAX.

A total of 10 geologic formations have been identified (Brockman et al., 1997) beneath WPNSTA and CAX. The upper most geologic formations consists of alluvial, colluvial, and marsh deposits composed of silt, sand, and pebbles with some clay. The geologic units are grouped into hydrostratigraphic units based upon hydraulic characteristics. The aquifers separated by confining/semi-confining units relevant to CERCLA investigations at WPNSTA and CAX are, from youngest to oldest; the Columbia aquifer, the Cornwallis Cave aquifer, and the Yorktown-Eastover aquifer. Groundwater flow is locally controlled by topography with discharge to nearby surface water bodies and a primary flow and discharge direction toward the York River.

Where present, the Columbia aquifer ranges in thickness from 5 to 10 ft thick, with horizontal hydraulic conductivity between about 0.4 to 8 ft/day and vertical hydraulic conductivity between 1.7×10^{-4} to 1.7×10^{-1} ft/day (Brockman et al., 1997). The hydraulic properties of the Cornwallis Cave aquifer are highly variable due to depositional effects and physical and geochemical weathering. In general, horizontal hydraulic conductivity ranges from 0.3 to 9 ft/day and vertical conductivity ranges from 6.2 × 10-4 to 2.4 × 10-1 ft/day (Speiran and Hughes, 2001). Finally, the thickness of the Yorktown-Eastover aquifer across WPNSTA Yorktown ranges from 60 to 100 ft. Horizontal hydraulic conductivity ranges from 0.004 to 3 ft/day and vertical hydraulic conductivity ranges from 1.7×10^{-5} to 4.8×10^{-1} ft/day. Transmissivity of the aquifer ranges from 0.5 to 40 ft^2/day, with groundwater flow from west-to-east.

2.2 AOC 1—Scrap Metal Dump

2.2.1 AOC 1 Location and History

AOC 1 is a debris disposal area west of Chapman Road within two ravines associated with unnamed tributaries to Jones Mill Pond (Figure 2-2). AOC 1 was identified in 1998 during a site visit by the Navy, USEPA, and the VDEQ. AOC 1 is divided into a 0.2 acre North Area and a 0.4 acre South Area (Figure 2-3). Runoff from AOC 1 flows approximately 1,000 ft west to Jones Mill Pond, a former source of potable water for CAX (Weston, 1999); potable water is currently supplied by Newport News Waterworks.

Wood and metal debris outcrop from the banks of the ravines, with debris being more extensive within the southern ravine. Debris observed during the 1998 site visits also

included two corroded cylinders, approximately 8 inches in diameter and 54 inches long, located along the top of a bank within the northern ravine of AOC 1. These cylinders were labeled "The Liquid Carbonic Co", and were determined to be empty and removed from the site in April 2000 by IMS Environmental Services. The date(s) of debris disposal at AOC 1 are unknown; however, it has been documented that some of this debris dates back to the World War I era (Weston, 1999). Based on an average debris thickness of 3 ft, the total volume of debris at AOC 1 is estimated to be 3,000 cubic yards (yd^3) (Baker, 2001a).

An aerial photo review revealed the following regarding AOC 1 (Baker, 2001a):

- **1942—**AOC 1 is cleared of trees and contains a large mound of light-toned material. The adjacent railroad yard is under construction
- **1955—**AOC 1 is partially re-vegetated
- **1963—**A large mound of fill is observed
- **1975—**Vegetation is re-established in AOC 1

AOC 1 is restricted to the general public by a locked chain link fence; however, it is unrestricted to Navy personnel who use Jones Mill Pond for recreation and fishing (Weston, 1999).

2.2.2 Previous Investigations at AOC 1

Final Site Inspection Narrative Report, *Penniman Shell Loading Plant*, *Williamsburg*, *Virginia* (Weston, 1999)

In 1999, an SI was conducted to assess potential sources of contamination associated with the former Penniman Shell Loading Plant Site, to determine the need for additional investigation, and if appropriate, to support site evaluation for proposal to the NPL. Of the 29 samples collected during the SI activities, two of the sediment samples were collected within the vicinity of AOC 1. Sediment samples PEN1-SED-04 and PEN1-SED-03 were collected from drainage channels leading to Jones Mill Pond within the vicinity of the North Area and South Area of AOC 1, respectfully.

Only analytical data for sediment sample PEN1-SED-04 was provided in the Final Site Inspection Narrative Report and are summarized in Table C-4 in Appendix C. As noted in this report, the concentration of manganese (168 milligrams per kilogram [mg/kg]) was elevated above the background sample (PEN1-SED-09) concentration of 20.8 mg/kg. It was recommended that a more specific investigation be conducted of the Jones Mill Pond Landfill area.

Final Site Inspection Report, *Site 4 and AOC 1*, *Naval Weapons Station Yorktown*, *Yorktown*, *Virginia*, *Cheatham Annex Site* (Baker, 2001a)

A 1999 SI was completed for Site 4 and AOC 1 and consisted of a geophysical survey and soil and surface water/sediment sampling. The 1999 sample locations within the North Area and South Area are shown in Figures 2-4 and 2-5, respectively.

Debris, including scrap metal, wood, empty drums, cinder blocks, bricks, wood, and concrete and concrete slabs was disposed of in both the northern and southern portions of

the AOC in ravines of Jones Mill Pond located approximately 2,500 ft downgradient of the areas. The geophysical survey results indicated that there is not extensive buried debris at the site, and that most of the buried debris lies within 10 to 12 ft beyond the edge of the visible surface debris.

All samples were analyzed for target compound list (TCL) organics, target analyte list (TAL) inorganics and cyanide, and explosives (nitramines/nitroaromatics). Summaries of these detections are included in Tables C-1 through C-4 in Appendix C. Total polycyclic aromatic hydrocarbons (PAHs) (~5000 micrograms per kilogram [µg/kg]) and arsenic (23.5 mg/kg) were detected in soil, with the highest concentrations in the northern area. Only low estimated levels of phthalates were detected in surface water and sediment. Arsenic (7.4 mg/kg) and low estimated levels below reporting limits of ethylbenzene and xylene were also detected in sediment.

2.3 AOC 2—Dextrose Dump Description

2.3.1 AOC 2 Location and History

AOC 2 is located to the north of Garrison Road, along the southern perimeter of CAX as shown on Figure 2-6. Approximately 1 wooded acre was identified during site visits by the Navy, USEPA, VDEQ, and Baker in 1998. AOC 2 consists of several rows of concrete foundation piers which at one time supported a Shipping House associated with PSLP. The majority of the structures associated with the Penniman facility were demolished between 1918 and 1925. Grass-covered lanes leading to the site area are likely locations of former rail lines that have been removed. Several partially buried glass bottles (many of which are labeled dextrose) and unlabeled drums were discovered in the area. Several mounds present in the area were suspected to contain buried debris.

2.3.2 Previous Actions and Investigations at AOC 2

Routine Housekeeping Effort (1998)

Reactives Management, Inc. removed a total of 470 bottles at ground surface as part of a routine housekeeping operation. Approximately 5 percent of the bottles (24 bottles) were selected randomly and analyzed. Each bottle contained greater than 2,000 parts per million (ppm) glucose, indicating that the bottles did contain dextrose. The bottle contents were emptied into the Hampton Roads Sanitation District sanitary sewer system, and the bottles were sent to a glass recycler (RMI, 1998). Only bottles on the surface were removed.

Final Field Investigation Report, Site 1 and AOC 2 (Baker, 1999)

A 1998 field investigation at AOC 2 consisted of a geophysical survey to estimate the extent of buried material and soil and groundwater sampling. Soil and groundwater samples were analyzed for TCL organics, nitramines/nitroaromatics, and TAL inorganics. Groundwater samples were collected from the Cornwallis Cave Aquifer (the shallowest aquifer underlying the site) via temporary monitoring wells installed in each direct push soil boring. The 1998 AOC 2 sample locations are shown in Figure 2-7 and the analytical data from this report are included in Tables 4-13 through 4-20 in Appendix C.

Conclusions of the Field Investigation at AOC 2 are:

Extent of Buried Debris

- Of the 12 drums visible at ground surface, most are at least partially buried and appear empty
- Results of the geophysical survey delineated anomalies that may coincide with buried drums of debris (see Figure 2-7)

Soil

- No semivolatile organic compounds (SVOCs), polychlorinated biphenyl (PCBs), or nitramines/nitroaromatics were detected in surface or subsurface soil
- Detected pesticides (heptachlor epoxide, 4,4-dichlorodiphenyldichloroethene [DDE], and 4,4'-dichlorodiphenyltrichloroethane [DDT]) are considered anthropogenic and attributed to routine pesticide application
- The detection of acetone in one soil sample is considered a laboratory artifact
- Metals concentrations were generally within the range of background for WPNSTA Yorktown and consistent with soils of the Virginia Coastal Plain; however, concentrations of chromium and lead exceeded ecological screening criteria and background concentrations

Groundwater

- No volatile organic compounds (VOCs), pesticides, PCBs, or nitramines/nitroaromatics were detected
- The detection of one SVOC, diethyl phthalate, is considered a laboratory artifact
- Metals concentrations were generally within the range of background for WPNSTA Yorktown groundwater

The Field Investigation Report (Baker, 1999) recommended that the sources of the geophysical anomalies and potential sources of contamination be identified by excavating six shallow test pits in the vicinity of the most significant anomalies detected.

Final Field Investigation Report, Site 7 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site (Baker, 2001b)

Six test pits were excavated and sampled in November 1999. Buried materials were encountered in each test pit and included empty drums, dextrose bottles and unopened respirator cartridge canisters. The samples collected from the test pits were analyzed for TCL organics and TAL inorganics. Toxicity Characteristic Leaching Procedure (TCLP) analysis and Resource Conservation and Recovery Act (RCRA) characterization of a soil sample composited from the stockpiled test pit soils (A2-TPCOMP-01) indicated that the stockpiled soils were not hazardous, and the soils were returned to the test pits. The analytical data from this report are included in Tables 4-5 through 4-8 in Appendix C.

A few of the drums at the site were coated with small amounts of tar or tar residue; therefore, a sample of the tar was collected and submitted for analysis of chemical warfare materials and degradation products, none of which were detected. One intact respirator

cartridge was analyzed for full TCLP parameters and RCRA characterization. Because cadmium and lead concentrations exceeded TCLP levels, the Navy, in consultation with the USEPA and VDEQ, agreed to expand the test pit program to define the extent of buried debris and canisters. The 1999 sample locations are shown in Figure 2-8.

A total of 47 test pits were advanced in 2000. Materials encountered included respirator cartridge canisters, empty drums, dextrose bottles, and military clothing. The lateral extent of the buried debris was not completely defined.

Based on the results of the second Field Investigation of AOC 2, the following conclusions were documented:

- Empty drums, unopened respirator cartridges in their original storage canisters, military uniforms, and dextrose bottles are buried at AOC 2
- While arsenic concentrations exceeded the USEPA risk-based concentrations (RBCs) for residential soil in soil samples collected from test pits within the dextrose dump (fill zone, native soil and confirmation composite samples), the detected concentrations of arsenic are within the range of background concentrations for WPNSTA Yorktown for surface and subsurface soil
- One detected concentration of iron (confirmation composite sample AS-CS03) was above the range of background concentrations for WPNSTA Yorktown for surface and subsurface soil; concentrations of iron within the remaining soil samples were within the range of background concentrations
- Sample AS-CS04 was collected from the fill zone soil that was stained black from an asphalt-like substance. This was the only location at which an organic concentration (Aroclor-1260, 350 µg/kg) exceeded the USEPA Region III residential soil RBC

The Field Investigation Report (Baker, 2001b) recommended a limited geophysical investigation to delineate the lateral extent of buried respirator cartridge canisters, the location of the eastern perimeter of disposal along Deer Pit Road, and a test pit investigation to confirm the results of the geophysical investigation.

Final Trenching Letter Report, Site 1, Site 4, and AOC 2, Naval Weapons Station Yorktown, Cheatham Annex Site, Williamsburg, Virginia (Baker 2002)

In 2001, 15 trenches were excavated, ranging from 2.5 ft to 20 ft in depth, and 6 ft to 63 ft in length. In eight of these trenches, dextrose bottles, some clothing, metal debris, and empty 55-gallon drums were observed. The remaining seven trenches contained native soil.

Based on the observations made during the trenching activities:

- The horizontal and vertical extent of the dextrose dump along Deer Pit Road was delineated.
- Debris in this area is primarily confined to beneath the road, with some surface debris outside the road area. The thickness of this debris ranged from several inches to 5 ft (debris was thickest beneath the center of the road, and tapered toward the road edges). The depth of the debris ranged from the surface to 1 ft below ground surface (bgs).

- The majority of debris observed consisted of bottled dextrose water. Along the extent of Deer Pit Road, the debris uncovered included dextrose bottles in wooden crates and clothing.
- No respirator cartridge canisters were found along or around Deer Pit Road during the trenching activities.
- An area of 55-gallon drums was verified from the previous investigations.

AOC 2 was separated into three areas based on the types of debris observed during the trenching activities. Areas 1a and 1b contain dextrose bottles and minor debris, and Area 3 contains military clothing (Figure 2-9). Area 2 contains respirator cartridge canisters and 55-gallon drums. Calculations of the debris volumes generated for each of these areas were computed for anticipated future disposal. The three areas are shown in Figure 2-9 and the calculated volumes are as follows:

Areas 1a, 1b, and 3 (inert debris)	=	890 yd^3
Area 2 (unopened respirator cartridges)	=	600 yd^3
Total volume of Areas 1a, 1b, 2, and 3	=	1,490 yd^3

2.3.3 Justification for No Additional Sampling at AOC 2

Based on the existing data, for the purposes of this SI, it is assumed that no additional sampling is necessary at AOC 2. Previous investigations identified the horizontal and vertical extent of disposed material. For those areas of AOC 2 where debris has been identified and sampling was not conducted, the debris is inert (e.g., dextrose bottles, deer carcasses, military uniforms) and is not considered a CERCLA source. Potential removal actions associated with these AOC 2 areas would be considered a base housekeeping effort, and not a CERCLA action.

In AOC Area 2 where respirator cartridge canisters and 55-gallon drums were identified, analytical data are adequate to support a qualitative risk screening approach and background comparison in order to determine whether a release has occurred that may pose an unacceptable risk at AOC 2.

2.4 AOC 6—Penniman AOC Description

2.4.1 AOC 6 Location and History

The PSLP was an explosives manufacturing facility operated by the DuPont de Nemours Company on what is now CAX and adjacent properties. This facility operated as a trinitrotoluene (TNT) manufacturing plant beginning in approximately 1916, and subsequently began loading artillery shells for the war effort in 1918. Between 1918 and 1925, following the end of World War I, this facility was demolished and reverted to farmland. The Navy established CAX on a portion of this property in 1942 (Weston, 1999).

In August 2000, the USEPA and Navy agreed to investigate five areas associated with the PSLP. These five areas comprise AOC 6 (Penniman AOC), and are located within the vicinity of the shell loading are of PSLP, south of Sanda Avenue (formerly DuPont's "G" plant) on Navy property (Weston, 1999) (Figure 2-2). These areas are the:

- **Ammonia Settling Pits—**Earthen ammonia settling pits at each of three PSLP buildings (Building 123—ammonia settling, Building 124—ammonia evaporating, and Building 125—ammonia finishing). Wastewater from the ammonia finishing at Building 125 was discharged through these pits.
- **TNT Graining House Sump—**Concrete-lined and open top pit believed to be the sump pit for the TNT graining house (Building 121) in the former shell loading area.
- **TNT Catch Box Ruins—**Earthen and brick-lined depressions located immediately adjacent to the TNT graining house (Building 121) in the former shell loading area. This area was used to separate TNT particles from wastewater.
- **1918 Drum Storage—**Storage of wooden kegs when the shell loading area was active. This area was identified from historic photos.

Figure 2-10 shows the location of each of these four areas within the PSLP.

2.4.2 Previous Investigations at AOC 6

Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia (Weston, 1999)

A 1999 SI included the collection of soil, sediment, surface water, and waste samples to assess potential sources of contamination associated with the Penniman Facility and to support HRS evaluations. During this SI, a total of seven waste source samples were collected among the five areas of AOC 6 as summarized below (Weston, 1999):

TABLE 2-1
1999 Waste Source Sampling at AOC 6
Results Exceeding USEPA Region III RBCs for Residential Soil

Area	Sample ID	Analytical Results[1]
Ammonia Settling Pits	PEN1-SO-01	Arsenic – 6 mg/kg
TNT Graining House Sump	PEN1-SO-03 PEN1-SO-03A	2,4,6-TNT – 28 mg/kg Arsenic – 15.5 mg/kg Cadmium – 4 mg/kg Lead – 7,580 mg/kg Manganese – 886 mg/kg
TNT Catch Box Ruins	PEN1-SO-04	2,4,6-TNT – 620 mg/kg Arsenic – 11 mg/kg Lead – 813 mg/kg
1918 Drum Storage Area	PEN1-SO-13 PEN1-SO-14	Arsenic - 4.7 mg/kg (PEN1-SO-13) Arsenic - 5.5 mg/kg (PEN1-SO-14)

Notes:
[1]Analytical results lists all compounds exceeding the USEPA Region III RBCs for Residential Soil in waste samples
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
J = Analyte present. Reported value may or may not be accurate or precise.
mg/kg = milligrams per kilogram

The analytical data from this report are included in Tables C-5 through C-7 in Appendix C. As concluded in the SI report, waste within the Ammonia Settling Pits and TNT Graining

House could be considered health risks due to the concentrations of arsenic in waste source samples above residential RBCs for soil (Table 2-1); these areas were considered potential sources for contaminant transport to Penniman Lake (Figure 2-10).

Samples collected from the 1918 Drum Storage Area (PEN1-SO-13 and PEN1-SO-14) had concentrations of arsenic that exceeded the RBC for residential soil (Table 2-1). As these concentrations were detected between 12 to 24 inches bgs and within 200 ft of buildings currently occupied by workers, an evaluation of the health risk posed to these workers was recommended.

2.5 AOC 7—Drum and Can Disposal Area Description

2.5.1 AOC 7 Location and History

In 2004, several small surface disposal areas containing a 55-gallon drum and numerous cans were identified north of CAX Depot Building 14 (Figure 2-2). One of the areas was described as a pit approximately 30 ft by 20 ft and 8 ft deep that contains 40 to 50 10-gallon rusted cans with labeling containing the word "tetrachloroethene" (Figure 2-11). In March 2006, Shaw Environmental & Infrastructure, Inc. (Shaw) cleared 1.42 tons of metal debris from the pit and surrounding area. No sampling or soil excavation was conducted during this removal action. Approximately 20 rusty pails and two empty 55-gallon drums were discovered approximately 250 ft from the pit. Upon completion of the removal action, a high-visibility fence was installed around the pit located in the woods, and caution tape was placed around the area where the pails and drums were removed (Shaw, 2006).

2.5.2 Previous Investigations at AOC 7

This AOC has not yet been investigated.

2.6 AOC 8—Area South of Site 7

2.6.1 AOC 8 Location and History

AOC 8, Area South of Site 7, is located along the York River, northeast of the intersection of Chase and Lynch Roads (Figure 2-2) on a flat, sparsely vegetated depression, with a berm along the northern perimeter. AOC 8 was previously thought to be the location of Site 7, Old DuPont Disposal Area, and was investigated as Site 7 in 1999 (Baker, 2001b). However, the investigation determined that the waste found was more recent than the World War I era, and thus, could not be Penniman/DuPont-related. This area was re-designated as "AOC 8" when subsequent site visits and test trenching work identified a location approximately 500 ft north of AOC 8 as the real Site 7 (Baker, 2004).

Gravel and ballast rock can be seen on the ground surface at AOC 8. To the east of the flat area, the land drops off slightly, and in a very small area along the perimeter, buried debris (pipe, metal, and wood) can be seen outcropping from the edge of the slope. The nature of the debris indicates that the disposal occurred more recently than the World War I era (Baker, 2001b).

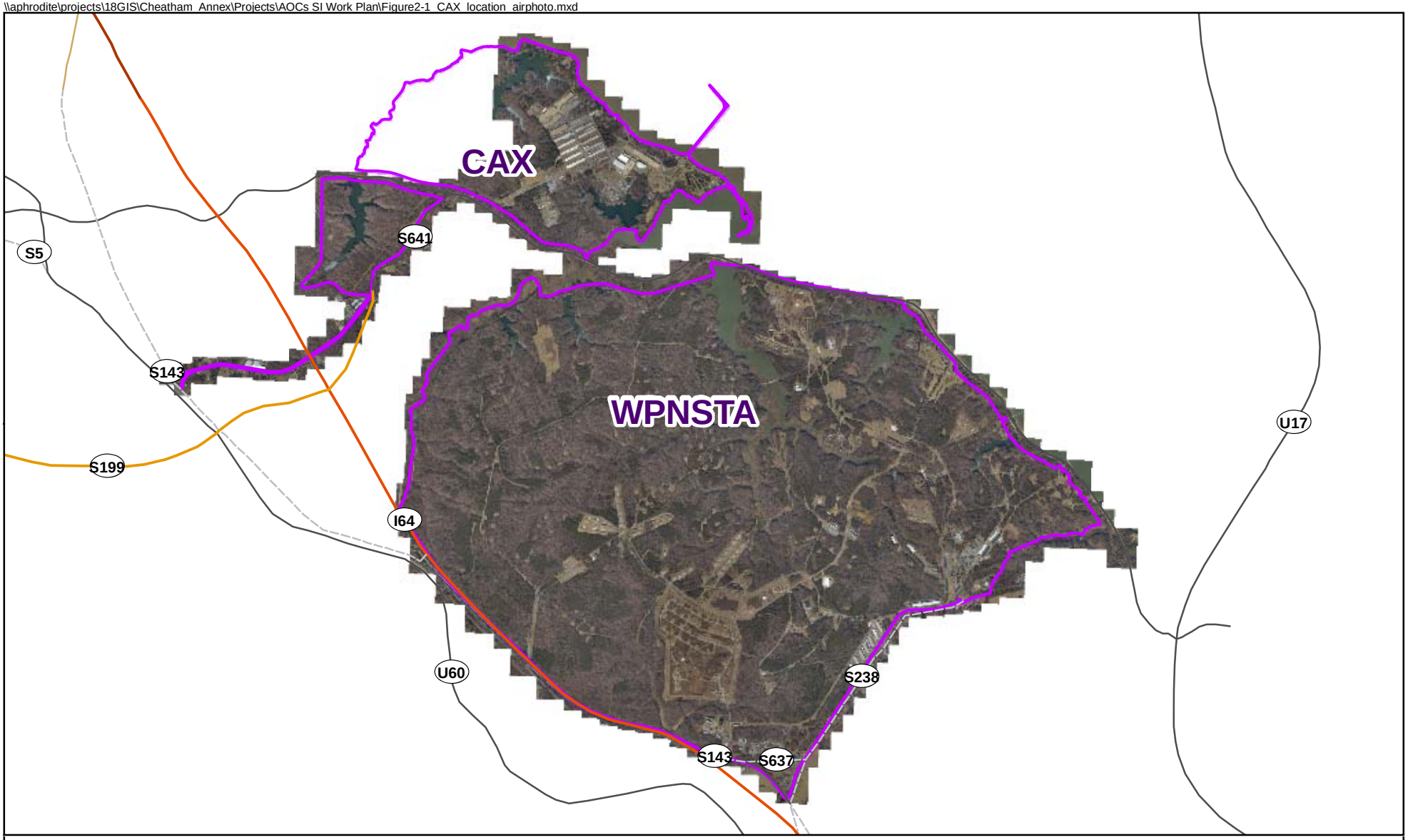
2.6.2 Previous Investigations at AOC 8

Final Field Investigation Report, Site 7 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site (Baker, 2001b)

A 1999 field investigation south of the recreational cabins included the excavation of ten test pits and collection of one sediment sample to define the lateral extent of buried debris at the site. The locations of these test pits and sediment sample (7-SD01) are shown in Figure 2-12. The debris found within the test pits (e.g., Styrofoam, a candy wrapper with a UPC bar code) indicated disposal was more recent than World War I era, suggesting this disposal area is not related to the Penniman facility which ceased operations shortly after World War I (Baker, 2001b). One piece of spent ordnance, a 75 millimeter (mm) salute round, was unearthed.

A sediment sample collected in a low-lying area east of the buried debris contained no VOCs, nitramines/nitroaromatics, or pesticides. Di-n-butylphthalate was detected at a concentration below the RBC for residential soil. Aroclor-1260 (540 L µg/kg) and arsenic (5.9 mg/kg) were detected at concentrations exceeding the residential soil RBC. The analytical data from this report are included in Table 4-4 in Appendix C. During this investigation, the lateral extent of debris at AOC 8 was not defined, the chemical characteristics of the debris were not determined, and additional investigation was recommended.

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure2-1_CAX_location_airphoto.mxd



Legend

Activity Boundaries

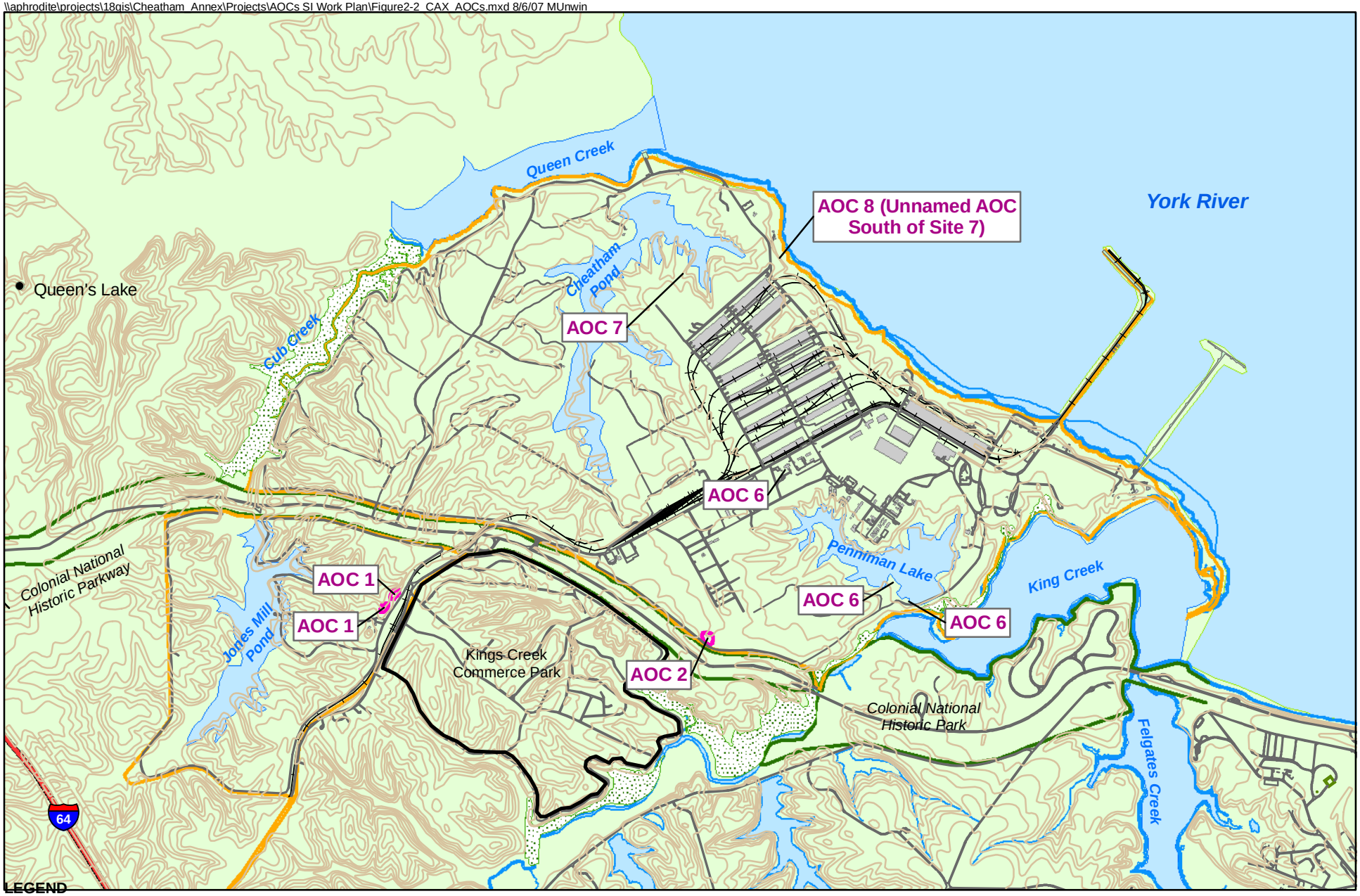
N
W E
S

0 0.6 1.2
Miles

Figure 2-1
Cheatham Annex (CAX) Location Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\projects\18gis\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure2-2_CAX_AOCs.mxd 8/6/07 MUnwin



LEGEND

- wmbg_cntr_sp
- Cheatham Annex Base Boundary
- Buildings and Structures
- Areas of Concern
- Mooring Facilities
- Wetlands
- Colonial National Historic Park Boundary
- Road Line
- Railroad
- Shoreline and Water Bodies
- Interstate 64

N

0 1,500 3,000 Feet

Figure 2-2
CAX Areas of Concern (AOCs) Location Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs_SI_Workplan\Figure2-3_AOC1.mxd

LEGEND

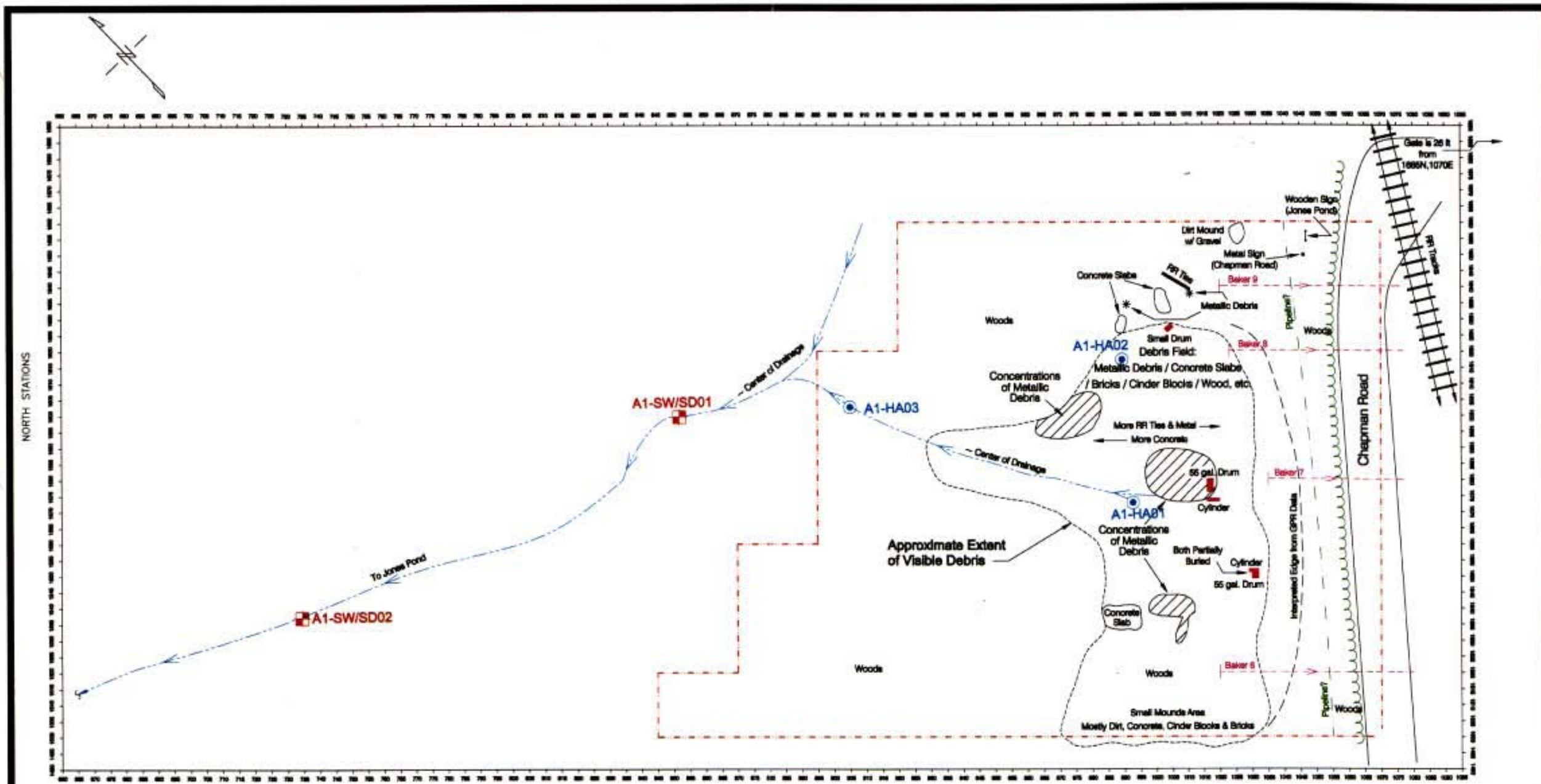
Approximate AOC 1 Study Area Boundary

N
W E
S

0 150 300
Feet

Figure 2-3
AOC 1 - Scrap Metal Dump Site Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL



NOTE: NO SUBSURFACE SOIL SAMPLE COLLECTED AT A1-HA01 DUE TO OBSTRUCTION

30 0 15 30
1 inch = 30 ft.

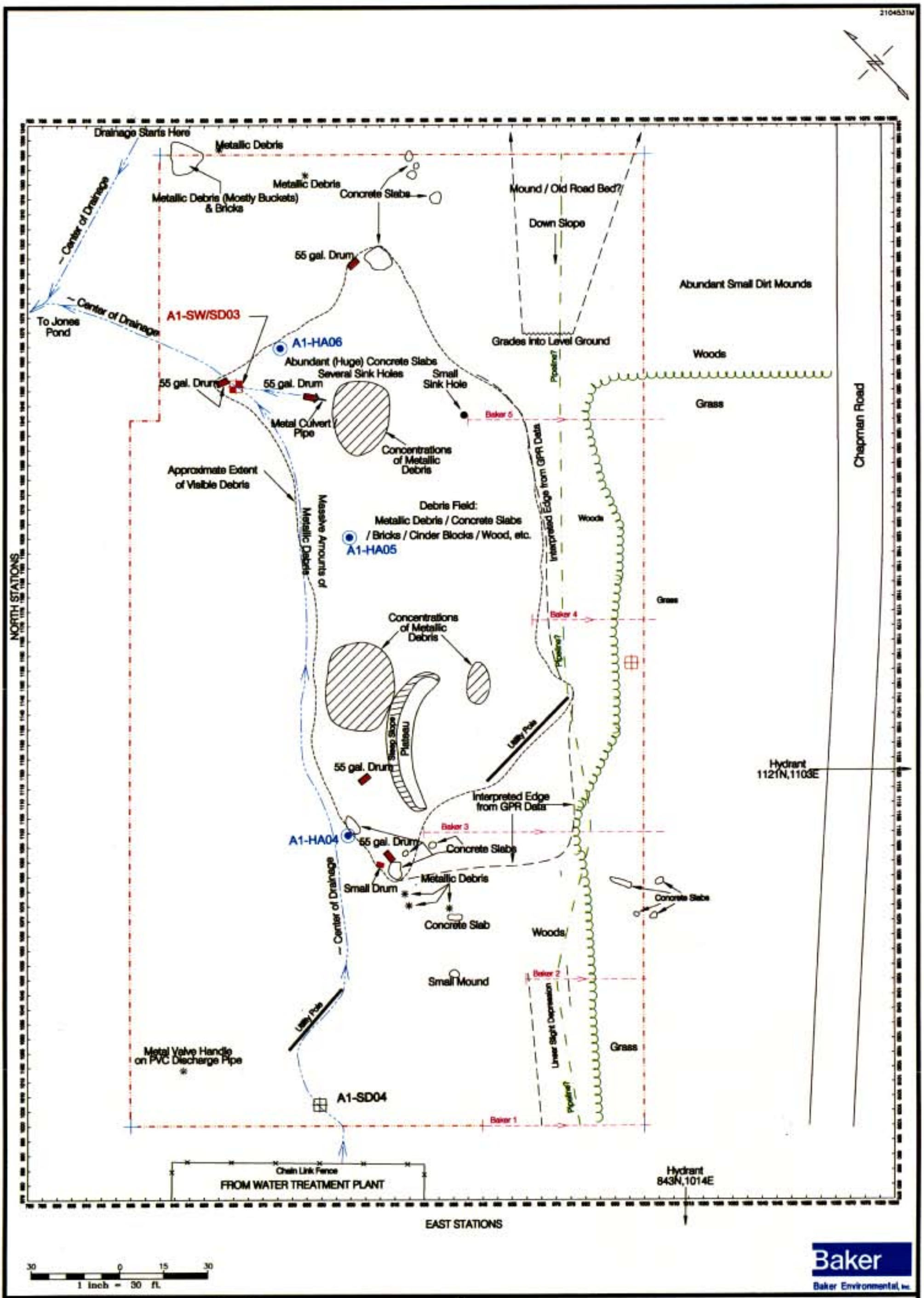
21D4529M

Baker
Baker Environmental, Inc.

LEGEND
- AREA OF GEOPHYSICAL INVESTIGATION
- GPR PROFILE
- HAND AUGER BORING LOCATION
- SURFACE WATER/ SEDIMENT SAMPLE LOCATION
- TREE LINE

SOURCE: NAEVA GEOPHYSICS,INC.,11/99

FIGURE 2-4
1999 INVESTIGATION LOCATION PLAN
AOC 1 (NORTH AREA)
NAVAL WEAPONS STATION YORTOWN
YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE



LEGEND

- AREA OF GEOPHYSICAL INVESTIGATION
- GPR PROFILE
- TREE LINE
- HAND AUGER BORING LOCATION
- SEDIMENT SAMPLE LOCATION
- SURFACE WATER/ SEDIMENT SAMPLE LOCATION

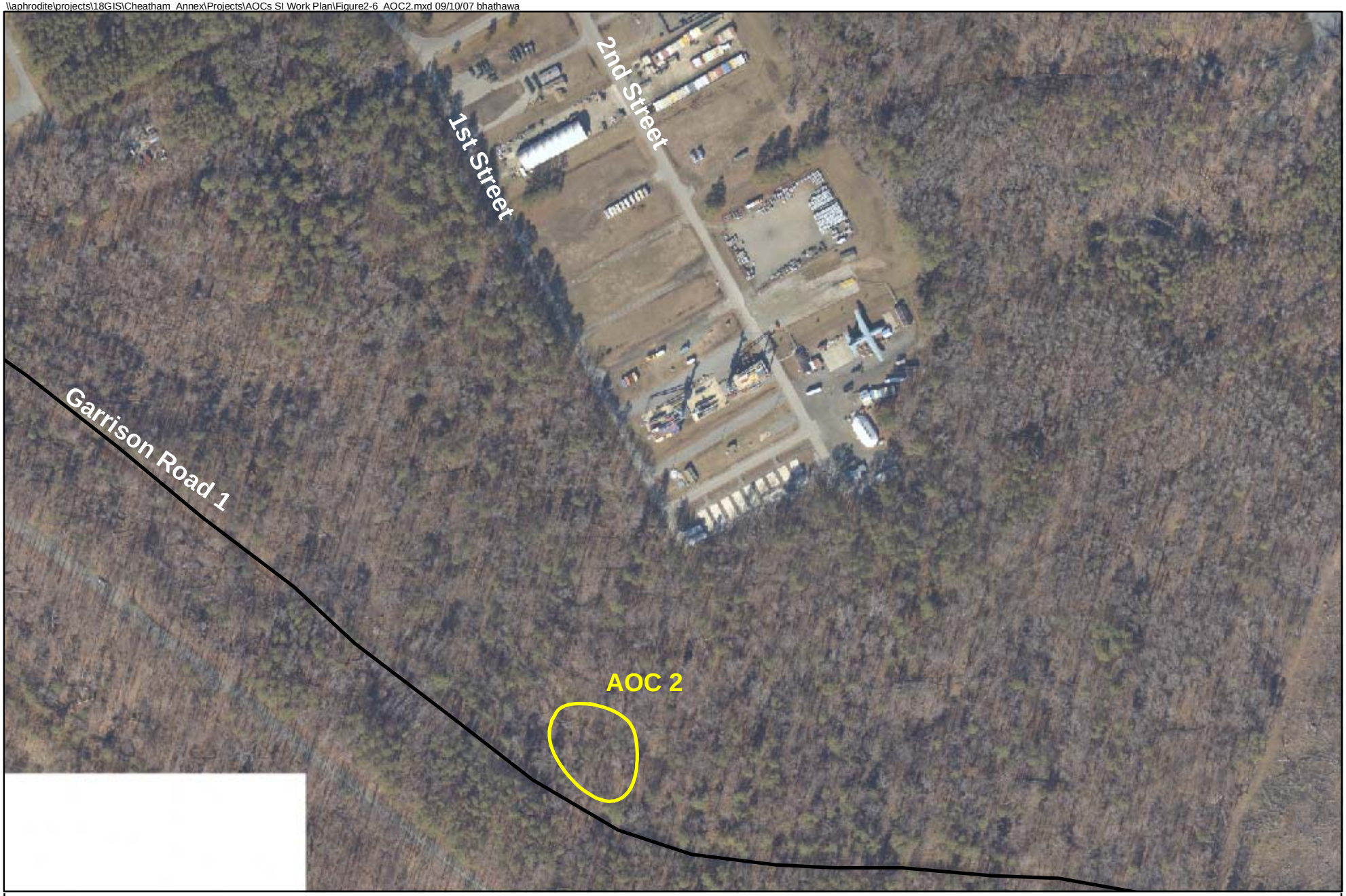
SOURCE: NAEVA GEOPHYSICS,INC.,11/99

FIGURE 2-5

1999 INVESTIGATION LOCATION PLAN -AOC 1 (SOUTH AREA)

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN VIRGINIA
CHEATHAM ANNEX SITE

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure2-6_AOC2.mxd 09/10/07 bhathawa



LEGEND

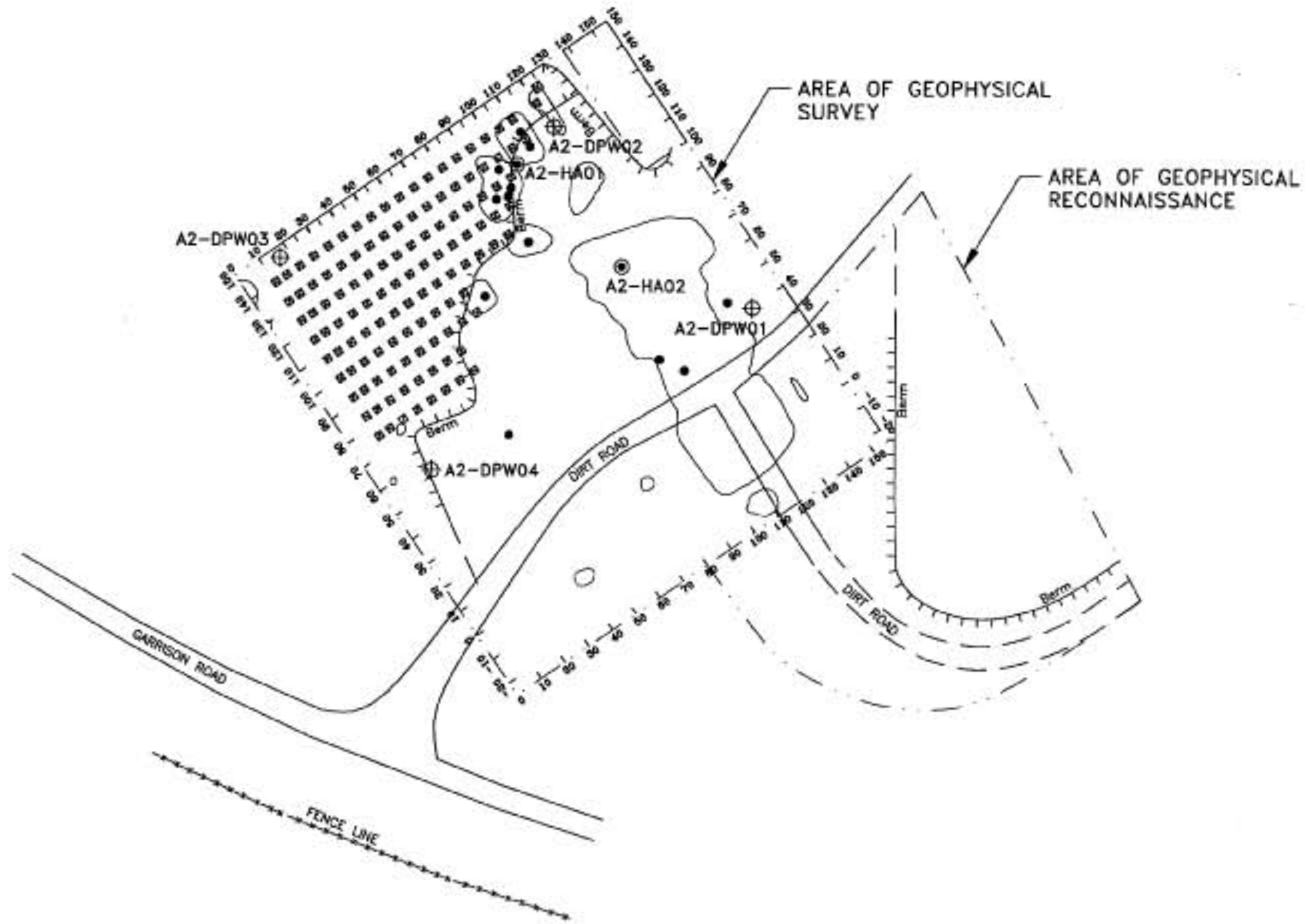
- Approximate AOC 2 Study Area Boundary
- CAX Boundary / Fenceline

N
W E
S

0 150 300
Feet

Figure 2-6
AOC 2 - Dextrose Dump Site Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL



NOTES:

1.) LOCATIONS FOR FENCE LINE, GARRISON ROAD, DIRT ACCESS ROAD LEADING TO SITE, AND TEMPORARY MONITORING WELLS SURVEYED BY PATTON, HARRIS, RUST AND ASSOCIATES. OCTOBER 1998.

2.) LOCATIONS FOR SURFACE/SHALLOW SUBSURFACE SOIL SAMPLE LOCATIONS SURVEYED BY BAKER VIA GPS. OCTOBER 1998.

3.) REMAINING FEATURES FIELD MAPPED BY NAEVA GEOPHYSICS, INC. OCTOBER 1998.

50 0 25 50
1 inch = 50 ft.

Baker
Baker Environmental, Inc.

LEGEND

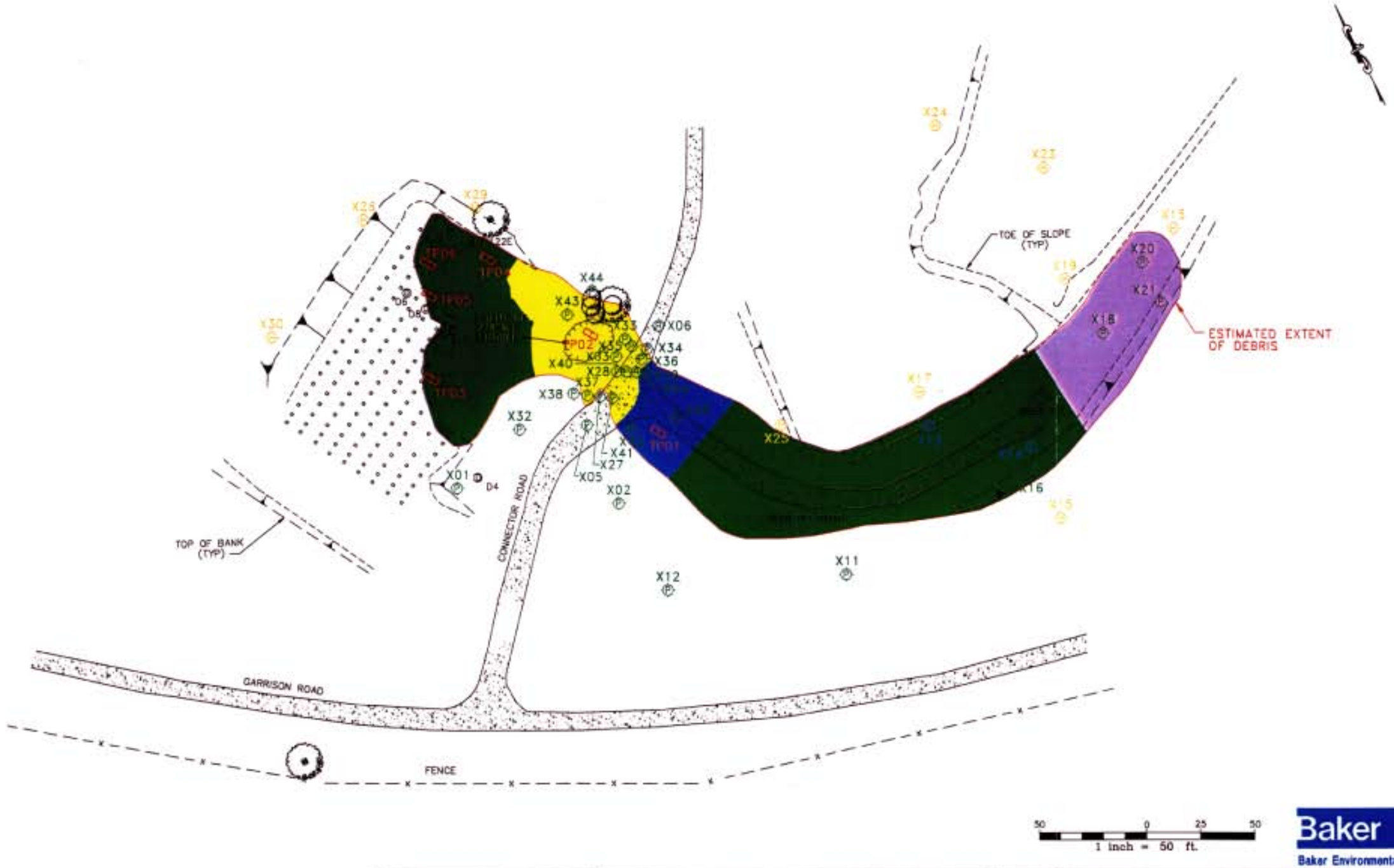
- EXPOSED 55 GALLON DRUM
- CONCRETE PIER
- AREAS OF SIGNIFICANT EM-61 ANOMALIES
- TEMPORARY WELL
- SURFACE SOIL AND SHALLOW SUBSURFACE SOIL SAMPLE LOCATION

SOURCE: PHR & A, 1998.

FIGURE 2-7
1998 INVESTIGATION LOCATION PLAN
AOC 2 – DEXTROSE DUMP

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

01217IB5Z



Baker
Baker Environmental, Inc.

LEGEND

- TEST PITS IN AREA CONTAINED DEXTROSE BOTTLES
- TEST PITS IN AREA CONTAINED RESPIRATOR CARTRIDGES. DRUMS ALSO PRESENT IN SOME LOCATIONS
- TEST PITS IN AREA CONTAINED DRUMS
- TEST PITS IN AREA CONTAINED MILITARY CLOTHING
- TP01 FIELD INVESTIGATION TEST PIT (NOVEMBER 1999)
- EXPLORATORY TEST PIT (JAN./FEB. 2000)
- EXPLORATORY TEST HOLE (JANUARY 2000)
- EXPOSURE OBSERVATION POINT (JANUARY 2000)

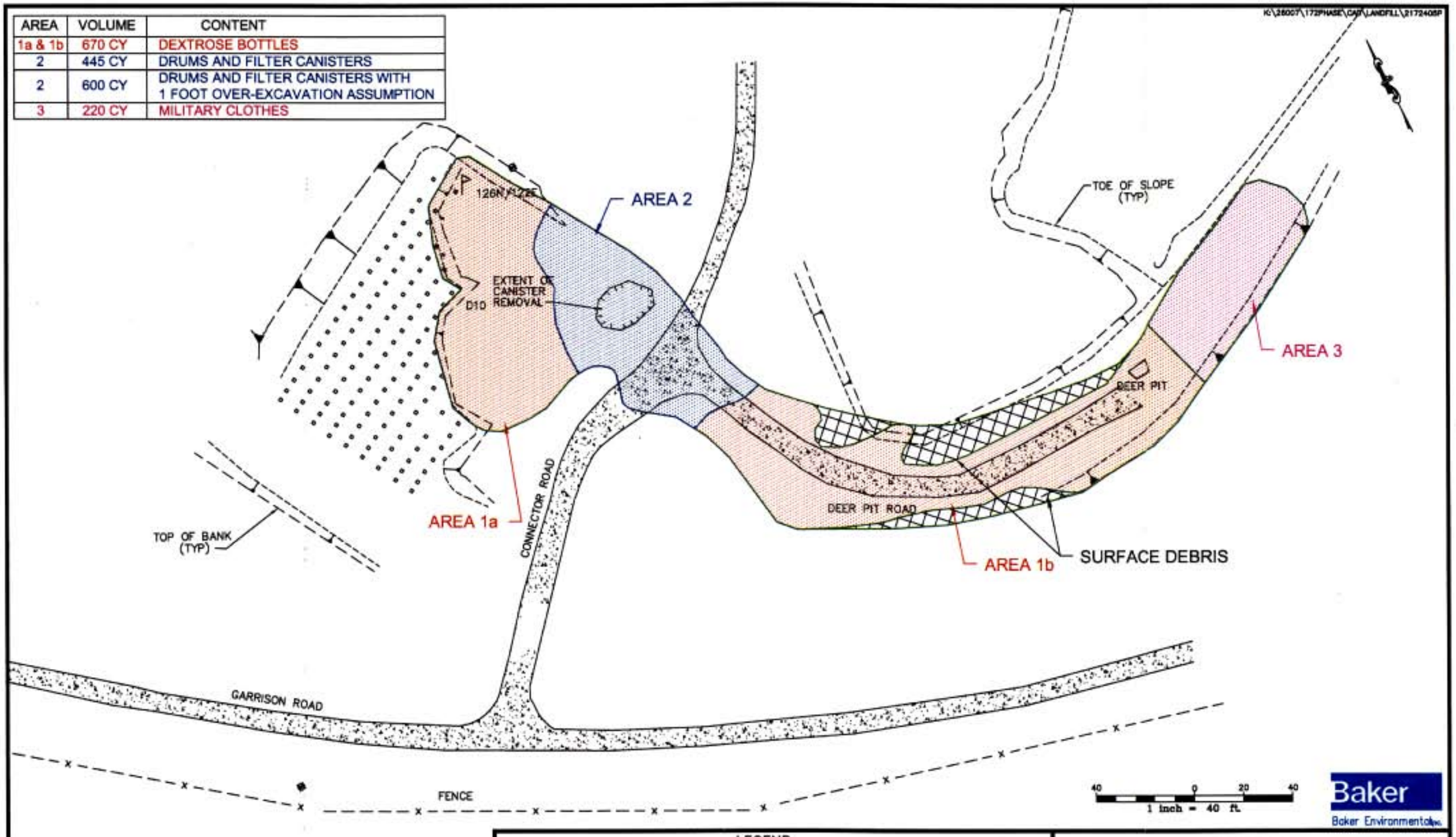
SOURCE: PATTON, HARRIS, RUST AND ASSOCIATES, MARCH 2000.

FIGURE 2-8

EXTENT OF DEBRIS MAP – AOC 2

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

AREA	VOLUME	CONTENT
1a & 1b	670 CY	DEXTROSE BOTTLES
2	445 CY	DRUMS AND FILTER CANISTERS
2	600 CY	DRUMS AND FILTER CANISTERS WITH 1 FOOT OVER-EXCAVATION ASSUMPTION
3	220 CY	MILITARY CLOTHES



LEGEND

- TOP OF BANK
- TOE OF SLOPE
- SLOPE INDICATOR
- CONCRETE PIERS
- GRAVEL ROAD

NOTE: COORDINATES ARE BASED ON THE VIRGINIA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NAD83, US SURVEY FOOT. ELEVATIONS SHOWN ARE BASED ON NAVD 88.

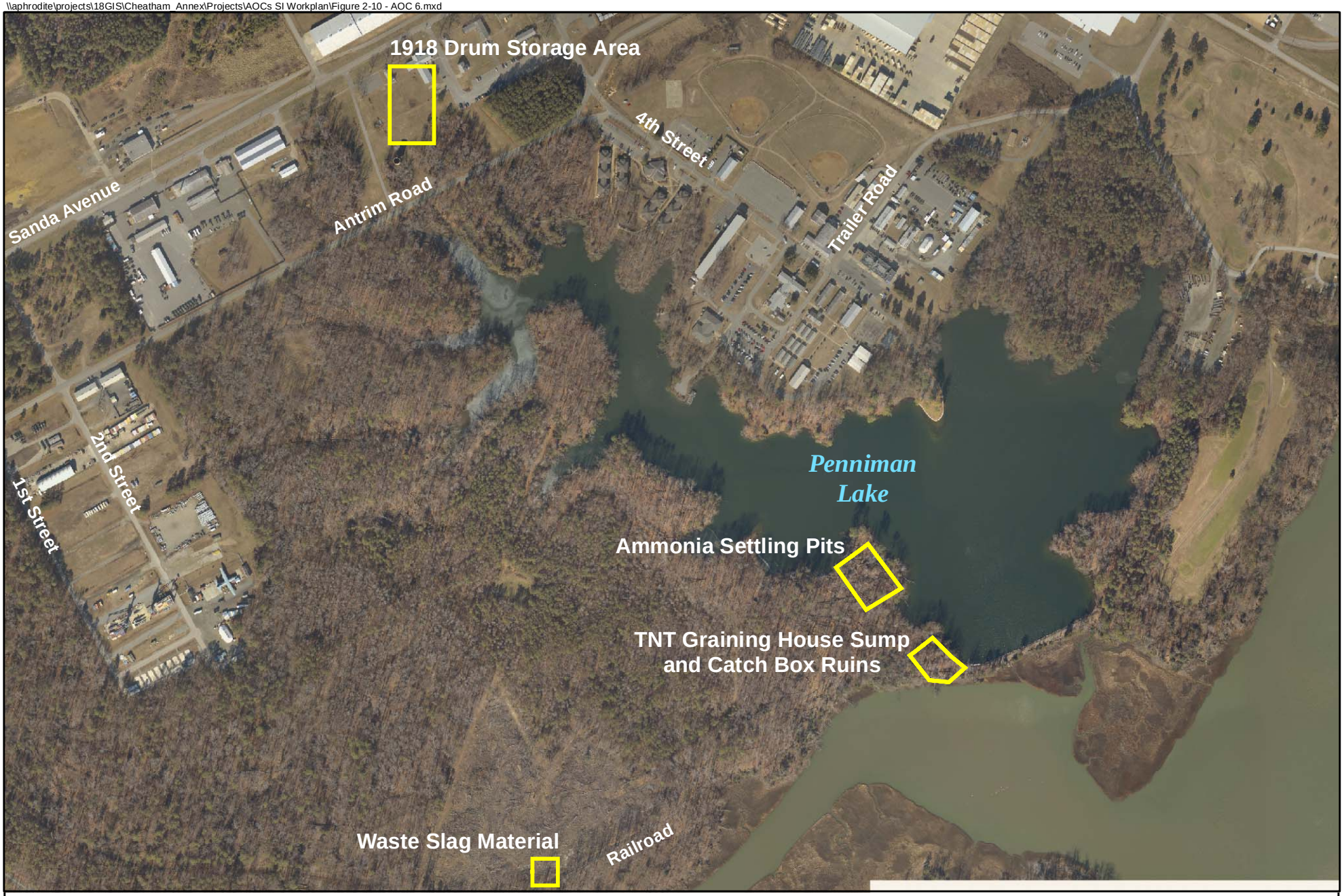
SOURCE: PATTON, HARRIS, RUST AND ASSOCIATES, MARCH 2000.

FIGURE 2-9

ESTIMATED DEBRIS/WASTE VOLUMES
AOC 2

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs SI Workplan\Figure 2-10 - AOC 6.mxd



LEGEND

Approximate Study Area Boundary

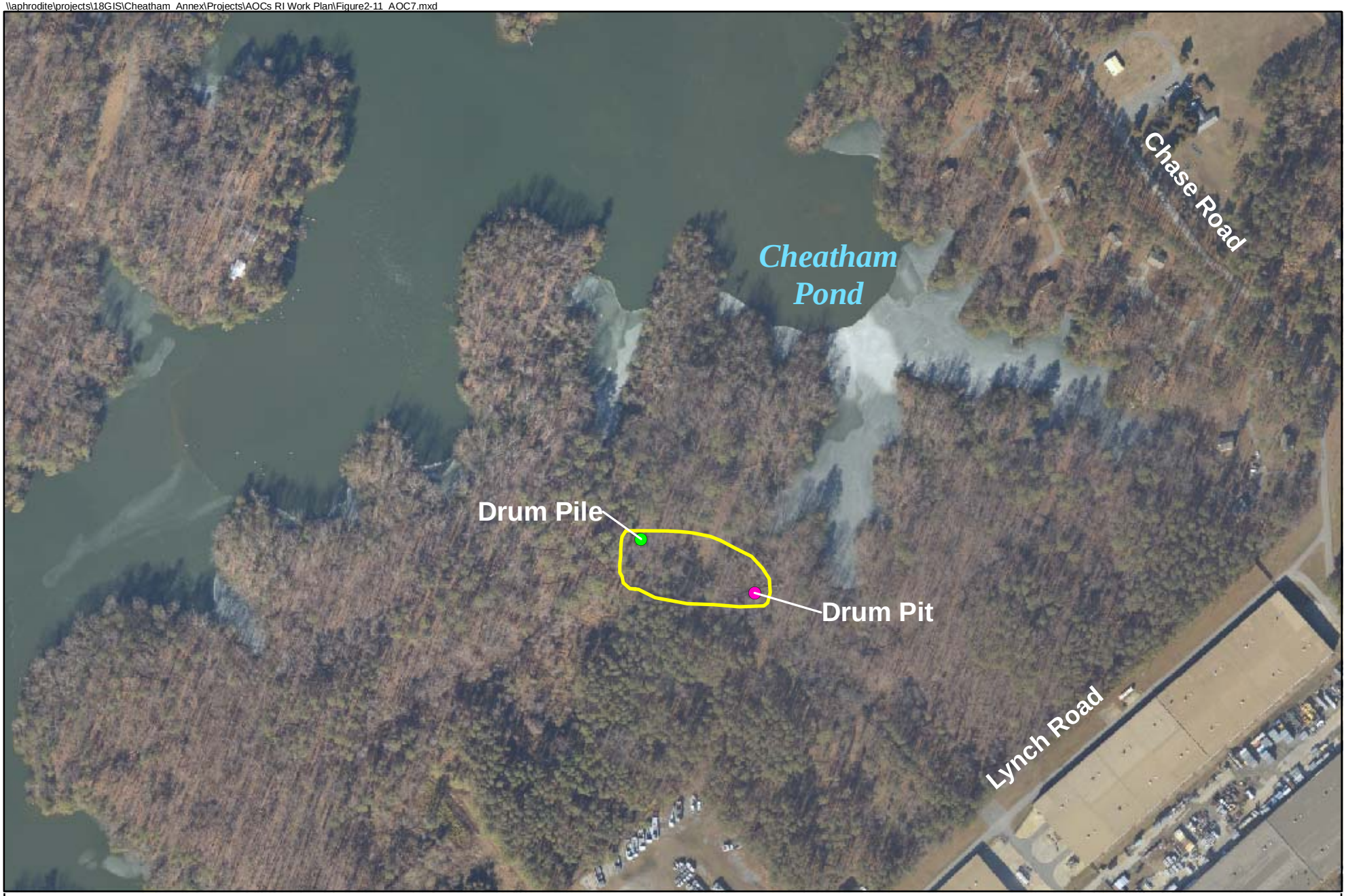
N
W E
S

0 200 400 600
Feet

Figure 2-10
AOC 6 - Penniman AOC
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs RI Work Plan\Figure2-11_AOC7.mxd



LEGEND

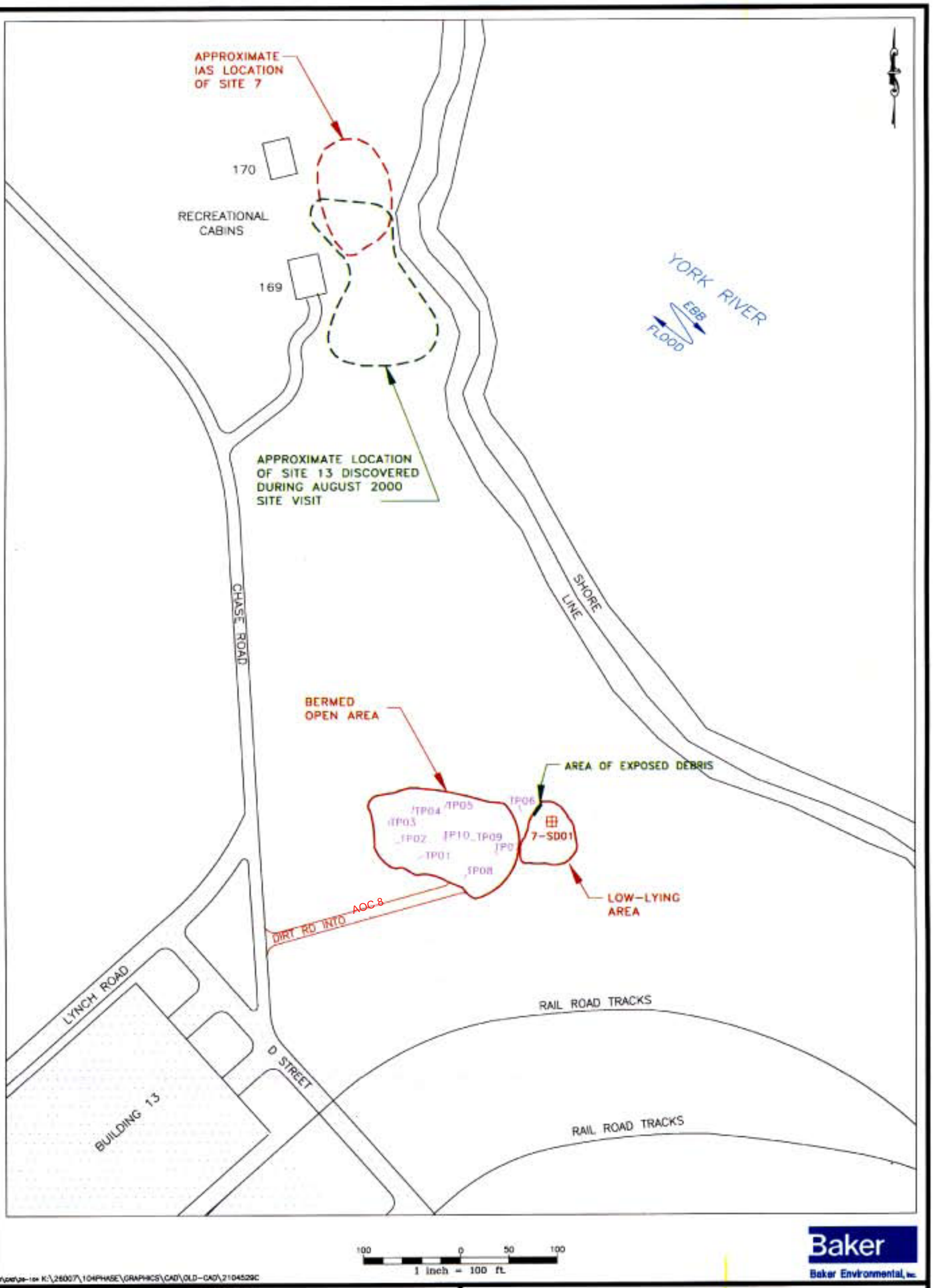
- Approximate Location of former Drum Pile
- Approximate Location of former Drum Pit
- Approximate AOC 7 Study Area Boundary

N
W E
S

0 150 300
Feet

Figure 2-11
AOC 7 - Drum and Can Disposal Area Site Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL



LEGEND

- TEST PIT LOCATION (APPROX.)
- SEDIMENT SAMPLE LOCATION (APPROX.)

SOURCE: NAVFAC DRAWING 4255912 "STORMWATER DRAINAGE DESIGNATION DRAWING-SECTOR 1"

FIGURE 2-12
1999 SAMPLE LOCATION PLAN
AOC 8

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SECTION 3

Field Investigation Work Plan

This section outlines the specific field investigation activities proposed for the SI of the CAX AOCs. All activities will be conducted in accordance with Navy CLEAN Standard Operating Procedures (SOPs), CH2M HILL SOPs, and the Master Plans (Baker, 2005a) unless stated otherwise in this project-specific WP.

The analytical results of the sampling conducted during the SI will be evaluated to determine if a release has occurred at any of the investigated AOCs and to assess whether further investigation is warranted to characterize environmental conditions at each AOC.

3.1 Investigation Objectives

The objective of the SI for the identified AOCs is to determine whether a release has occurred that has the potential to adversely affect human health or the environment. Project objectives will be accomplished through the collection of DPT surface/subsurface soil and groundwater samples at the AOCs, surface water and sediment sampling at AOC 6, and test pitting at AOC 7 and AOC 8, as necessary, to further characterize the AOC and:

- Determine if there have been any releases
- Eliminate from further consideration any AOCs that pose no unacceptable threat to human health or the environment
- Determine the need to quantify potential risk, as appropriate
- Determine the need for interim removal actions, as appropriate

The soil, groundwater, and sediment analytical results of the field investigation will be compared to accepted UTLs and risk-based screening criteria. Risk-based comparisons may include residential Regional Screening Levels (RSLs), Federal Maximum Contaminant Levels (MCLs), soil screening levels, and Biological Technical Assistance Group (BTAG) ecological criteria. Based on these comparisons and a discussion of potential contaminant migration pathways, potentially affected receptors, and site-specific conditions, conclusions and recommendations will be made regarding the sites investigated.

3.2 Proposed SI Activities

This section outlines the general sampling approach and proposed sampling locations.

3.2.1 General Sampling Approach

Mobilization/Demobilization

Following approval of the final WP, field preparation and mobilization activities will begin. Prior to mobilization, all field team members will review the appropriate master planning

documents (including the Master Field Sampling Plan [FSP] [Baker, 2005b] and the Master Quality Assurance Project Plan [QAPP] [Baker, 2005c]), along with the final WP, UFP-QAPP (Appendix B), and site-specific HASP. A field team kickoff meeting will be held to ensure that personnel are familiar with the scope of field activities and health and safety issues.

Mobilization activities include obtaining utility clearance for proposed sampling locations, coordination with base personnel and subcontractors, and preparation of field equipment. Demobilization activities will include reseeding any vegetation damaged by field vehicles, review of chains of custody to ensure that all analytical samples were collected as planned and submitted for the appropriate analysis, and packaging and shipment of rental equipment for return to the appropriate vendors. These activities will be conducted in accordance with the FSP referenced above.

MEC Awareness

Munitions and explosives of concern (MEC) are not expected to be encountered at these AOCs. However, given prior CAX use as a shell loading facility and the installation's presence within a historical Civil War battle trail, all personnel will complete 3R (recognize, retreat, report) training prior to the start of field efforts.

In the unlikely event that MEC or suspected MEC is discovered, field sampling will be suspended and the Fire Department will be notified. In addition, the Navy Remedial Project Manager (RPM) will also be notified. Emergency response will be from the WPNSTA Yorktown Detachment Explosive Ordnance Disposal (EOD) team to determine if the item is MEC and to provide identification and disposal. If the item is confirmed to be MEC, a Munitions Response Site (MRS) Identification and Notification Report will be forwarded to the Naval Ordnance Safety and Security Activity (NOSSA) in accordance with NOSSA INST 8020.15A.

Soil Sampling

Sample locations will be marked prior to sample collection using a handheld Global Positioning System (GPS) unit. Surface (0 to 6 inches bgs) and subsurface (6 to 24 inches bgs) samples will be collected using a stainless steel trowel or hand auger according to the procedures described in the SOP, *Soil Sampling,* included in the UFP-QAPP (Appendix B), or with DPT as described in the SOP, *Direct-Push Soil Sample Collection,* included in the UFP-QAPP (Appendix B), depending on the proposed sample location. A visual description of the soil will be logged and samples will be packed into laboratory prepared sample containers. The analyses specific to each AOC are described in Section 3.2.2. The complete soil analytical protocol has been summarized in Table 3-3. All of the analytical data generated during the field program will be validated by an independent data validation contractor in accordance with USEPA standard procedures.

DPT Groundwater Sampling

DPT groundwater locations will be marked prior to sample collection using a handheld GPS unit. Soils will be logged until groundwater is encountered using either split-spoons or acetate sleeves. The DPT will be advanced to collect discrete groundwater samples. DPT groundwater samples will be collected from AOCs in accordance with the SOP, *Direct-Push Groundwater Sample Collection,* included in the UFP-QAPP (Appendix B). Due to the wooded

conditions, uneven terrain, and difficult vehicle access issues at several of the AOCs, it is anticipated that a hydraulic DPT mounted on a small all-terrain tractor or four-wheel-drive vehicle will be used. DPT groundwater samples will be collected with a retractable steel screen advanced to a specified depth and with the low-flow purging technique using a peristaltic pump. In the source areas, the sample collection depth will be determined based on the depth of the first observed presence of groundwater. In upgradient and downgradient areas, the sample depth interval will be approximately 0 to 2 ft below the water table. Groundwater parameter data comprising pH, oxidation reduction potential (ORP), temperature, specific conductance, turbidity, and dissolved oxygen (DO) will be collected in the field using a field water quality meter (e.g., Horiba U-22). A groundwater sample will be attempted within approximately 5 minutes of low-flow purging, regardless of the observed turbidity. Groundwater collected from the DPT is considered to be representative of groundwater in that sample interval and should not need significant purging.

Surface Water and Sediment Sampling

Sediment and surface water samples will be collected at AOC 6 at locations described in Sections 3.2.2.2. Surface water and sediment samples will be collected beginning downstream and working to upstream locations. At any co-located surface water and sediment sampling station, surface water samples will be collected prior to the collection of sediment samples. Surface water sample collection will be conducted in accordance with the SOP, *Surface Water Sampling,* included in the UFP-QAPP (Appendix B). Prior to sample collection, water quality data will be measured using a Horiba U-22 water quality meter (pH, conductivity, turbidity, DO, temperature, salinity, and ORP) and the York River tidal cycle for the date of sampling will be recorded.

To allow the field personnel to handle the sediment sampler with relative ease and preserve sample integrity, sediment sample collection will be conducted utilizing an Ekman grab sampler in accordance with *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* (USEPQ, 2001) and the SOP, *Sediment Sampling,* included in the UFP-QAPP (Appendix B). At each proposed sediment sample location, samples will be collected from 0 to 4 inches bgs and 4 to 8 inches bgs using an Ekman grab sampler. A visual description of the sediment will be logged and samples will be transferred into laboratory prepared sample containers.

Test Pits

A visual inspection of site soil will be conducted to determine the most likely location of any potential release (based on presence of waste or possible staining of ground surface). Test pits will be excavated in these areas with a backhoe until native soil is reached in accordance with the SOP, *Trenching for Landfill Delineation,* included in the UFP-QAPP (Appendix B). If waste is encountered during test pit excavation, the waste will be returned to the test pit, and available clean overburden will be placed over the waste. If the encountered waste poses a threat of release, then the field team will consult with the project team on proper disposal. If native soil is not encountered within a depth of 10 ft bgs, then the field team will consult with the project team regarding a path forward for excavation. The soil type and presence/absence of waste will be logged for each test pit. All test pits will be backfilled with the excavated material. Grab soil samples will be collected from within the backhoe bucket or from the bottom of the excavated area via hand auger. No minimum number of

samples has been determined, as sample collection is dependent on field conditions which include whether waste is encountered, and the ability to sample beneath such waste.

Quality Assurance/Quality Control and Sample Handling

Quality Assurance/Quality Control. Quality assurance/quality control (QA/QC) requirements for environmental sampling, handling, and management are detailed in Appendix B and in the Master Plans (Baker, 2005a). Field QC samples (consisting of trip blanks, field blanks, equipment blanks, duplicate samples, and matrix spike [MS]/matrix spike duplicate [MSD] samples) will be collected during the investigation and submitted for laboratory analysis. Required QA/QC samples and the required frequency of collection are as follows:

Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect contamination in the decontamination water. A field blank is decontamination water collected directly in the sample bottle. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from each source of decontamination water for each sampling event, where a sampling event is defined as 1 week	All laboratory analyses requested for the environmental samples collected at the site for that week
Equipment Blank	Designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to the laboratory for analysis.	One each day of sampling	All laboratory analyses requested for environmental samples collected at the site on that day
Trip Blank	Designed to assess contamination introduced during shipping and field handling procedures. A trip blank is a clean sample of a matrix that is taken from the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Typically, a trip blank is analyzed only for volatile compounds.	One blank per cooler containing volatiles	Typically, a trip blank is analyzed only for volatile compounds.
Field Duplicate	Designed to check precision of data in the laboratory. A field duplicate is a sample collected in addition to the native sample at the same sampling location during the same sampling event.	10 percent: one every 10 samples	Same parameters as parent sample
MS/MSD	Designed to evaluate potential matrix interferences, accuracy, and precision. Three aliquots of a single sample—one native and two spiked with the same concentration of MS compounds—are analyzed.	5 percent: one every 20 samples	Same parameters as parent sample

Table 3-1 presents the required sample bottle, preservation, and holding time requirements for the proposed analyses. The anticipated number of field samples and their associated QA/QC samples for the proposed sampling are listed in Table 3-2.

Station Identification System. Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are Facility, AOC/Site/Operable Unit (OU) number, Location Type, Sequential Location Number, and possibly an additional qualifier. The naming scheme that will be used to identify a sampling location is documented in Table 3-3.

Sample Identification System. Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the Field Team Leader (FTL) will review the proposed level of effort and create a list of unique sample identification names, or sample IDs.

A standardized numbering system will be used to identify all samples collected during sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A list of the sample identification numbers will be maintained by the FTL, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the format described below.

Each normal and duplicate sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are Facility, AOC/Site/OU Number, Location Type, Sequential Location Number with possibly an additional qualifier, Depth (as applicable) and Date. Each field QC sample will also be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are Qualifier Code, Qualifier Number, and Date. Each unique set of sample attributes will be assigned a unique sample name. The naming scheme that will be used to identify a field sample is documented in Table 3-4.

This sample designation format will be followed throughout the field activities conducted at CAX. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample Packaging and Shipping. Samples will be tightly packed in a cooler with bubble wrap packaging material and ice as a preservative. The samples will be either picked up at the site by the analytical laboratory or shipped to the laboratory via overnight courier. The FTL will be responsible for completion of the following forms:

- Sample labels and chain-of-custody (COC) seals
- COC forms
- Appropriate labels and forms required for shipment

Custody of the samples will be maintained and documented at all times. COC will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory.

Surveying

CH2M HILL will survey to the nearest 1 meter, soil, groundwater, surface water, and sediment sampling locations, and any other relevant site markers for horizontal control using a portable GPS unit. The survey coordinates will be used to properly locate the sampling locations in a Geographic Information System (GIS).

Decontamination

Unless disposable, all equipment involved in field investigation activities will be decontaminated upon arrival at the site, between sampling locations, and at the conclusion of investigation activities. Stainless steel sample equipment will be decontaminated using the following protocol:

1. Rinse and scrub with potable water
2. Wash with distilled water and Liquinox™ solution
3. Rinse with potable water
4. Rinse with distilled or potable water and methanol solution
5. Air dry
6. Rinse with deionized water
7. Air dry and wrap exposed areas with aluminum foil for transport and handling if equipment will not be used immediately

Nitric acid solution will not be used in the decontamination processes due to potential health and safety concerns and because an acid solution can leach metals from metallic equipment. Details on procedures for decontamination can be found in the SOPs, *Decontamination of Personnel and Equipment,* and *Decontamination of Drilling Rigs and Equipment,* included in the UFP-QAPP (Appendix B).

Investigation-derived Waste Management

All investigation-derived waste (IDW) generated will be managed during the investigation in accordance with the Master Plans (Baker, 2005d). IDW is expected to consist of water from the decontamination of sampling equipment generated during sampling activities. Aqueous IDW will be containerized in 55-gallon drums, which will be temporarily stored at a location to be determined by NAVFAC. IDW drums will be labeled in accordance with Section 3.24 of the MPP. One sample will be collected for the purpose of IDW characterization, and will be analyzed for full toxicity characteristic leachate procedure (TCLP), ignitability, corrosivity, and reactivity analyses.

The IDW will be properly disposed of by subcontractors within 90-days of generation, based on the results of the waste characterization analyses. Disposable equipment, including personal protective equipment (PPE), will be decontaminated in accordance with Section 3.23 of the MPP and disposed of with normal facility trash. The IDW subcontractor has not been determined for this sampling event; however, once the subcontractor is identified, the Navy will be notified and the associated UFP-QAPP worksheet(s) in Appendix B will be updated.

3.2.2 Sampling Rationale

To identify whether a contaminant release has occurred, the rational for proposed sampling locations presented herein are based on the site conceptual models developed from site characteristics and data collected in previous investigations. Specifically, a review of available historical data was conducted to support the sampling rationale in this Work Plan. This included the comparison of limited historical data to current RSLs. Site Investigation field activities will include re-sampling of media at the AOCs to support the findings of the original sampling events and to assist in determining the nature and extent of previously identified contaminants. Final sampling locations will be determined in the field by the field team leader based on professional judgment to accommodate site-specific topographic and hydrologic conditions, with a bias toward locations with the greatest potential for contamination as well as thorough spatial coverage. A summary of the proposed sampling program is listed in Table 3-5.

AOC 1 (Scrap Metal Dump)

The source for potential contamination of site media (soil, groundwater, surface water, and sediment) is the debris (wood and metal) disposed of at the site. Elevated lead was reported in surface soil (501 mg/kg) and subsurface soil (1,100 mg/kg) in a sample from the southern area. Elevated arsenic (23.5 mg/kg) was detected in a soil sample in the northern area. With the exception of arsenic (7.4 mg/kg) in sediment, only low estimated levels of phthalates, ethylbenzene and xylene near reporting limits were detected in surface water and sediment. The conceptual site model (CSM) of potential contaminant transport consists of leaching from the debris to adjacent soils with infiltration to groundwater, and surface water runoff to topographic lows and drainage areas. Current potential receptors are industrial workers and ecological receptors.

Proposed sample locations are shown on Figures 3-1 and 3-2. Proposed sampling in the northern area consists of nine co-located surface and subsurface soil sample locations, with three locations coincident with DPT groundwater samples, for a total of 18 soil samples (nine surface and nine subsurface soil) and three groundwater samples. The six combined surface soil/subsurface soil samples are located at estimated areas of exposed surface debris, based on the *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown Virginia, Cheatham Site* (Baker, 2001a) as illustrated on Figure 2-4. The three DTP groundwater samples are located at areas representing upgradient, site specific, and downgradient groundwater conditions. Proposed sampling in the southern area consists of ten co-located surface and subsurface soil sample locations, with four locations coincident with DPT groundwater samples, for a total of 20 soil samples (ten surface and ten subsurface soil) and four groundwater samples. The six combined surface soil/subsurface soil samples are located at estimated areas of exposed surface debris, based on the *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown Virginia, Cheatham Site* (Baker, 2001a) as illustrated on Figure 2-5. The four DPT groundwater samples are located at areas representing upgradient, site specific, and downgradient groundwater conditions.

All samples will be submitted to an off-site laboratory for full suite analyses:

- TCL VOCs by Contract Laboratory Protocol (CLP) OLM04.3
- TCL SVOCs by CLP OLM04.3
- TAL total metals/cyanide by CLP ILM05.3 using inductively coupled plasma (ICP)-AES
- Dissolved metals by CLP ILM05.3 using ICP-AES (groundwater)
- TCL pesticides/PCBs by CLP OLM04.3
- Explosives plus PETN and 3,5-dinitroaniline by SW846 8330
- Nitroglycerin by SW846 8332
- Nitroguanadine by lab-supplied method (laboratory will submit SOP for approval by CH2M HILL)
- Total organic carbon (TOC) by Lloyd Kahn (soil)
- pH by SW846 9045C (soil)

AOC 6 (Penniman AOC)

The sources for potential contamination of site media (soil, groundwater, surface water, and sediment) at the four areas comprising AOC 6 are as follows:

- **Ammonia Settling Pits—**Wastewater from the ammonia finishing building
- **TNT Graining House Sump—**Wastewater from the TNT graining house
- **TNT Catch Box Ruins—**Particles separated from the wastewater from the TNT graining house
- **1918 Drum Storage Area—**Unidentified contents of drums formerly stored at this location

Waste source samples indicate the potential for metals and nitroaromatics (2,4,6-TNT) to be present in site media above human health screening criteria (Table 2-1), and also contained detections of VOCs (Ammonia Settling Pits and TNT Graining House Sump), SVOCs (TNT Graining House Sump, TNT Catch Box Ruins, and 1918 Drum Storage Area), and pesticides (Ammonia Settling Pits, TNT Graining House Sump, TNT Catch Box Ruins, and 1918 Drum Storage Area) (Table C-5 in Appendix C). Constituents previously detected in surface water sediment are presented in Tables C-6 and C-7 in Appendix C.

The conceptual site model of potential contaminant transport consists of leaching from the former waste sources to adjacent soils with infiltration to groundwater, and surface water runoff to topographic lows and drainage areas, and groundwater discharge. Current potential receptors are industrial workers, base personnel (in the vicinity of the 1918 Drum Storage Area), and terrestrial and aquatic ecological receptors.

Sampling will be conducted in each of the four areas of AOC 6 (Penniman AOC). The proposed sampling locations at the Ammonia Settling Pits, the TNT Graining House Sump,

TNT Catch Box Ruins and the 1918 Drum Storage Areas are depicted in Figures 3-3 and 3-4, and are described as follows:

Ammonia Settling Pits: Five co-located surface and subsurface soil sample locations, with three locations coincident with DPT groundwater samples, for a total of ten soil samples (five surface and five subsurface soil) and three groundwater samples (Figure 3-3). The five-co-located surface soil/subsurface soil samples are located in the former the ammonia finishing and ammonia evaporating pits, in the vicinity of the former ammonia settling pit, downgradient of the former ammonia settling pits, and outside the boundary of the ammonia settling pits. The three DPT groundwater samples are located at areas estimated to represent upgradient, site specific, and downgradient groundwater conditions.

TNT Graining House Sump and TNT Catch Box Ruins: The proposed sample locations within the TNT Graining House Sump and TNT Catch Box Ruins area are biased toward soil and groundwater locations that are estimated to have been directly affected by former TNT manufacturing discharges, as well as estimated downgradient locations.

TNT Graining House Sump
Soil samples will be collected from beneath the TNT Graining House Sump at two co-located surface and subsurface soil sample locations. An attempt will be made to obtain the soil samples by utilizing mechanical and manual excavation techniques to remove enough soil from the base of the foundation to allow for operation of a hand auger. The soil samples will then be collected from under the TNT Graining House Sump with a hand auger positioned as close to 90º to the vertical wall of the foundation and the center of the sump.

An attempt will be made to collect both surface and subsurface soil samples; however, this will depend on the ability to hand auger beneath the sump. If the groundwater table is encountered prior to reaching the base of the foundation, the two co-located surface and subsurface soil sample locations will be modified. The co-located soil sample locations will be placed adjacent to the northeast and southeast walls of the foundation and the subsurface soil sample will be collected from the depth interval directly above groundwater. An unexploded ordnance (UXO) Technician III will visually monitor excavations for the presence of discolored soil, crystals, etc that may indicate that TNT is present in high concentrations (10 percent or above). If visual observations indicate that TNT may be present in high concentrations, further boring at that location must be suspended until the suspect soil is analyzed. If the analysis reveals that TNT is present in concentrations of 10 percent or more, it is considered MEC and the procedures outlined in Section 3.2.1, *MEC Awareness,* will be implemented. Excavations will be in accordance with CH2M HILL HSE&Q SOP 307, *Excavation and Trenching Safety.*

The soil samples will be analyzed for explosives plus PETN and 3,5-dinitroaniline, nitroglycerine, and nitroguanadine on an expedited basis. If the concentrations of these constituents are below 10 percent, then a DPT groundwater sample will be collected adjacent to the sump to the southeast, for a maximum total of four soil samples (two surface and two subsurface soil) and one groundwater sample (Figure 3-3). If the concentrations of explosive constituents in soil are greater than 10 percent, DPT groundwater samples will not be collected since the soil would be considered a MEC and an explosive safety issue would exist for intrusive activities.

TNT Catch Box Ruins
Five co-located surface and subsurface soil samples will be collected from the TNT Catch Box Ruins and surrounding area. If the groundwater table is encountered prior to reaching the base of the catch box ruins, the co-located surface and subsurface soil sample location within the TNT catch box ruins will be modified. The co-located soil sample location will be placed adjacent to the sump to the northeast and the subsurface soil sample will be collected from the depth interval directly above groundwater. During sample collection, a UXO Technician III will visually monitor for the presence of discolored soil or crystals that may indicate that TNT is present in high concentrations (10 percent or above). If visual observations indicate that TNT may be present in high concentrations, further boring at that location must be suspended until the suspect soil is analyzed. If the analysis reveals that TNT is present in concentrations of 10 percent or more, it is considered MEC and the procedures outlined in Section 3.2.1, MEC Awareness, will be implemented.

These soil samples will be analyzed for explosives plus PETN and 3,5-dinitroaniline, nitroglycerine, and nitroguanadine on an expedited basis. If the concentrations of these constituents are below 10 percent, then a DPT groundwater sample will be collected at locations coincident with three of the five soil sample locations, for a total of 10 soil samples (five surface and five subsurface soil) and three groundwater samples (Figure 3-3). If the concentrations of explosive constituents in soil are greater than 10 percent, DPT groundwater samples will not be collected since the soil would be considered a MEC and an explosive safety issue would exist for intrusive activities.

1918 Drum Storage Area: Six co-located surface and subsurface soil samples will be collected from the area within and surrounding the drum and can disposal area, with three locations coincident with DPT groundwater samples, for a total of 12 soil samples (six surface and six subsurface soil) and three groundwater samples (Figure 3-4). While the boundary of the 1918 Drum Storage Area has been estimated based on historical photos, the specific drum storage location is unknown. As such, the proposed sampling locations are biased toward obtaining general representative samples from each corner of this area. The three DPT groundwater samples are located at areas estimated to represent upgradient, site specific, and downgradient groundwater conditions.

In addition to samples to be collected from the four areas above, sediment and surface water samples will be collected from Penniman Lake within the vicinity of AOC 6 (Figure 3-3). At two locations, co-located surface water and sediment (0-4 inches and 4-8 inches bgs) will be collected, for a total of 2 surface water and 4 sediment samples.

All samples will be submitted to an off-site laboratory for full suite analyses:

- TCL SVOCs by CLP OLM04.3
- TAL Total Metals/Cyanide by CLP ILM05.3 using ICP-AES
- Dissolved Metals by CLP ILM05.3 using ICP-AES (groundwater and surface water)
- Explosives plus PETN and 3,5-dinitroaniline by SW846 8330
- Nitroglycerin by SW846 8332
- TOC by Lloyd Kahn (soil and sediment)

- pH by SW846 9045C (soil and sediment)
- Nitroguanadine by lab-supplied method (laboratory will submit SOP for approval by CH2M HILL)
- Acid volatile sulfate/simultaneously extracted metals (AVS/SEM) (sediment)
- Grain size by ASTM D422 (sediment)
- Hardness (surface water)

AOC 7 (Drum and Can Disposal Area)

The source for potential contamination of site media (soil and groundwater) is the debris (drums and cans) disposed of at the site. To date, analytical data has not been collected at AOC 7. The conceptual site model of potential contaminant transport consists of leaching from the debris to adjacent soils with infiltration to groundwater, and surface water runoff to topographic lows and drainage areas. Current potential receptors are industrial workers and terrestrial ecological receptors.

Test pits will occur to delineate the horizontal extent of the debris. Test pits will be advanced until native soil is encountered or to an estimated depth of 10 ft. Should debris/ fill continue beyond the 10 ft depth, the field team will consult with the project team. One subsurface soil grab sample will be collected from the native soil at the bottom of three of the test pits, biased where the most significant debris is encountered. Once the horizontal extent of the debris is established, an additional test pit will be dug just outside the north, south, east, and west waste boundary, and one surface and subsurface soil sample will be collected. The number of tests pits will be determined in the field based on site conditions and the extent of debris.

Based on observed debris described during the March 2006 removal action conducted by Shaw at AOC 7, proposed sampling consists of four DPT groundwater samples and 14 soil samples (seven locations for co-located surface and subsurface soil.) Four of the soil sample locations will be coincident with DPT groundwater samples and three locations from test pits within the AOC 7 study area boundary. Proposed sample locations are shown on Figure 3-5; however, the exact number of test pits and which test pits will be sampled will be field determined. Additionally, since AOC 7 has not yet been investigated, and due to the lack of fixed markers and structures at this AOC, the exact proposed sampling locations will be determined by the field team leader in consultation with the project manager.

All samples will be submitted to an offsite laboratory for full suite analyses:

- TCL VOCs by CLP OLM04.3
- TCL SVOCs by CLP OLM04.3
- TAL Total Metals/Cyanide by CLP ILM05.3 using ICP-AES
- Dissolved Metals by CLP ILM05.3 using ICP-AES (groundwater)
- TCL Pesticides/PCBs by CLP OLM04.3
- Explosives plus PETN and 3,5-dinitroaniline by SW846 8330

- Nitroglycerin by SW846 8332
- Nitroguanadine by lab-supplied method (laboratory will submit SOP for approval by CH2M HILL)
- TOC by Lloyd Kahn (soil)
- pH by SW846 9045C (soil)

AOC 8 (Unnamed AOC South of Site 7)

The source for potential contamination of site media (soil, groundwater, surface water, and sediment) is the debris (pipe, metal, wood, and possible household debris [styrofoam and candy wrappers formerly observed]) disposed of at the site. In the one sediment sampled analyzed (7-SD01), one SVOC (di-n-butylphthalate, 69 J µg/kg) was detected. Additionally, elevated concentrations of aroclor-1260 (540 L µg/kg) and arsenic (5.9 mg/kg) exceeded the USEPA Region III RBC for residential soil. The conceptual site model of potential contaminant transport consists of leaching from the debris to adjacent soils with infiltration to groundwater, and surface water runoff to topographic lows and drainage areas. Current potential receptors are industrial workers and terrestrial and aquatic ecological receptors.

Test pits will occur to delineate the horizontal extent of the debris. Based on existing test pit data (Baker, 2001b), the vertical extent of debris is expected to be at 7 ft bgs or less. Test pits will be advanced until native soil is encountered or to an estimated depth of 10 ft. Should debris/fill continue beyond the 10 ft depth, the field team will consult with the project team. One subsurface soil grab sample will be collected from the native soil at the bottom of three of the test pits, biased where the most significant debris is encountered. Once the horizontal extent of the debris is established, an additional test pit will be dug just outside the north, south, east, and west waste boundary, and one surface and subsurface soil sample will be collected. The number of tests pits will be determined in the field based on site conditions and the extent of debris.

Proposed sampling at AOC 8 consists of four DPT groundwater samples and 18 soil samples (nine locations for co-located surface and subsurface soil). Four of the soil sample locations will be coincident with DPT groundwater samples, three locations from test pits within the waste boundary, and two locations from test pits at the waste boundary. Proposed sample locations are shown on Figure 3-6; however, the exact number of test pits and which test pits will be sampled will be field determined.

All samples will be submitted to an off-site laboratory for full suite analyses:

- TCL VOCs by CLP OLM04.3
- TCL SVOCs by CLP OLM04.3
- TAL Total Metals/Cyanide by CLP ILM05.3 using ICP-AES
- Dissolved Metals by CLP ILM05.3 using ICP-AES
- TCL Pesticides/PCBs by CLP OLM04.3
- Explosives plus PETN and 3,5-dinitroaniline by SW846 8330

- Nitroglycerin by SW846 8332
- Nitroguanadine by lab-supplied method (laboratory will submit SOP for approval by CH2M HILL)
- TOC by Lloyd Kahn (soil)
- pH by SW846 9045C (soil)

3.2.3 Health and Safety Plan

The Yorktown Master HASP will be utilized along with the project-specific HASP included in Appendix A.

3.2.4 Data

During the SI, three types of data will be generated: field, laboratory, and data validation. This subsection presents documentation and processing procedures for the data.

Field Data

The field team will document all field activities, including any visits to the site by regulatory personnel or their contractors, in a bound field logbook. The logbook will also be used to document, explain, and justify all deviations from the approved WP and Master Plans (Baker, 2005d). Its pages will have water-resistant sizing and will be consecutively numbered. Waterproof ink, preferably black, will be used to record entries in the field logbook. Each page will be dated and signed by the individual making the entry. The field logbook should provide a summary of the field activities.

The sampling team will record in the field logbook sampling information, physical and geological information, and any field measurements taken during sampling. A copy of all field logbook entries and COC records will be made available upon request.

Laboratory Data

Upon their arrival at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.

Raw data will be entered by the analysts in bound laboratory notebooks. All calculations will be entered into designated laboratory notebooks with a sufficient amount of data to compute without reference to other documents. A tracking form will be used to show that at least 10 percent of all calculations have been checked by the analyst and the laboratory QA supervisor from the raw data to the final value stages prior to reporting the results of a group of samples. This tracking form, as well as all logs and calculations, will be made available for any QA audit conducted during the investigation.

Instrument calibration logs and internal QC procedures will be documented in accordance with the analytical method in use. All proposed analytical methods have been documented

in detail in the Master Plans and in Section 3.2.3. Documentation of these activities will be made available during QA audits.

The reporting requirements will be in accordance with the ICP 6010B analytical method for inorganics analysis, or other specified analytical method.

Copies of all the analytical data reports, including the QC data, will be maintained by CH2M HILL in the project files.

Data Validation

Following receipt from the contract laboratory and screening as described in Section 3.6.7, data will be sent to an independent data validation subcontractor for validation. Refer to attached UFP-QAPP (Appendix B) for details.

3.2.5 Evaluation and Reporting

Following receipt of the analytical data from the laboratory and data validator, naturally occurring and anthropogenic (metals, pesticides, PAHs, and phthalates) constituents will be compared to accepted background UTLs for soil (Soil Association Group 2 [AOC 2, AOC 6, AOC 7, and AOC 8] and Soil Association Group 3 [AOC 1], groundwater, and sediment. The background comparison will be used to determine the likelihood of a release relative to background, and may include population to population statistical comparisons (Wilcox Rank Sum or other appropriate statistical method) to support the release assessment. Groundwater and surface water/sediment data may also be evaluated with respect to concentrations upgradient and downgradient of the AOC source.

In summary, the SI data will be screened against the following criteria:

Soil

- Available CAX Background upper confidence limits (UCLs)
- Industrial Soil Regional Screening Levels
- Residential Soil Regional Screening Levels
- Ecological Floral and Fauna Screening criteria (surface soil only)

Sediment

- Available CAX Background UCLs
- Industrial Soil Regional Screening Levels adjusted by 10
- Residential Soil Regional Screening Levels adjusted by 10
- Ecological Floral and Fauna Screening Criteria (surface soil only)

Groundwater

- Available CAX Background UCLs
- Tap Water Regional Screening Levels adjusted (metals only)
- Federal MCLs (metals and VOCs only)

Surface Water

- Available CAX Background UCLs
- Tap Water Regional Screening Levels Adjusted by 10 for groundwater

- Ecological Freshwater Screening Criteria
- Federal MCLs (metals only)

Human health evaluation of lead exposure risk is based on blood-lead uptake using a physiologically based pharmakokinetic model referred to as the IEUBK model. The lead soil-screening level of 400 mg/kg is typically used to screen soil. In the event of a lead concentration in excess of 400 mg/kg at a site, the IEUBK model is used to determine if the concentrations are adequately protective of human health. Concentrations of less than 400 mg/kg in soil are considered adequately protective of human health under residential land-use conditions. Therefore, lead concentrations above background will be screened against 400 mg/kg for human health and 120 mg/kg for the ecological soil screening level, while other constituents will be screened against corresponding residential RSLs.

For naturally occurring and anthropogenic constituents that exceed background UTLs, results will be screened against the most conservative human health (residential) risk-based criteria and/or relevant medium-specific ecological screening values (Table 3-6). All other detected results will be compared to risk-based criteria to determine if a release has occurred that may pose unacceptable risk. If constituents do not exceed health-based and/or ecological screening criteria, then it will be concluded that the possible release does not represent an unacceptable risk to human health and/or the environment and no further action is warranted. If it is determined that a release has occurred that may pose potential unacceptable risk, the project management team will consulted for consideration of the following path forward options:

- Risk management
- Further SI sampling
- Remedial Investigation with quantitative risk assessments
- Engineering Evaluation/Cost Analysis (EE/CA)for interim removal action

TABLE 3-1
Analyses, Bottleware, Preservation, and Holding Time Requirements
Cheatham Annex Areas of Concern, Williamsburg, Virginia
Site Investigation Work Plan

Media	Analysis	Method	Container	Preservation / Storage	Holding Times
Groundwater	TCL VOCs	CLP OLM04.3	(3) 40 mL VOA Vial	<6°C, 1:1 HCL, pH <2	10 Days VTSR
Groundwater	TAL Metals, TAL Diss. Metals	CLP ILM05.3	500 mL Plastic	HNO3, pH <2	6 Months/28 Days (Hg)
Groundwater	Cyanide	CLP ILM05.3	250 mL Plastic	Naoh	14 Days
Groundwater	TCL SVOCs	CLP OLM04.3	(2)1000 mL Glass	<6°C	5 Days VSTR/40 Days
Groundwater	TCL Pesticides/ PCBs	CLP OLM04.3	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	5-days of VTSR / 40 - days analysis
Groundwater	Explosives	SW846 8330	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Groundwater	Nitroglycerin	SW846 8332	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Groundwater	Nitroguanadine	SW846 8330M	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Surface Water	TAL Metals/Cyanide, TAL Diss. Metals	CLP ILM05.3	500 mL Plastic	HNO3, pH <2	6 Months/28 Days (Hg
Surface Water	Explosives	SW846 8330	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Surface Water	Nitroglycerin	SW846 8332	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Surface Water	Nitroguanadine	SW846 8330M	1-L Amber Glass with Teflon-lined lid	Cool to 4 degree C	7-days ext/ 40-days analysis
Surface and Subsurface Soil	TCL VOCs	CLP OLM04.3	2 oz. Soil jar	<6°C	10 VSTR Days
Surface and Subsurface Soil	TAL Metals	CLP ILM05.3	2 oz. Soil jar	<6°C	6 Months/28 Days (Hg)
Surface and Subsurface Soil	Cyanide	CLP ILM05.3	2 oz. Soil jar	<6°C	14 Days
Surface and Subsurface Soil	Total Organic Carbon	Lloyd Kahn	2 oz. Soil jar	<6°C	14 Days
Surface and Subsurface Soil	pH	SW846 9045C	2 oz. Soil jar	<6°C	7 Days

TABLE 3-1
Analyses, Bottleware, Preservation, and Holding Time Requirements
Cheatham Annex Areas of Concern, Williamsburg, Virginia
Site Investigation Work Plan

Media	Analysis	Method	Container	Preservation / Storage	Holding Times
Surface and Subsurface Soil	TCL SVOCs	CLP OLM04.3	4 oz. Soil jar	<6°C	10 Days VSTR/40 Days
Surface and Subsurface Soil	TCL Pesticides/ PCBs	CLP OLM04.3	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	10-days of VTSR / 40 - days analysis
Surface and Subsurface Soil	Explosives	SW846 8330	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis
Surface and Subsurface Soil	Nitroglycerin	SW846 8332	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis
Surface and Subsurface Soil	Nitroguanadine	SW846 8330M	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis
Sediment	TAL Metals	CLP ILM05.3	2 oz. Soil jar	<6°C	6 Months
Sediment	Cyanide	CLP ILM05.3	2 oz. Soil jar	<6°C	14 Days
Sediment	AVS/SEM	EPA 821-R-91-100	2 oz. Soil jar	(4 ± 2) ° C, dark	14 Days
Sediment	Total Organic Carbon	Lloyd Kahn	2 oz. Soil jar	<6°C	14 Days
Sediment	pH	SW846 9045C	2 oz. Soil jar	<6°C	7 Days
Sediment	Grain Size	ASTM D422	500 g - 1 16oz jar or zip-lock bag	None	None
Sediment	Explosives	SW846 8330	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis
Sediment	Nitroglycerin	SW846 8332	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis
Sediment	Nitroguanadine	SW846 8330M	8-oz Glass with Teflon-lined lid	Cool to 4 degree C	14-days ext/ 40-days analysis

Notes
TCL = Target compound list
TAL = Target analyte list
HCL = Hydrochloric acid
HNO_3 = nitric acid
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds
PCBs = Polychlorinated biphenyls

TABLE 3-2
Sample Collection Frequencies
Cheatham Annex Areas of Concern, Williamsburg, Virginia
Site Investigation Work Plan

	Laboratory Analysis[1]											
	TCL Volatile Organic Compounds (CLP OLM04.3)	**TCL Semi-Volatile Organic Compounds (CLP OLM04.3)**	**TAL Total Metals/Cyanide (CLP ILM05.3 using ICP-AES)**	**TAL Dissolved Metals (CLP ILM05.3 using ICP-AES)**	**TOC (Lloyd Kahn)**	**pH (SW846 9045C)**	**Hardness**	**TCL Pesticides/PCBs (CLP OLM04.3)**	**Acid Volatile Sulfate/Simultaneously Extracted Metals (AVS/SEM)**	**Explosives plus PETN and 3,5-dinitroaniline (SW846 8330)**	**Nitroglycerin (SW846 8332)**	**Nitroguanadine (SW846 8330M)**
QA/QC Samples	GW Duplicates - 2 GW MS/MSD - 2 GW Field Blanks 4 GW Equipment Blanks - 4 Soil Duplicates - 7 Soil MS/MSD - 8 Soil Field Blanks - 4 Soil Equipment Blanks - 4 Trip Blanks - 3 (GW), 4 (Soil)	GW Duplicates - 2 GW MS/MSD - 2 GW Field Blanks - 4 GW Equipment Blanks - 4 Soil Duplicates - 7 Soil MS/MSD - 8 Soil Field Blanks - 4 Soil Equipment Blanks - 4	GW Duplicates - 3 GW MS/MSD - 4 GW Field Blanks - 4 GW Equipment Blanks - 4 SW Duplicates - 1 SW MS/MSD - 2 SW Field Blanks - 1 SW Equipment Blanks - 1 Soil Duplicates - 9 Soil MS/MSD - 10 Soil Field Blanks - 4 Soil Equipment Blanks - 4 Sed Duplicates - 1 Sed MS/MSD - 2 Sed Field Blanks - 1 Sed Equipment Blanks - 1	GW Duplicates - 3 GW MS/MSD - 4 GW Field Blanks 4 GW Equipment Blanks - 4 SW Duplicates - 1 SW MS/MSD - 2 SW Field Blanks - 1 SW Equipment Blanks - 1	Soil Duplicates - 9 Soil MS/MSD - 10 Sed Duplicates - 1 Sed MS/MSD - 2	Soil Duplicates - 9 Soil MS/MSD - 10 Sed Duplicates - 1 Sed MS/MSD - 2	SW Duplicates - 1 SW MS/MSD - 2	GW Duplicates - 2 GW MS/MSD - 2 GW Field Blanks - 4 GW Equipment Blanks - 4 Soil Duplicates - 6 Soil MS/MSD - 6 Soil Field Blanks - 4 Soil Equipment Blanks - 4	Sed Duplicates - 1 Sed MS/MSD - 2 Sed Field Blanks - 1 Sed Equipment Blanks - 1	GW Duplicates - 3 GW MS/MSD - 4 GW Field Blanks 4 GW Equipment Blanks - 4 SW Duplicates - 1 SW MS/MSD - 2 SW Field Blanks - 1 SW Equipment Blanks - 1 Soil Duplicates - 9 Soil MS/MSD - 10 Soil Field Blanks - 4 Soil Equipment Blanks - 4 Sed Duplicates - 1 Sed MS/MSD - 2 Sed Field Blanks 1 Sed Equipment Blanks - 1	GW Duplicates - 3 GW MS/MSD - 4 GW Field Blanks - 4 GW Equipment Blanks - 4 SW Duplicates - 1 SW MS/MSD - 2 SW Field Blanks - 1 SW Equipment Blanks - 1 Soil Duplicates - 9 Soil MS/MSD - 10 Soil Field Blanks 4 Soil Equipment Blanks - 4	GW Duplicates - 3 GW MS/MSD - 4 GW Field Blanks - 4 GW Equipment Blanks - 4 SW Duplicates - 1 SW MS/MSD - 2 SW Field Blanks - 1 SW Equipment Blanks - 1 Soil Duplicates - 9 Soil MS/MSD - 10 Soil Field Blanks - 4 Soil Equipment Blanks - 4

Notes and Abbreviations:
[1]Number of samples to be analyzed is listed by each QA/QC sample type
TCL = Target Compound List
TAL = Target Analyte List
MS/MSD = Matrix Spike and Matrix Spike Duplicate pair
Field duplicates are collected at the rate of 1 for every 10 environmental samples
Equipment rinsate blanks are typically collected at the rate of 1 per day per media
Field blanks are typically collected at the rate of 1 per week during sampling
MS/MSDs are collected at the rate of 1 for every 20 samples

TABLE 3-3
Station Identification Scheme
Cheatham Annex, Williamsburg, Virginia

First Segment	Second Segment	
Facility, AOC Number	**Station/Sample Type**	**Station Number, Modifier**
AA,ANN	**AA**	**NNN_A**

Notes: "A"= alphabetic "N"= numeric

Facility:

CA = Cheatham Annex

Site/AOC/SWMU Number – Sequential Number:

AOC = A01, A02, A03…

BSxx = Background locations outside of site (BS25 = Background Site 25)

BKL = Background locations outside of the facility

BKG = Facility-wide background locations (inside base)

CHAX = Cheatham Annex QC Samples Only

Station/Sample Type:

DS	=	Direct Push—Soil
DW	=	Direct Push—Groundwater
SW	=	Surface Water
SD	=	Sediment Location
SO	=	Soil Location
SW	=	Surface Water
TP	=	Test Pit
IDW	=	Investigation Derived Waste
QC	=	QA/QC blanks only

Station Number:

Sequential Station Number (i.e., 001, 002, 003…)

Modifier (used selectively):

D = Deep monitoring well
S = Shallow monitoring well

Example Station IDs:

YS01-DS002 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1

CAA05-MW002S = Shallow monitoring well location 2, at Cheatham Annex, AOC 5.

YBKL-SD002 = Background sediment location #2 located outside of Yorktown Naval Weapons Station

YBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Yorktown Naval Weapons Station

YNWS-QC = QC sample collected at Yorktown Naval Weapons Station

***Note:* Location ID for any QA/QC blank samples (trip blanks, field blanks, equipment rinse blanks) will be Facility -QC and Facility–IDW for any IDW samples.

TABLE 3-4
Sample Identification Scheme
Cheatham Annex, Williamsburg, Virginia

First Segment	Second Segment	Third Segment	Fourth Segment
Station ID **Facility, AOC Number**	**Station/Sample Type, Station Number, Modifier**	**Depth** **(As Needed)**	**Date** **(MMYY)** $_A$
AA,ANN	**AANNN$_A$**	**A**	**NNNN$_A$**
Notes: "A"= alphabetic "N"= numeric			
Facility: CA = Cheatham Annex Site/AOC/SWMU – Sequential Number: AOC = A01, A02, A03… BSxx = Background locations outside of site (BS25 = Background Site 25) BKL = Background locations outside of the facility BKG = Facility-wide background locations (inside base) CHAX = Cheatham Annex QC Samples Only	Station/Sample Type: DS = Direct Push—Soil DW = Direct Push—Groundwater SW = Surface Water SB = Subsurface Soil SD = Sediment Location SO = Soil Location (Composite) SS = Surface Soil SW = Surface Water TP = Test Pit WS = Waste Char. – Soil WW = Waste Char. - Water Station Number: Sequential Location Number (e.g., 001, 002, 003) Modifier (used selectively): D = Deep monitoring well S = Shallow monitoring well P = Duplicate	Depth: Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C… Sample Number: 1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506 2. QC Samples (Blank Samples) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106 Qualifier Codes: TB = Trip Blank FB = Field Blank EB = Equipment Blank 3. Drill Rig Samples – Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507 4. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C… 5. Note – The sample ID for normal samples begins with the location ID (first and second segments).	

Example Sample IDs:

YS02-DS003-C-0805 = Direct push soil sample collected at location 3, in OU2 at the Yorktown Naval Weapons Station, from the third depth collected below ground surface (BGS) in August 2005.

YBKL-SS011-0403 = Surface soil collected at location # 11, at a background location outside of YNWS in April 2003.

CAA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at Cheatham Annex.

YW01-SW023P-0306 YNWS duplicate surface water sample collected at location 23 from SMWU-1 in March 2006.

YW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Yorktown Naval Weapons Station.

TABLE 3-5
Summary of Sampling Program
Cheatham Annex Areas of Concern, Williamsburg, Virginia
Site Investigation Work Plan

Sample Media	Sample Depth/Location and Rationale	Laboratory Analysis[1]												
		TCL Volatile Organic Compounds (CLP OLM04.3)	TCL Semi-Volatile Organic Compounds (CLP OLM04.3)	TAL Total Metals/Cyanide (CLP ILM05.3 using ICP-AES)	Dissolved Metals (CLP ILM05.3 using ICP-AES)	TOC (Lloyd Kahn)	pH (SW846 9045C)	Grain size (ASTM D422)	Hardness	Acid Volatile Sulfate/Simultaneously Extracted Metals (AVS/SEM)	TCL Pesticides/PCBs (CLP OLM04.3)	Explosives plus PETN and 3,5-dinitroaniline (SW846 8330)	Nitroglycerin (SW846 8332)	Nitroguanadine (SW846 8330M)
Surface Soil	Collected the first six inches (6") of soil from each location shown in Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6. Note: Surface soil sample locations at AOC 7 will be determined in the field. Will allow for characterization of surface soil across the site. Co-located with subsurface soil samples.	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9		AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9				AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9
Subsurface Soil	Collected from the six to twenty-four inch (6"-24") interval of soil from each location shown in Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6. Note: Subsurface soil sample locations at AOC 7 will be determined in the field. Will allow for characterization of surface soil across the site. Co-located with surface soil samples.	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9		AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9				AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9	AOC 1 (North) - 9 AOC 1 (South) - 10 AOC 6 - 18 AOC 7 - 7 AOC 8 - 9
Groundwater	Collected via DPT from each location shown in Figures 3-1, 3-2, 3-3, 3-4, 3-5, and 3-6. Note: Groundwater sample locations at AOC 7 will be determined in the field.	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4						AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4	AOC 1 (North) - 3 AOC 1 (South) - 4 AOC 6 - 10 AOC 7 - 4 AOC 8 - 4
Surface Water	Collected directly below the water surface at low tide under low flow conditions. The surface water sample location at AOC will be collected at the point of direct discharge to Penniman Lake, as determined in the field.		AOC 6 - 2	AOC 6 - 2	AOC 6 - 2				AOC 6 - 2			AOC 6 - 2	AOC 6 - 2	AOC 6 - 2
Sediment	Collected from 0-4" and 4-8" bgs, from downstream to upstream at low tide and under low flow conditions, from each location shown in Figure 3-3.		AOC 6 - 4	AOC 6 - 4		AOC 6 - 4	AOC 6 - 4	AOC 6 - 4		AOC 6 - 4		AOC 6 - 4	AOC 6 - 4	AOC 6 - 4

Notes and Abbreviations:
[1]Number of samples to be analyzed is listed by each designated AOC
AOC = Area of Concern
TCL = Target Compound List
TAL = Target Analyte List
TOC = Total organic carbon

TABLE 3-6
Summary of Screening Values[1]
Cheatham Annex Areas of Concern, Williamsburg, Virginia
Site Investigation Work Plan

Analytical Data	Screening Criteria									
	Available CAX Background Data[2]	**Industrial Soil Regional Screening Level[3]**	**Industrial Soil Regional Screening Level Adjusted x 10[3,4]**	**Residential Soil Regional Screening Level[3]**	**Residential Soil Regional Screening Level Adjusted x 10[3,4]**	**Tap Water Regional Screening Levels Adjusted x 0.1[3,4]**	**Tap Water Regional Screening Levels Adjusted x 10 for Groundwater[3,4]**	**Ecological - Fresh Water[5]**	**Ecological - Floral and Fauna[5]**	**Federal MCLs[6]**
Surface Soil	**X**	**X**		**X**					**X**	
Subsurface Soil	**X**	**X**		**X**						
Sediment	**X**		**X**		**X**				**X**	
Groundwater	**X**					**X (metals only)**				**X (metals and VOCs only)**
Surface Water	**X**						**X**	**X**		**X (metals only)**

Notes:
[1]Specific screening values are listed in Worksheet 15 of the UFP QAPP included in Appendix B
[2]Background data source will be determined by the Yorktown Partnering Team prior to data analysis.
[3]Regional Screening Level value for soil (beta version, 5/27/08)
[4]Values adjusted to account for multiple contaminants during Human Health Risk Assessment
[5]Ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values are based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils will be used if established. If not established, the Freshwater Sediment values will be applied. These values are the most current available as of January 2008.
[6]MCLs are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.
MCLs = Maximum Contaminant Levels

\\aphrodite\proj\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure 3-1 - AOC1 - Proposed SI Sample Locations.mxd 5/21/08 MUnwin

LEGEND

- Groundwater, Surface Soil, Subsurface Soil Sample Location
- Surface Soil and Subsurface Soil Sample Location
- Approximate AOC 1 Study Area
- Topographic surface contour (feet above mean sea level)

N
W E
S

0 50 100
Feet

Figure 3-1
Proposed SI Sample Locations, AOC 1 (North Area)
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\proj\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure 3-2 - AOC1 South - Proposed SI Sample Locations.mxd 10/7/08 MUnwin

LEGEND

- Groundwater, Surface Soil, Subsurface Soil Sample Location
- Surface Soil and Subsurface Soil Sample Location
- Approximate AOC 1 Study Area
- Topographic surface contour (feet above mean sea level)

N
W E
S

0 50 100
Feet

Figure 3-2
Proposed SI Sample Locations, AOC 1 (South Area)
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\proj\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure 3-3 - AOC 6 - Proposed SI Sample Locations.mxd 6/2/08 MUnwin

LEGEND

- Groundwater, Surface Soil, and Subsurface Soil Sample Location
- Groundwater Sample Location
- Surface Soil and Subsurface Soil Sample Location
- Sediment and Surface Water Sample Location
- Topographic surface contour (feet above mean sea level)
- Approximate AOC 6 Study Area
- Buildings

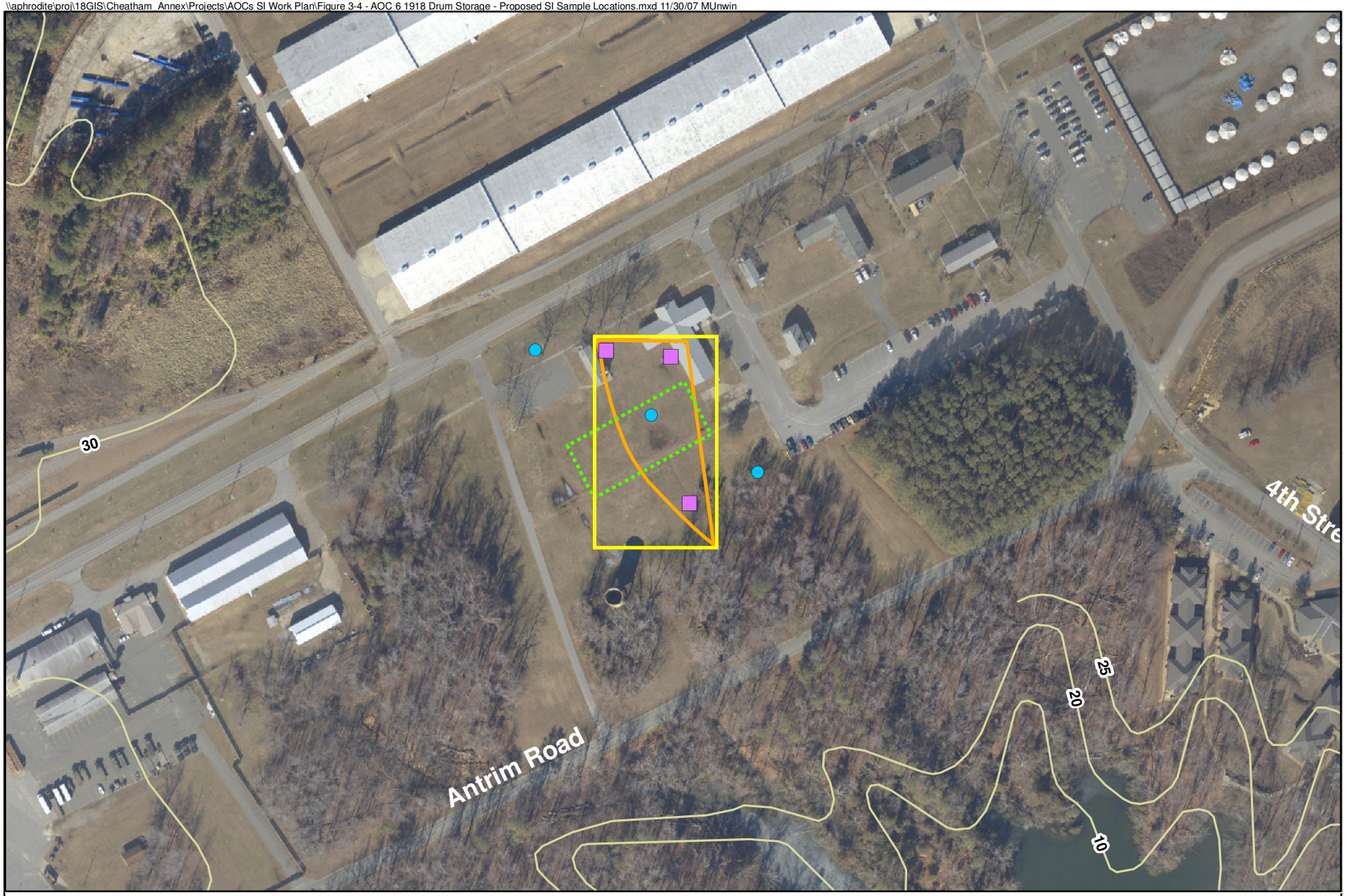
N W E S

0 75 150 Feet

Figure 3-3
Proposed SI Sample Locations, AOC 6, Ammonia Settling Pits and TNT Catch Box Ruins
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\proj\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure 3-4 - AOC 6 1918 Drum Storage - Proposed SI Sample Locations.mxd 11/30/07 MUnwin



LEGEND

- Groundwater, Surface Soil, and Subsurface Soil Sample Location
- Surface Soil, Subsurface Soil Sample Location
- Approximate Study Area Boundary
- Approximate Location of Paved Parking Lot (November 15, 2007)
- Approximate Extent of 1918 Drum Storage Area
- Topographic surface contour (feet above mean sea level)

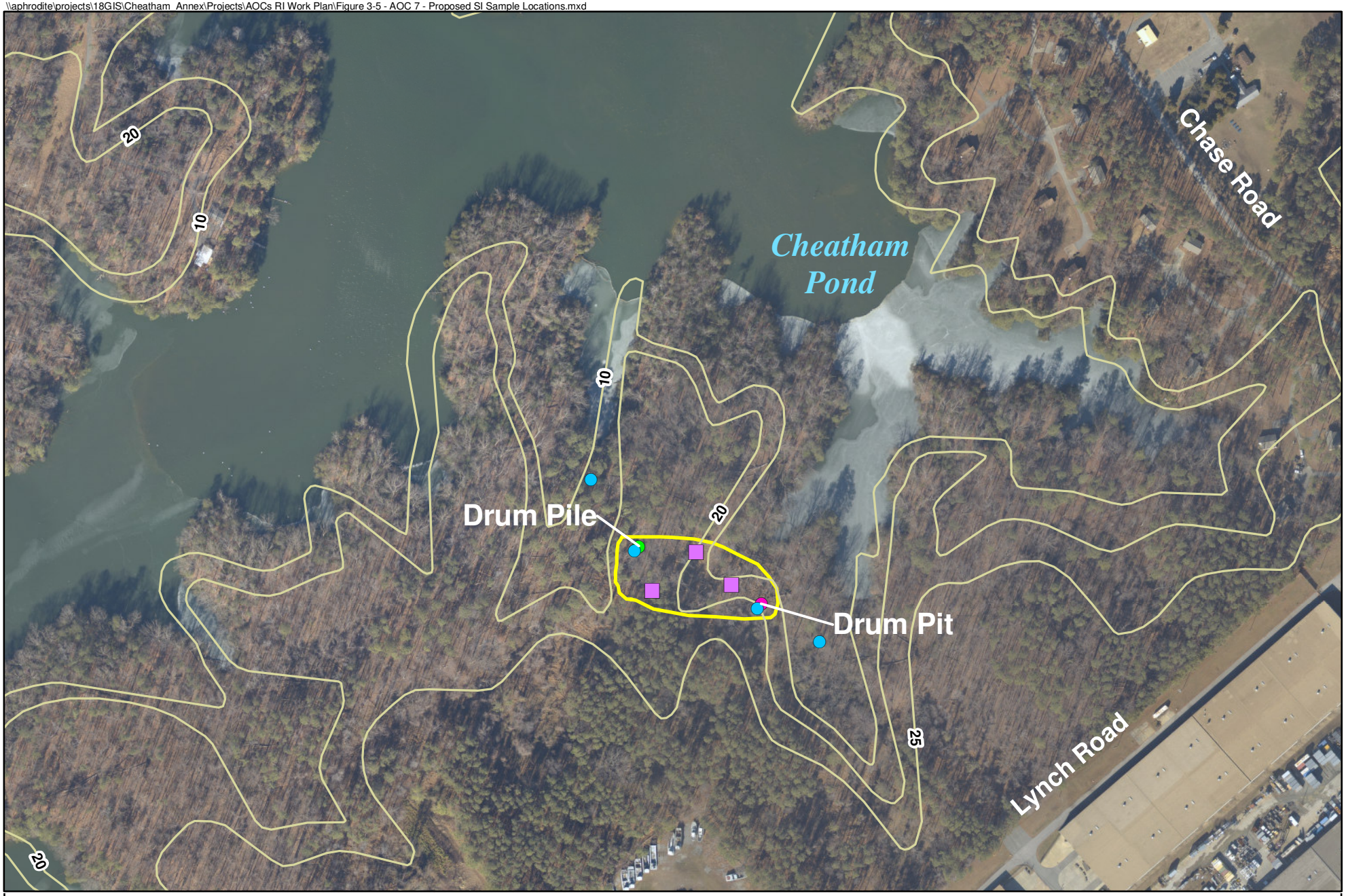
N
W E
S

0 100 200
Feet

Figure 3-4
Proposed SI Sample Locations, AOC 6, 1918 Drum Storage Area
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\projects\18GIS\Cheatham_Annex\Projects\AOCs RI Work Plan\Figure 3-5 - AOC 7 - Proposed SI Sample Locations.mxd



LEGEND

- Approximate Location of former Drum Pile
- Approximate Location of former Drum Pit
- Groundwater, Surface Soil, and Subsurface Soil Sample Location
- Surface Soil and Subsurface Soil Sample Location
- Topographic surface contour (feet above mean sea level)
- Approximate AOC 7 Study Area Boundary

N W E S

0 150 300 Feet

Figure 3-5
Proposed SI Sample Locations, AOC 7
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\aphrodite\proj\18GIS\Cheatham_Annex\Projects\AOCs SI Work Plan\Figure 3-6 - AOC 8 - Proposed SI Sample Locations.mxd 7/28/08 MUnwin

LEGEND

- Approximate AOC 8 Study Area
- Observed Surficial Boundary
- Groundwater, Surface Soil, and Subsurface Soil Sample Location
- Surface Soil and Subsurface Soil Sample Location
- Topographic surface contour (feet above mean sea level)

N
W E
S

0 50 100
Feet

Figure 3-6
Proposed SI Sample Locations, AOC 8
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

SECTION 4

Staffing, Reporting and Deliverables

4.1 Project Personnel, Organization, Reporting, and Schedule

4.1.1 Project Organization

The key organizations involved in this project are NAVFAC Mid-Atlantic, the USEPA, VDEQ, and CH2M HILL, Inc. Project execution will be conducted by CH2M HILL and its subcontractors.

CH2M HILL is the primary point of contact with NAVFAC MIDLANT. CH2M HILL will manage the overall project, providing day-to-day oversight and related program management support to execute the project successfully.

4.1.2 Project Personnel

The roles and responsibilities of the key personnel are discussed below.

- **Deputy Program Manager—**Doug Dronfield will provide program management support of this project and will ensure that all contract requirements are met during execution of this project.
- **Activity Manager—**Marlene Ivester will be responsible for the overall implementation of the project and will ensure that information is communicated to the Navy and project team. Ms. Ivester will communicate with the Navy RPM concerning the overall activity.
- **Project Manager—**Laura Lampshire will have overall CH2M HILL responsibility for technical support and oversight for day to day project execution, budget and schedule review and tracking, invoice review, personnel resources planning and allocation, and project coordination. Mrs. Lampshire will also coordinate field activities with project field personnel.
- **Corporate Munitions Response Safety Officer—**Dan Young, will oversee the implementation of the MEC awareness information to ensure that it meets all specific needs of the project and that appropriate health and safety requirements relative to MEC are defined.
- **Program Health and Safety Manager—**Steve Beck will support the implementation of the HASP (refer to Appendix A) to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are defined.

4.1.3 Community Involvement

The existing Community Involvement Plan (CIP) for the WPNSTA Yorktown and CAX is designed to present the community relations program for the Navy Environmental Restoration Program (ERP) at these facilities and to document the program activities to date (CH2M HILL, 2006). The purpose of the CIP is to provide techniques to ensure effective

communication among stakeholders involved in the ERP, including the NAVFAC Mid-LANT, WPNSTA Yorktown, the regulatory agencies, and the community.

As part of the CIP, the WPNSTA Yorktown/CAX Restoration Advisory Board (RAB) meets approximately twice per year, typically in May and November, to provide technical review and public comment. In addition to the RAB meetings, the Five-Year Review Report is available for the public to view. This report documents the evaluation of the effectiveness of remedies and remedial actions for sites with hazardous substances, pollutants, or contaminants remaining above levels that allow for Unlimited Use and Unrestricted Exposure (UUUE), and for which there is a Record of Decision (ROD) or Decision Document (DD) in place. All community relations activities and documents pertaining to CAX are documented in the Administrative Record and Information Repository. The Administrative Record is maintained by the NAVFAC Atlantic Librarian and Records Manager, who can be reached at (757) 322-4785 or Bonnie.Capito@navy.mil.

4.1.4 Project Schedule

The schedule for project implementation is provided as Table 4-1. This schedule may require revision as the project progresses.

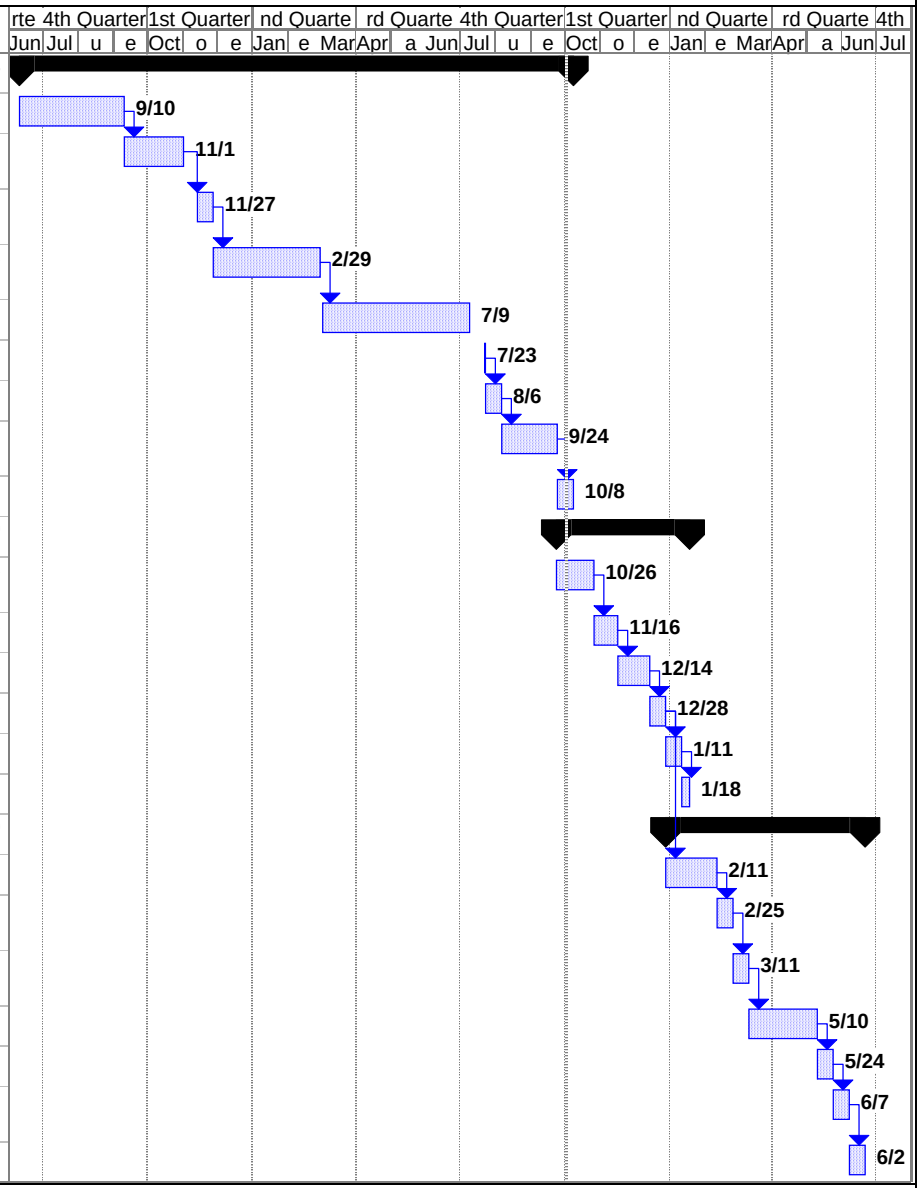
4.1.5 Reporting

A Supplemental SI Report for AOC 1 and a Draft SI report for the remaining AOCs will be prepared to document the findings of the site investigations. The report will summarize all field activities, evaluate the collected data, and identify if a release has occurred at any of the AOCs that pose potential unacceptable risk. The reports will present a conceptual site model based on the site features and analytical data, which will be included in tabular format. Release mechanisms, preliminary evaluation of fate and transport, and potential receptors will be identified.

Following Navy and regulatory review, Draft Final reports will be prepared incorporating review comments and submitted to the Navy and regulators for final acceptance. Any additional comments will be addressed and Final SI reports will be submitted.

Table 4-1
CAX AOCs 1, 6, 7, and 8 Site Investigations - Project Schedule

ID	CAX AOCs Site Investigation - CTO-174	Duration	Start	Finish
1	**Work Plan**	**486 days**	**Mon 6/11/07**	**Wed 10/8/08**
2	Preparation of Preliminary Work Plan	92 days	Mon 6/11/07	Mon 9/10/07
3	Preliminary Work Plan review by NAVFAC	52 days	Tue 9/11/07	Thu 11/1/07
4	Respond to NAVFAC Comments and Produce Draft Work Plan	14 days	Wed 11/14/07	Tue 11/27/07
5	Comment Resolution and QAPP revisons	94 days	Wed 11/28/07	Fri 2/29/08
6	Regulatory Review of Draft Work Plan	129 days	Mon 3/3/08	Wed 7/9/08
7	Comment Resolution	1 day	Wed 7/23/08	Wed 7/23/08
8	RTCs on Draft Work Plan	14 days	Thu 7/24/08	Wed 8/6/08
9	Regulatory Review of Draft Final Work Plan, QAPP and RTCs	49 days	Thu 8/7/08	Wed 9/24/08
10	Final Work Plan Production	14 days	Thu 9/25/08	Wed 10/8/08
11	**Field Investigation**	**117 days**	**Wed 9/24/08**	**Sun 1/18/09**
12	Field Work - Subcontractor procurement and field preparation	33 days	Wed 9/24/08	Sun 10/26/08
13	Field Work - test pits, media sampling	21 days	Mon 10/27/08	Sun 11/16/08
14	Laboratory Analyses	28 days	Mon 11/17/08	Sun 12/14/08
15	Analytical Data QC	14 days	Mon 12/15/08	Sun 12/28/08
16	Analytical Data Validation	14 days	Mon 12/29/08	Sun 1/11/09
17	Loading of Analytical Data into Endat	7 days	Mon 1/12/09	Sun 1/18/09
18	**SI Report**	**175 days**	**Mon 12/29/08**	**Sun 6/21/09**
19	Preparation of Preliminary SI Report	45 days	Mon 12/29/08	Wed 2/11/09
20	Preliminary SI Report review by NAVFAC	14 days	Thu 2/12/09	Wed 2/25/09
21	Respond to NAVFAC Comments and Product Draft SI Report	14 days	Thu 2/26/09	Wed 3/11/09
22	Regulatory Review of Draft SI Report	60 days	Thu 3/12/09	Sun 5/10/09
23	RTCs on Draft SI Report	14 days	Mon 5/11/09	Sun 5/24/09
24	Regulatory Review of Draft Final SI Report and RTCs	14 days	Mon 5/25/09	Sun 6/7/09
25	Final SI Report Production	14 days	Mon 6/8/09	Sun 6/21/09



Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

SECTION 5

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Appendix A
Project-Specific Health and Safety Plan

Project-Specific
Health and Safety Plan

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

Contract Task Order 174

October 2008

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Virginia Beach, Virginia

Project-Specific Health and Safety Plan

Introduction

This Project-Specific Health and Safety Plan (HASP) presents the hazards known or anticipated to be present at the Naval Weapons Station (WPNSTA) Yorktown, Cheatham Annex (CAX) during the Site Investigation scheduled to take place in early 2008 at the various Areas of Concern (AOCs). This Project-Specific HASP will be used by CH2M HILL and its subcontractors to identify and mitigate task-specific hazards and to select appropriate health and safety protective measures not otherwise covered in the Master HASP for WPNSTA Yorktown (CH2M HILL, 2007).

The Yorktown Master HASP has been previously developed and must accompany/supplement this Project-Specific HASP. The Master HASP contains information pertinent to the general conditions at CAX, such as general site information, hazard evaluation and control, personnel responsibilities and requirements, a general description of personal protective equipment, customary decontamination procedures, and emergency response procedures. On-site personnel must review both the Master-HASP and the project-specific HASP and sign an agreement to comply with its provisions prior to commencing on-site work. The Master-HASP and project-specific HASP are considered operational documents that are subject to revisions in response to various project-specific conditions that may be encountered. However, these documents may be modified or updated only with the approval of the Project Health and Safety Officer (PHSO) and Project Manager.

Policy

CH2M HILL's policy is that on-site hazardous waste management activities be performed in conformance with both the Master HASP and a Project-Specific HASPs. The documents are written based on the anticipated hazards and expected work conditions, and apply to field activities to be performed under the Work Plan. Applicability of this Master-HASP and the Project-Specific HASPs extends to all CH2M HILL employees, CH2M HILL's subcontractors, and visitors entering the site. CH2M HILL subcontractors must follow an established health and safety plan; in most cases, either adopting this master plan with appropriate project-specific HASP (e.g., surveyor), or adopting same and amending both with safety and/or health requirements specific to their work (e.g., driller). HASPs authored by a subcontractor must be reviewed by CH2M HILL's PHSO before commencing on-site work. After being reviewed, this information will become part of the appropriate project-specific HASP.

This Project-Specific HASP in combination with the Master HASP will, at a minimum, meet the requirements under Occupational Safety and Health Administration (OSHA) Standard *29 Code of Federal Regulations* (CFR) 1910.120 (Hazardous Waste Operations and Emergency Response).

PRE-ENTRY REQUIREMENTS

During site mobilization, the Site Health and Safety Officer (SHSO) will perform a reconnaissance of each site as identified in the project-specific Work Plan (WP) to evaluate and determine the chemical, physical, and environmental hazards; establish or confirm emergency points of contact and procedures; and review any other issues deemed necessary to address site safety and health. The SHSO will then conduct a health and safety briefing with the site personnel to discuss data obtained from the previous site reconnaissance, provisions outlined in this Master HASP and project-specific HASP, and appropriate safety and health procedures and protocols.

CH2M HILL HEALTH AND SAFETY PLAN

This HASP will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must read both the Master HASP and this Project-Specific HASP, and sign **Attachment 1** of both documents.

Project Information and Description

PROJECT NO:	358846
CLIENT:	Department of the NAVY, Atlantic Division
PROJECT/SITE NAME:	Yorktown Naval Weapons Station, Cheatham Annex
SITE ADDRESS:	Yorktown Naval Weapons Station, Cheatham Annex, Williamsburg, Virginia
CH2M HILL PROJECT MANAGER:	Laura Lampshire
CH2M HILL OFFICE:	Virginia Beach
DATE HASP PREPARED:	12/19/2007
DATE(S) OF SITE WORK:	October 2008- June 2008
SITE ACCESS:	Military Base Pass and Special Areas Badge are required. Please inform the Project Manager if you require a Visitor's Badge at least 14 days prior to arriving at Cheatham Annex for the fieldwork so that proper arrangements may be made with the security staff. (Note: Individuals are required to provide an I-9, notarized Yorktown background check request form, badge paperwork, and copy of birth certificate/passport/driver's license.)
SITE SIZE:	AOC 1, Scrap Metal Dump – 0.2 acre (North Area) and 0.4 acre (South Area) AOC 6, former Penniman Shell Loading Plant – Various sizes, most 1 acre or less AOC 7, Drum and Can Disposal Area – Less than 1 acre AOC 8, Area South of Site 7 – Approximately 1 acre
PREVAILING WEATHER:	The climate of Williamsburg, Virginia is characterized by warm and humid summers and mild winters. July is generally the warmest month, with average daily temperatures in the upper 80s. The lowest temperatures

generally are recorded in late January and early February, when average high temperatures are in the middle 40s. Average annual precipitation is 38 inches; average annual snowfall is approximately 2 inches.

SITE TOPOGRAPHY:

CAX lies within the Atlantic Coastal Plain physiographic province, which is underlain by unconsolidated sediment of the Quaternary, Tertiary, and Cretaceous ages. These sediments dip to the southeast, with a combined thickness of 1,900 feet in the vicinity of CAX. The topography of CAX contains gently rolling terrain dissected by ravines and stream valleys from sea level along the eastern boundary, which borders the York River, to a maximum elevation of approximately 50 ft above mean sea level (amsl) on a few scattered hills in the western portion of the site (CH2M HILL, Baker, and CDM, 2003). The majority of the site is open fields surrounded by woods.

SITE DESCRIPTION AND HISTORY:

CAX is divided into two parcels, with the larger parcel along the banks of the York River and the smaller parcel south of the Colonial National Historic Park on the northwest and east, Queens Lake subdivision to the west, and the city of Williamsburg to the south and southwest. Almost all of the activities at CAX (administration, training, maintenance, support, and housing) take place within the larger parcel of land. The smaller parcel contains Jones Mill Pond, referred to as Jones Pond, and is used mainly as a watershed protection area. The properties are bordered by Colonial National Historical Park on the northwest and east, Queens Lake subdivision to the west, and the city of Williamsburg to the south and southwest.

CAX had been the location of the Penniman Shell Loading Plant, a large powder and shell loading facility operated by Dupont during World War I. The facility closed in 1918. Between 1918 and 1943, the property was used for farming or left idle until CAX was commissioned in 1943. In July 1987, CAX was designated the Hampton Roads Navy Recreational Complex and in October 1998, control of CAX was transferred from Fleet and Industrial Supply Center (FISC) to WPNSTA Yorktown. Today, the mission of CAX includes supplying the Atlantic Fleet ships and supplying recreational opportunities to military and civilian personnel. Outdoor recreational facilities include cabins, camp sites, an 18-hole golf course, swimming pool, ball fields, freshwater and saltwater fishing areas, boating, wildlife watching, and hunting.

1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Final Site Investigation Work Plan for Various Areas of Concern, WPNSTA Yorktown, CAX, CH2MHILL, October 2008)

The objective of the SI for the identified AOCs is to determine whether a release has occurred that has the potential to adversely affect human health or the environment. Project objectives will be accomplished through the collection of hand auger or DPT surface/subsurface soil and DPT groundwater samples at the AOCs, surface water and sediment sampling at AOC 6, trenching at AOC 6, and test pitting at AOC 7 and AOC 8, as necessary, to further characterize the AOC and:

- Determine if there have been any releases
- Eliminate from further consideration any AOCs that pose no unacceptable threat to human health or the environment
- Determine the need to quantify potential risk, as appropriate
- Determine the need for interim removal actions, as appropriate

1.1.1 Hazwoper-Regulated Tasks for AOCs -1, -6, -7, and -8

- DPT installation
- Groundwater Sampling
- Soil Sampling
- Surface Water Sampling
- Sediment Sampling
- Investigative Derived Waste (IDW) sampling and disposal
- Test pitting/excavation
- Hand Augering
- Surveying

1.2 Project HS&E Change Management Form

*This evaluation form should be reviewed on a **continual basis** to determine if the current project-specific HASP adequately addresses ongoing project work, and it should be modified whenever new tasks are contemplated or changed conditions are encountered.*

Project Task: **SI to include soil (trenching/test pitting, hand augering), sediment, surface water, and groundwater (DTP) sampling, surveying, and IDW sampling**	Activity Manager: **Marlene Ivester/HRO**
Project Number: **358846**	Project Name: **WPNSTA Yorktown, Cheatham Annex**

Evaluation Checklist	Yes	No
1. Has CH2M HILL staff changed?		
2. Has a new subcontractor been added to the project?		
3. Is any chemical or product to be used that is not listed in **Attachment 7** of the plan?		
4. Are all tasks addressed in Section 1.1 of the project-specific HASP?		
5. Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6. Have other safety, equipment, activity, or environmental hazards been encountered that are not addressed in Section 2.1 of the plan?		

If the answer is "YES" to Questions 1-3, a HASP revision is NOT needed. Please take the following actions:

- Confirm that the staff's medical and training status is current—check training records at: http://www.int.ch2m.com/hands (or contact your regional SPA) and confirm subcontractor qualifications.
- Confirm with the project KA that subcontractor safety performance has been reviewed and is acceptable.
- Confirm with H&S that subcontractor safety procedures have been reviewed and are acceptable.

If the answer is "YES" to Questions 4-6, a HASP revision MAY BE NEEDED. To determine if a revision is needed, please contact HS&E directly or complete the field project start-up form at: http://www.int.ch2m.com/hsdocgen/fppricing.asp.

1.3 Task Hazard Analysis

(Refer to Section 2 of plan for hazard controls)

POTENTIAL HAZARDS	TASKS								
	Test pit/ excavation	Drilling, geoprobe, and well installation & abandonment	Groundwater monitoring, aquifer testing	Surface water and sediment sampling using a boat	Surface water and sediment sampling from the shore or water	Hand augering	Surveying	IDW drum sampling and disposal	Observation of loading material for offsite disposal
Flying debris/objects	X	X		X	X	X		X	X
Noise > 85dBA	X	X		X					X
Electrical	X	X	X	X					
Suspended loads	X	X		X					X
Buried utilities, drums, tanks	X	X				X			
Slip, trip, fall	X	X	X	X	X	X	X	X	X
Back injury	X	X	X	X	X	X		X	
Confined space entry	X						X		
Trenches / excavations	X								
Visible lightning	X	X	X	X	X	X	X	X	X
Vehicle traffic									X
Elevated work areas/falls	X				X				
Fires	X	X			X			X	
Entanglement		X				X			
Drilling		X							
Heavy equipment	X	X		X					X
MEC = blast/ fragmentation. UXO Technician to provide avoidance support. Contact with MEC/ MPPEH is prohibited.	X (at AOC 6 only)					X (at AOC 6 only)			
Working near water					X				
Working from boat				X					
IDW Drum Sampling								X	

1.4 Environmental Impacts

(Refer to the Hazard Control Section for control measures)

Tasks/Conditions	Impacts						
	Air Pollution	**Land Pollution**	**Land Disposal**	**Noise Pollution**	**Water Pollution**	**Resource Depletion**	**Human Hazard**
Drilling				X			X
Waste Soil Stored or Discharged		X	X		X		X
Water (Waste or Storm) Stored or Discharged		X	X		X		X

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the Site Safety Coordinator (SSC) for clarification.

In addition to the controls specified in this section, "Project-Activity Self-Assessment Checklists" are contained in **Attachment 11**. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor project-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: **Initially and if conditions change (as determined by the SSC).**

2.1 Project-Specific Hazards

2.1.1 Inclement Weather

- Work may proceed in light rain- wear rain gear.
- Exposure to slips, trips and falls is increased during rainy and snowing conditions.
- Take cover in field vehicle during adverse weather conditions (High winds, heavy rain).
  - Work shall cease and cover sought in the event of lightning or tornado warnings.
  - Identify "Take Shelter" areas before starting project.
  - Work may proceed in light rain- wear rain gear.
- Notify the Project Manager and Client Representative after shelter has been sought.

Adverse weather conditions requiring immediate suspension of field work activities are defined as the following:

- Thunder or lightning. Thunderstorm watches or warning, as the situation warrants, will be used as an alert to potential electric activity. Typically, a 30-minute stand-down occurs to allow the storm cell to pass the area. If lightning or thunder is observed within the stand down period, the 30-minute time frame is extended until electrical activity ceases.
- Sustained wind speeds of 20 miles per hour (mph) or wind gusts of 25 mph for boating activities.
- Sustained wind speeds of 25 mph or wind gusts of 35 mph for high profile work where wind chill is not a factor, i.e., greater than 60°F.
- Sustained wind speeds of 40 mph or wind gusts of 45 mph for non-high profile work.
- Moderate rain and/or snow fall of 0.11 to 0.3 inch per hour during hoisting activities. Freezing rain is also cause for suspension of hoist use.
- An equivalent wind chill factor of -24°F on the wind chill factor chart (below) will trigger systematic shut down of all non-emergency work activities.
- A tornado/hurricane warning for the general area or county will suffice in requiring a general work stoppage.
- If you are inadvertently caught outside in a thunder/lightning storm, take the following precautions:
  - Seek shelter among densely wooded areas.

- Avoid lone trees as shelter.
- Avoid open, bare areas.
- Do not cross water bodies.

2.1.2 Field Vehicle (Driving)

- Familiarize yourself with vehicle features.
  - Mirror adjustments, seat adjustments, cruise control features, etc.
  - Pre-program radio stations.
- Ensure snow, ice and fog are completely removed from windows prior to driving.
- Review driving directions prior to departing
- Inspect vehicle prior to departure (tire pressure, tread, signals, horn, lights).
- Adjust headrest to proper position.
- Always wear seatbelt while operating vehicle.
- Inquire; and obtain, a vehicle pass from the client if required.
- Observe warning signs, yield to traffic, and observe all posted traffic signs.
- Pull off the road, put the car in park and turn on flashers before talking on a mobile phone.
- Maintain a First Aid kit, Bloodborne Pathogens kit and Fire Extinguisher in the field vehicle at all times.
- Close car doors slowly and carefully. Fingers can get pinched in doors or in the trunk.
- Use a spotter when backing up near monitoring wells.
- Turn off vehicle when leaving it. Leave keys in vehicle.
- Maintain valuables in the trunk.

2.1.3 Wireless Phone Restrictions

- Wireless phones are only to be used in areas where work is not in progress (only in office buildings or parked cars).
- The use of pagers in the work area is allowed (Treat wireless phone like a pager i.e. check caller ID and call back in proper location).

2.1.4 Well Drilling

(Reference CH2M HILL SOP HSE-204, *Drilling* (See **Attachment 11**))

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.
- Wear hearing protection as specified in Section 4.0

The SSC shall complete the H&S Self-Assessment Checklist – Drilling included in Attachment 11 of this amendment to verify compliance with CH2M HILL's drilling program.

2.1.5 Slips, Trips, and Falls

- Institute and maintain good housekeeping practices.
- Pick up tools and debris in the work area.
- Walk or climb only on equipment and/or surfaces designed for personnel access.
- Be aware of poor footing and potential slipping and tripping hazards in the work area.

2.1.6 Boat Operation

- CH2M HILL employees will only pilot small boats in territorial waters or near coastlines on navigable waters. Commercial boating services will be conducted by professional marine operators and must be subcontracted.
- CH2M HILL employees who intend to operate a small boat during the course of the project shall first demonstrate to a designated Qualified Boat Operator that they are experienced in operating boats similar to those used for the project, that they possess basic skill necessary to operate, maneuver, troubleshoot basic mechanical problems that may occur, and that they are knowledgeable of the requirements of this SOP, related SOPs, and the project Health and Safety Plan. The demonstration shall take the form of an operational sea trial developed by the Qualified Small Boat Trainer. A sea trial checklist is included in the **Attachment 13** section of this HASP.
- Watercraft shall be licensed and identified in accordance with state or other applicable regulations.
- The boat operator shall complete a float plan prior to leaving the dock or shore. A copy of the float plan shall be left with a reliable individual or marina staff who will notify the coast guard if the vessel does not return according to the float plan schedule.
- Check all safety systems such as brakes, windshield wipers and lights. Tires must be in good condition and properly inflated. Make sure windshields and lights are free of obstructions such as dirt.
- U.S. Coast Guard-approved Type II personal flotation devices (PFDs), or life jacket, shall be provided for each employee and will be worn.
- PFDs will be inspected before and after each use. Defective equipment will not be used.
- A minimum of one Type IV ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue.
- The vessel shall be equipped with fire extinguishers or a fixed fire extinguishing systems.
- Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling.
- All gasoline engines, except outboard motors, installed in a boat must have an approved backfire flame arrestor (backfire preventor) fitted to the carburetor.
- The boat shall carry at least one operational air horn or similar sound signaling device.
- Visual distress signals shall be maintained onboard (e.g., flare, distress flag, distress light).
- Work requiring the use of a boat will not take place at night or during inclement weather.
- The boat must be operated according to U.S. Coast Guard regulations (speed, lighting, right-of-way, etc.).
- The engine should be shut off before refueling the generator; do not smoke while refueling.
- Sampling with a line/rope shall be done with the engine in neutral, or by other means, that effectively prevents propeller entanglement.
- Sampling line/rope that is loose on the deck shall be kept to a minimum, caution must be exercised to avoid entanglement, and the line/rope shall not be looped or wrapped around any part of a person.
- Marine Distress Communications information shall be posted near the vessel radio or telephone.
- Dive boats will display dive flags while divers are in the water. A communication system will also be established between vessel operator and the divers.

- If conditions of low or limit visibility is possible, boats shall be equipped with lighting (navigation and anchor).

2.1.7 Working Above or Near Water

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PDFs), or life jacket, shall be worn.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A life-saving skiff must be provided for emergency rescue.

A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.

2.1.8 Groundwater Sampling

- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (refer to Section 4).
- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to **Section 5** on air monitoring).
- Use caution when opening well lids. Wells may contain poisonous spiders, hornet or wasp nests.
- Use the appropriate lifting procedures (see Master HASP) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact with the groundwater and acid used in sample preservation, wash exposed skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.

2.1.9 Soil Sampling

- Tie down loose items if utilizing a van.
- Utilize a spotter if backing vehicles or equipment towards sampling location.
- Inspect the sampling area for obstructions and Poison Ivy and Poison Oak, or other physical hazards.
- If sample locations are located in dense tall grassy areas consider utilizing a “Bug-Out” suit or Tyvek to mitigate the potential for tick bites.
- If lifting heavy equipment from vehicle, move items to the rear and get assistance when lifting.
- Be alert for bees, wasps and other insects when sampling.
- Ensure only personnel with current 40-hour Hazwoper and 8 hour refresher training perform task.
- Log calibration of Direct Reading Instrument in either a field log book or on attached form.
- Notify others in area that task is going to be performed, delineate an exclusion zone as applicable.
- Don personal protective equipment (PPE) as specified in **Section 4** of this site-specific HASP.
- Position yourself upwind prior to sampling, if possible.
- Review Material Safety Data Sheets for chemical preservatives, decontamination agents and calibration gas.
- Do not handle sample jars without **Nitrile** gloves.

2.1.10 Working around Material Handling Equipment

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Because heavy equipment may not be equipped with properly functioning reverse signal alarms, never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers; equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

2.1.11 Arsenic (Reference CH2M HILL SOP HSE-501, *Arsenic*)

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride.
- Arsenic is considered a "Confirmed Human Carcinogen."
- Arsenic particulates (inorganic metal dust) are odorless. Vapor and gaseous odor varies depending upon specific organic arsenic compound.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- For self-assessment & additional information on Arsenic, **Refer to Attachments 11 & 12**

2.1.12 Cadmium (Reference CH2M HILL SOP HSE-504, *Cadmium*)

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Cadmium is considered a "Suspected Human Carcinogen."
- Cadmium particulates (fumes and dust) are odorless.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.13 Lead (Reference CH2M HILL SOP HSE-508, *Lead)*

The following requirements pertain to lead contaminated soils:

- Work shall progress in a sequence from less contaminated to more contaminated areas.
- Water should be added to soils prior to and during excavation, air rotary drilling, and other activities that create or have the potential to create airborne lead contaminated dust. For air rotary drilling operations, water can be added to the boring to reduce dust generation from the cyclone. Depending upon soil type, watering of soil may be required several days prior to commencing ground intrusive activities.
- Personnel working in the vicinity of lead contaminated soil shall wear disposable coveralls or equal and exercise enhanced personal hygiene (i.e., frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing/footwear; etc.).

- For self-assessment & additional information on Lead, **Refer to Attachments 11 & 12**

2.1.14 TCE- Trichloroethylene (Used for MIPS Calibration)

(Reference NIOSH pocket Guide to Chemical Hazards)

- Only staff with Hazard Communication training, 40-Hour Hazardous Waste Training, medical monitoring, and PPE requirements inclusive of Respirator fit test shall handle this product or respond to spills.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Skin absorption is a potential route of TCE exposure.
- TCE is considered a "Potential Human Carcinogen."
- The exposure limit of 25 ppm as set by the NIOSH REL Health and Safety Dept. shall not be exceeded.
- A Short Term Exposure Limit (STEL: 200 ppm over 15 minutes) exists for this material.
- TCE has an sweet odor, like chloroform.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person and implemented during the response of any release.

2.1.15 IDW Drum Sampling

Personnel are permitted to handle and/or sample drums containing investigation-derived waste (IDW) only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.

The SSC shall complete the H&S Self-Assessment Checklist –Waste Characterization, Sampling and Analysis included in Attachment 11 of this amendment to verify compliance with CH2M HILL's policies.

2.1.16 Munitions and Explosives of Concern (MEC)

(Reference CH2M HILL SOP HSE-610, *Ordnance Explosives* (OE))

CH2M HILL HSE&Q SOP 610 *Explosives Usage and Munitions Response* (MR) outlines the appropriate procedure for dealing with any MEC discovered during the project. A UXO Technician will be on site when the possibility exists of exposure to Munitions and Explosives of Concern (MEC) during sampling activities. This will begin with the initial sampling at AOC 6. The UXO Technician shall conduct a safety briefing that will be included in the daily safety meeting minutes. This safety briefing will address the potential MEC hazards identified in the Hazard Analysis. While sampling at AOC 6, the UXO Technician has the authority to stop work if MEC is encountered. Prior to work at AOC 6, all field personnel (those who go to or work at the site) will have completed 3R (recognize, retreat and report) Training.

2.2 General Hazards

- Refer to the Master HASP for the following practices and hazards:

- **General Practices and House Keeping** (CH2M HILL SOP HSE-209)
- **Hazard Communication** (CH2M HILL SOP HSE-107)
- **Shipping and Transportation of Chemical Products** (CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods)
- **Lifting** (CH2M HILL SOP HSE-112)
- **Fire Prevention and Control** (CH2M HILL SOP HSE-208)
- **Electrical** (CH2M HILL SOP HSE-206)
- **Stairways and Ladders** (CH2M HILL SOP HSE-214)
- **Heat and Cold Stress** (CH2M HILL SOP HSE-211)
- **Handling of Compressed Gas Cylinders**
- **Procedures for Locating Buried Utilities**
- **Confined Space Entry** (CH2M HILL SOP HSE-203)

2.3 Biological Hazards and Controls

- Refer to the Master HASP for detailed information pertaining to biological hazards and controls.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual,* and *Corporate Health and Safety Program, Radiation Protection Program Manual*, for standards of practice in contaminated areas.

Hazards	Controls
None.	None.

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
VOCs					
Trichloroethylene (TCE)	**GW:** 7.3 D mg/L (J4 DPT GW) **SD:** 960 mg/kg (12SD25) **SW:** 3.3 mg/L (15SW12) **Soil:** 9.7 mg/kg (J4 DPT soil)	50 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45
SVOCs					
PAHs (limits as Coal Tar Pitch)	**SD**: 0.524 mg/kg (4SD07) **Soil**: 2.61 mg/kg (21SS15)	.02 mg/m^3	80 Ca	Dermatitis and bronchitis	UK

METALS

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Arsenic	**SS:** 23.5 mg/kg (AOC1, A1-HA01) **SB:** 33.3 mg/kg (AOC1 south, A1-HA06) **SD**: 10.5 mg/kg (AOC1 south, A1-SD03-00) **SW**: 19 ug/L (AOC1 south, A1-SW03D)	0.01 mg/m3	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Antimony	**Waste source:** 4.6 L mg/kg (AOC 6 metallic slag material)	5 mg/m3	NE	Few symptoms, chronic baritosis	Dust
Cadmium	**Waste source:** 4 mg/kg (AOC6 TNT graining house sump)	0.005 mg/m3	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chromium (hexavalent)	**Waste source**: 32.9 mg/kg (AOC6 metallic slag material)	0.005 mg/m3	15 Ca	Irritated respiratory system, nasal septum perforation, liver and kidney damage, leucytosis, leupen, monocytosis, eosinophilla, eye injury, conjunctivitis, skin ulcer, sensitization dermatitis	NA

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
VOCs					
Iron oxide (dust)	**SS**: 35,200 mg/kg (AOC1 north, A1-HA02) **SB:** 39,700 mg/kg (AOC1 south, A1-HA06)	5 mg/m3	2,500 mg/m3	Benign pneumoconiosis, cough	Dust
Lead	**SS:** 501 mg/kg (AOC1 south, A1-HA05) **SB**: 1,120 mg/kg (AOC1 south, A1-HA05) **Waste source**: 7,580 mg/kg (AOC6 TNT graining house sump)	0.05 mg/m3	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
PCB's					
PCBs (Aroclor-1260) (Limits as Aroclor 1254)	**SD**: 0.540 L mg/kg (AOC8)	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
Nitroamines					
2,4,6-TNT	**Waste source:** 620 mg/kg (AOC 6 TNT catch box ruins)	NIOSH REL 0.5 mg/m^3	NE	Irritation to the skin, mucus membrane; Liver damage, jaundice; Cyanosis; Sneezing, Coughing, Sore throat, muscle pain, kidney damage, cardiac irregularity.	10.59

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water), SD (Sediment).

[b] Appropriate value of PEL, REL, or TLV listed. C = Ceiling concentration not to be exceeded. Skin = Chemical may be readily absorbed through the skin, contributing to overall exposure.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.

Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.

Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HSE-113, *Medical Monitoring,* and HSE-110, *Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Marlene Ivester	HRO	Activity Manager	Not Applicable
Cecilia Landin	VBO	Deputy Activity Manager	Not Applicable
Laura Lampshire	WDC	Project Manager	Not Applicable
David Livingston	VBO	Field Team Leader/SSC	SC-HW/FA-CPR
Carol Peterson	VBO	Field Team Member/SSC	SC-HW/FA-CPR
Jason Mills	VBO	Field Team Member	FA-CPR
Ted Dingle	VBO	Field Team Member	FA-CPR

3.2 Drug-Free Workplace & Screening Program

(SOP HSE-105, *Drug-Free Workplace*)

CH2M HILL does not tolerate illegal drugs, or any use of drugs, controlled substances, or alcohol that impairs an employees work performance or behavior. CH2M HILL employees and subcontractors shall not be involved in any manner with the unlawful manufacture, distribution, dispensation, possession, sale, or use of illegal drugs in the workplace. The use or possession of alcohol in the workplace is also prohibited. Any violation of these prohibitions may result in discipline or immediate discharge. All subcontractors and employees (CH2M HILL, CH2M HILL Constructors, Inc. [CCI]) are required to submit to a pre-employment and/or pre-assignment test for drug. Pre-assignment drug tests must be taken within 30 days of the employee's arrival date at the project. The SC or PSC must verify that each subcontractor employee has completed drug testing by obtaining written verification from the employer (e.g., certificate of successful participation in testing for each person). A subcontractor employee's participation in a random testing program, that meets CH2M HILL program requirements, since the beginning of their employment can be used in lieu of the pre-assignment requirement. Being

subject to only post-incident testing will not be adequate to meet the random or pre-assignment requirements.

3.2.1 Pre-employment or Pre-assignment Testing

Each employee is required to complete the Policy Acknowledgement and Consent Form. This form is not only important because it is the method for initiating pre-employment or pre-assignment testing, but if there is a problem with an employee, you will need to have this form signed before you can take action. You are responsible for verifying that all employees have completed the form (or equivalent). For CH2M HILL employees, these records are part of the employee's HR record, and for subcontractor employees, they are part of the subcontractor's files. You may need to contact the HRM or contract administrator (KA), respectively, to help you verify that the appropriate records are in place. If during the course of the project you receive a completed form from an employee, you need to give it to the Drug Free Workplace Program Administrator (DFWPA).

When drug or alcohol testing is required, employees cannot work onsite prior to successfully passing the test. The Health & Safety Manager (HSM) will verify with the DFWPA or the Project Manager (PM) or Construction Manager (CM) that the people listed in the site-specific written safety plan have successfully passed the test before approving the plan. If personnel other than those listed in the site-specific written safety plan come onsite, the PM or CM is responsible for verifying with the DFWPA that they have successfully passed their drug and alcohol tests.

3.2 Field Team Chain of Command and Communication Procedures

- Refer to the Master HASP for detailed information pertaining to Field Team Chain of Command and Communication Procedures.

3.3.1 Client

- Refer to the Master HASP for detailed client contact information.

3.3.2 CH2M HILL

- Refer to the Master HASP for detailed CH2M HILL contact information.

3.3.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HSE-215, *Subcontractor, Contractor, and Owner*)

Subcontractor: American Environmental Drilling (DTP/Trenching) Contact Name: Guy Veni Telephone: 800-779-8854 or (910) 944-3368	Subcontractor: IDW Contact Name: TBD Telephone: TBD
Subcontractor: Accumark (Utility Locating) Contact Name: Andy Woolard Telephone: (757) 777-8106	

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in **Attachment 8** are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in **Attachment 1**.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HSE-117, *Personal Protective Equipment*, HSE-121, *Respiratory Protection*)

PPE Specifications [a,g]

Task	Level	Body	Head	Respirator [b]
• General site entry. No chemical exposure anticipated • Geophysical Surveys	D	**Coveralls:** Work clothes **Boots:** Steel-toe, leather work boots **Gloves:** Work gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Groundwater Sampling • Soil Sampling • IDW Sampling • Drilling activities	Modified D	**Coveralls:** Uncoated Tyvek or cotton coveralls **Boots:** Steel-toe leather work boots **Gloves:** Inner surgical-style nitrile &/or outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Sediment Sampling • Surface Water Sampling • Working from boat	Modified D	**Coveralls:** Uncoated Tyvek and personal floatation device (PFD) **Boots:** Steel-toe leather work boots **Gloves:** Inner surgical-style nitrile &/or outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Tasks requiring upgrade	C	**Coveralls:** Polylaminated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner & outer surgical-style nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SSC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

[g] Steel-toed work boots are not required to be worn by the UXO Technician

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HSE-207, *Air Monitoring)*

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]	PPE	Frequency [b]	Calibration
PID: MultiRae with 10.6 eV lamp or equivalent	• All Sampling Activites • IDW Mgmt.	1-25 ppm → 25 – 500 ppm → > 500 ppm →	Level D Level C Level B. Not authorized. Notify HSM	Initially and periodically during task	Daily
Dust Monitor: Visual	• All Sampling Activites • IDW Mgmt	No Dust → Visible Dust→	Level D Level D. Practice dust suppression techniques/engineering controls	Continuous during task	NA
Noise-Level Monitor: Voice	• All Activities	Must shout to be heard at 3 feet →	Hearing protection required Stop; re-evaluate	Continuous during task	NA

[a] Action levels apply to sustained breathing-zone measurements above background for more than 5 minutes.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: MultiRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

Not required

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to: HSM: Steve Beck/MKE

6 Decontamination

(Reference CH2M HILL SOP HS-506, *Decontamination*)

- **Refer to Section 6.0 of Master HASP**

6.1 Decontamination Specifications

Personnel	Sample Equipment
• Hand wash/rinse • Dispose of PPE in municipal trash, or contain for disposal	• Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

- **Refer to Figure 6-1 of Master HASP**

7 Spill-Containment Procedures

- **Refer to Master HASP**

8 Site-Control Plan

- **Refer to Master HASP**

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-510, *Site Control)*

- **Refer to Master HASP**

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-220, *Site-Specific Written Safety Plans)*

- **Refer to Master HASP**

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-106, *Emergency Response*)

9.1 Pre-Emergency Planning

- **Refer to Master HASP**

9.2 Emergency Contacts

- **Refer to Master HASP and Attachment 2**

9.3 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	**Field Vehicle**
First aid kit	**Field Vehicle**
Eye Wash	**Field Vehicle**
Potable water	**Field Vehicle**
Bloodborne-pathogen kit	**Field Vehicle**
Additional equipment (specify): Cell Phone	**On the SSC**

9.4 Incident Response

- **Refer to Master HASP**

9.5 Emergency Medical Treatment

- **Refer to Master HASP**

9.6 Evacuation

- **Refer to Master HASP**

9.7 Evacuation Signals

- **Refer to Master HASP**

9.8 Incident Notification and Reporting

- **Refer to Master HASP**

9.9 Serious Incident Notification and Reporting

- **Refer to Master HASP**

10 Behavioral Based Loss Prevention

10.1 Job Hazard Analysis (JHA)

- **Refer to Attachment 4**

10.2 Pre-Task Safety Plans (PTSP)

- **Refer to Attachment 5**
- **Complete either a PTSP from or a STAC card for each day for the project**

10.3 Safe Work Observations

- **Refer to Attachment 6**

10.4 Loss/Near-Loss Investigations

- **Refer to Master HASP – Attachment 7**

11 Approval

This project-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

11.1 Original Plan

Written By: Laura Lampshire/WDC Date: 12/03/2007

Approved By: Steve Beck **Date: 12/20/07**

11.2 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

12 Attachments

Attachment 1: Employee Signoff Sheet
Attachment 2: Emergency Contacts
Attachment 3: Biological Hazards – Refer to Master HASP
Attachment 4: Job Hazard Analysis - Drilling and Groundwater Sampling
Attachment 5: Pre-Task Safety Plan
Attachment 6: Safe Work Observation Form
Attachment 7: Loss/Near-Loss Investigations – Refer to Master HASP
Attachment 8: Initial Medical Treatment Form – Refer to Master HASP
Attachment 9: Project-Specific Chemical Product Hazard Communication Form
Attachment 10: Chemical-Specific Training Form
Attachment 11: Self-Assessment Checklist

- Drilling
- Respiratory Protection
- Waste Characterization, Sampling and Analysis
- Cadmium
- Arsenic
- Lead

Attachment 12: Material Safety Data Sheets/Fact Sheets
Attachment 13: Waste Management Planning

EMPLOYEE SIGN-OFF SHEET

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: WPNSTA Yorktown, Cheatham Annex, Areas of Concern

Project Number: 358846

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

Project Contact List

&

Emergency Contact Sheet

CH2MHILL

PROJECT CONTACTS LIST

This form shall be completed and updated as necessary by the Safety Coordinator. A copy of the completed form shall be posted in a prominent location onsite and/or attached to the CH2M HILL HSE plan.

Client: **Department of Navy – Atlantic Division**

Project/Site Name: **WPNSTA YORKTOWN, Cheatham Annex Areas of Concern**

Project Number: **358846**

Project Contacts	Name	Phone Number	Cell Number
Client ***Contact to client shall only be made after contacting Project Manager**	Christopher Murray/NAVFAC	(757) 444-3811	(757) 510-5732
CH2M HILL Activity Manager	Marlene Ivester/HRO	(757) 873-1442, x34	(757) 650-4924
CH2M HILL Deputy Activity Manager	Cecilia Landin/VBO	(757) 671-6266	(757) 748-3001
CH2M Hill Project Manager	Laura Lampshire/WDC	(301) 570-1042	(301) 580-0027
CH2M HILL Safety Coordinator	Carol Peterson/VBO	(757) 671-6275	(757) 285-2560
CH2M HILL Safety Coordinator	David Livingston/VBO	(717) 671-6239	(757) 338-2136
CH2M Hill HS&E Manager	Steve Beck/MKE	(414) 847-0277	(414) 526-4517
CH2M HILL Environmental Compliance Coordinator (ECC)	Linda Hickok/SYR	(315) 422-8495 Ext. 229	(315) 751-3903

CH2M HILL Subcontractors Contact List

Subcontractor	Primary Task	Site Manager	Phone	Safety Rep.	Phone

Client Contractors Contact List

Contractor Name	Primary Task	Contact	Phone

Emergency Contacts

Occupational Injury Nurse 1-800-756-1130

Medical Emergency – 911
Facility Medical Response #:
7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Branch Medical Clinic Ambulance #:
7-4911 (on-station phone)
(757)887-4911 (off-station phone)
Public Ambulance #:
911 (off-station phone)

CH2M HILL Medical Consultant
Health Resources
Dr. Jerry H. Berke, M.D., M.P.H.
600 West Cummings Park
Suite 3400
Woburn, MA 01801
1-781-938-4653 or 1-800-350-4511
(After hours calls will be returned within 20 minutes)

Fire/Spill Emergency -- 911
Facility Fire Response #:
7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Spill Response #:
7-4911 (on-station phone)
(757) 887-4911 (off-station phone)

Local Occupational Physician
Dr. Laura Staton
46440 Benedict Drive
Suite 108
Sterling, Virginia 22170
Phone: (703)444-5656

Security & Police – 911
Facility Security #: 7-4911 (on-station phone)
(757) 887-4911 (off-station phone)_
Local Police #: (757) 887-4911

Corporate Director Health and Safety
Name: Jerry Lyle/BOI
Phone: 208/345-5314
24-hour emergency beeper: 888-444-1226

Utilities Emergency Miss Utility 800-552-7001
Water: 7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Water Emergency: 7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Gas: 7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Electric: 7-4911 (on-station phone)
(757) 887-4911 (off-station phone)
Public Works: (757) 887-4637

Health and Safety Manager (HSM)
Name: Steve Beck/MKE
Phone: (414)272-2426 ext. 277
Radiation Health Manager
Name: Howard Gillipin/DEN
Phone: (206)453-5005

Safety Program Administrator (SPA)
Name: Lynn Bong/MKE
Phone: (414)272-2426 ext. 384

Regional Human Resources Department
Name: Cindy Bauder/WDC
Phone: (703)47106405 ext. 4243

Activity Manager
Name: Marlene Ivester/HRO
Phone: (757) 873-1442 Ex. 34

Corporate Human Resources Department
Name: John Monark/COR
Phone: 303/771-0900

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355
CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

Worker's Compensation
Contact the regional Human Resources Department to have an Incident Report Form (IRF) completed, or contact Julie Zimmerman after hours: 303/664-3304
Auto Claims
Rental: Carol Dietz/COR (303)713-2757
CH2M HILL Owned: Zurich Insurance Company 1-800-987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Federal Agency (CERCLA):	USEPA Robert Stroud (215)814-3366	**State Agency:**	District of Colombia Henry Cobo (202)535-1910

Hospital

Hospital Name/Address:	Sentara Williamsburg Community Hospital 1308 S. Mount Vernon Ave. Williamsburg, Virginia 23185	**Hospital Phone #:**	((757) 253-6030 (General Information)

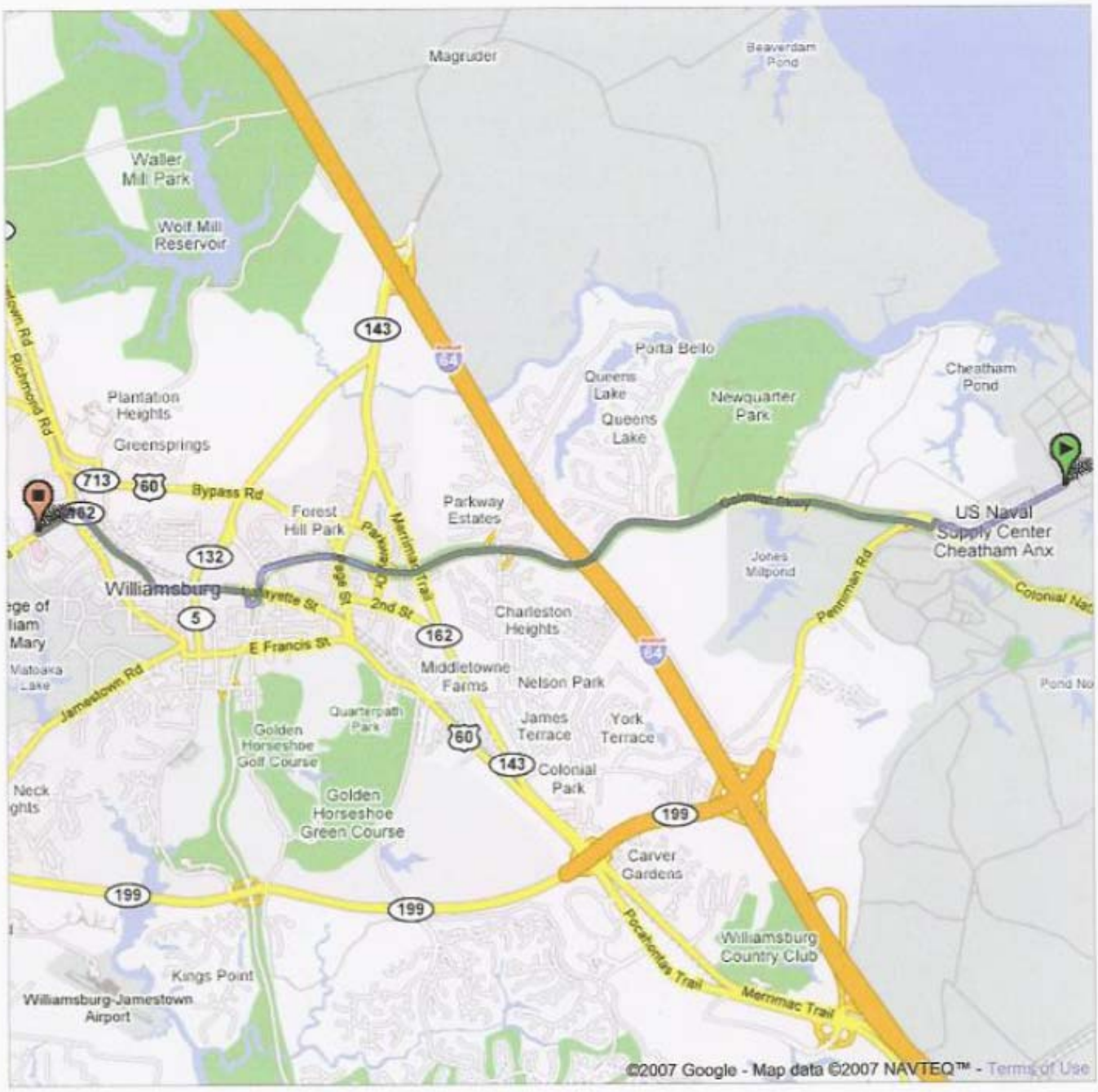
Directions to Hospital

From Gate 1:

- From the CAX entrance gate, turn left onto the ramp to Colonial National Historical Pkwy/Colonial Pkwy
- Turn right at Colonial National Historical Pkwy/Colonial Pkwy
- Turn right at N. England Street
- Turn left at Lafayette St./VA-162/VA-5. Continue to follow Lafayette St./VA-162
- Continue on Monticello Ave. Hospital is 1 block on the left on S. Mt. Vernon Ave.

Emergency Hospital Route from Cheatham Annex to:

Sentara Williamsburg Community Hospital
1308 S. Mount Vernon Ave.
Williamsburg, Virginia 23185
Ph# (757) 253-6030



BIOLOGICAL HAZARDS
(REFER TO MASTER HASP)

JOB HAZARD ANALYSIS (JHA)

FOR

Drilling &
Groundwater Sampling

Job Hazard Analysis	
Company Name: **CH2M HILL**	Project Name/#:
Work Activity/Task: **Drilling**	Principal Contractor: **CH2M HILL**
Date:	Note: Sign off to be provided at Tool Box talk
Prepared by:	Supervisor:
Signature:	Safety Coordinator (SC):
Plant & Equipment Required: - Machinery: maintenance checks provided by subcontractor - Operator: suitably qualified and competent, with health, safety, and environment (HS&E) training	Training Requirements (in addition to those in project's written safety plan: - OHS Construction Induction - Waste Management for waste streams and materials

Job Step	Potential Hazard	Controls
Forms/Permits	Unknown client-specific hazards.	• Well driller license, drill rig permit • Well installation or abandonment notification • Dig/drill permit obtained, where required by client facility • Water withdrawal permit obtained, where required
Site Setup	Striking underground utilities	• Location of underground utilities and installations identified • Daily briefing
	Striking overhead utilities	• Locate and take appropriate precautions with required distances from power lines • Lower mast and secure during travel
	Physical environmental hazards	• Use of appropriate personal protective equipment (PPE) where required. Safety boots, hard hats, safety glasses and hearing protection are mandatory. Respirators when chemical hazards exist. No loose-fitting clothing, rings, watches, etc.; long hair to be restrained close to the head.
	Dermal or inhalation exposure to contaminants	• Investigate history of area; determine nature and degree of contaminants that could be present • Conduct air monitoring for potential hazardous atmospheres as described in the project's written safety plan. • Use respirators and other PPE as prescribed in the project's written safety plan

Job Step	Potential Hazard	Controls
Site Setup (Continued)	Fire	• No smoking around the drill rig
	Struck by vehicles	• Follow traffic control plan • Wear high-visibility warning vests
	Drill rig travel	• Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads and accommodate waste materials. • Drill rig travel will be conducted with mast secured in its lowered position • Tools and equipment secured prior to rig movement • Only personnel seated in cab are to ride on the rig vehicle • Ensure clearance of overhead power lines • Use alarm or spotter when reversing rig
	Illegal offsite impacts	• Excavation area checked for wetlands, endangered species, cultural/historic resources
	Spread of contamination from contaminated drill cuttings	• Manage cuttings in accordance with all project plans
Drilling Activities	Rotating machinery parts of drill rig	• Daily inspection of drill rig & equipment • Ensure appropriate guards are installed or suitable barriers to forewarn personnel of dangers • Personnel clear during set up, clear of rotating parts • Loose clothing, long hair, and jewelry to be safely secured • Hands or feet should not be used to move cuttings away from auger • Rig in neutral and augers stopped rotating before cleaning • Kill switch installed, clearly identified and operational • Rig placed in neutral when operator not at controls • Pressurized lines and hoses secured from whipping hazards
	Hoisting operations	• Ensure all personnel are clear of operation to a suitable safe distance
	Overturning of drill rig	• Establish drill pad if necessary • Drill rig level and stabilized
	Securing ropes and cables	• Ensure security to stable fixture. Do not wrap around any part of the body. • Drill rig ropes in clean, sound condition

Job Step	Potential Hazard	Controls
Drilling Activities (Continued)	Damage underground utilities	• Exposed underground utility lines supported • Daily briefing
	Striking hazardous materials	• Implement suitable safety procedures for the nature of the hazard • Smoking prohibited around drilling area • Use of PPE as required • Daily briefing
	Failure of drill rig components	• Defective components repaired prior to return to service • Lockout/tagout procedures used prior to maintenance • Cathead in clean and sound condition • Good housekeeping on and about the rig
	Driving equipment into excavation	• Warning/identification system used to remind equipment operators of core holes
	Spread of waste materials/streams	• Stockpile, excavation covers, liners, silt fences in place where required • Dispose of drill cuttings and purge water properly
	Weather	• Drill rig not to be operated in severe inclement weather such as lightning storms, high winds, or severe rain. Mast to be lowered in these conditions.
	Exposure to dust	• Fugitive dust suppressed
	Exposure to airborne contaminants	• Potential hazardous atmospheres tested prior to entry • Air monitoring conducted per project's written safety plan for hazardous atmospheres • Rescue equipment provided where potential for hazardous atmospheres exists • Ventilation used to control hazardous atmospheres and air tested frequently • Appropriate respiratory protection used when ventilation does not adequately control hazards
	Improper disposal of waste	• Waste disposed of according to project's written safety plan and regulations

Manager Name: _____
Date/Time: _____

HSM Name: _____
Date/Time: _____

	PRINT NAME	SIGNATURE	
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
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	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

Activity:	**Date:**
	Project:
Description of the work: Sample preparation, collection, packaging, shipment, and water level surveys	**Project Manager:**
	Field Services Manager:
	Health & Safety Manager:

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Extraction Well Sampling		
Sign out and load vehicle	1. Slips/trips/falls 2. Loading heavy equipment/pinch points backstrain 3. Shifting loads/pinch points	1. Ice melt or sand to improve traction in winter 2. Use partner, liftgate, lift w/ legs 3. Tie down loads securely with rope, bungee cords, load bars
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas 4. Lights, hazards, brakes, directionals 5. Four wheel drive, seat belts. 6. Crew member
Setting up Site/Exclusion Zone	1. Uneven ground, holes, stumps, extension cords/slips, trips and falls 2. Site visitors/unauthorized site entrants 3. Electrical hazards/shock from generator 4. Generator/noise hazard, spill hazard 5. Confined Space Entry	1. Recon site, flag potential trip hazards, organize site to minimize walking areas 2. Establish suitable exclusion zone 3. Use GFCI and grounding rods 4. Place generator at extension cord length distance down wind of site and place generator on bermed poly sheeting 5. Flagging, cones 6. Caution tape, rope 7. GFCI, grounding rod 8. Extension cord, poly sheeting 9. Fall Protection 10. Oxygen/LEL Meter

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Accessing and opening well/vault	1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 2. PID readings > 5ppm 3. Contact with potentially contaminated water. 4. Entering/exiting vault 5. Heavy well covers	1. Know the limitations of all hand tools. Use socket wrenches and bolt cutters, as necessary, to remove old, rusty locks 2. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 3. Wear nitrile gloves 4. Watch for slippery ladder/watch head. 5. Use partners help with equipment. 6. PID 7. Nitrile gloves 8. Boots, hard hat 9. Work gloves 10. Crow bars
Water level measurement	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	1. Share physical aspects of job with partner 2. Recoil meter slowly as the probe reaches meter
Sample Collection	1. Pinch points 2. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 3. Tape Gun – sharp edge	1. Watch hands and fingers when attaching sample ports. 2. Hold sample containers away from face when filling and wear proper PPE 3. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun
Site Breakdown	1. Moving drums of purge water/pinch points, muscle strain	1. Use partner and lift gate to move drums from ground to truck bed 2. Safety glasses and nitrile gloves
Groundwater Pump Decontamination (Summer)		
Signout and load vehicle	1. Warm/Hot weather/sun exposure, dehydration 2. Insects/Ticks-Lime Disease, Bees and Wasps 3. Poison Ivy, Sumac/itching rash 4. Loading 30-gal carboys of DI water/pinch points, backstrain 5. Shifting loads/pinch points, equipment and vehicle damage	1. Keep exposed skin covered/sun block, drink plenty of water continually 2. Ticks – See Tick AHA 3. Be aware of bees nests under well covers, trees, etc. 4. Wear appropriate clothing, use Ivy Block 5. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. Use hand truck to move carboys of DI water. 6. Tie down all loads securely (Rope, bungee cords, load bars)
Driving vehicle from site to site and to CSA decon shed	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas and when backing up. Review potential hazards at each sampling location.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Accessing Decon Shed	1. Pump control units/electrocution 2. Contact with potentially contaminated water.	1. Assess shed floor areas. Be sure that sump pump is plugged in and operating. Wear overboots. 2. Keep all electric cords out of water. 3. Wear nitrile gloves 4. Hooks, GFCI
Moving pumps	1. Moving pumps from truck to Decon shed, back to truck, and finally placed in Field Services trailer.	1. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. Use hand truck to move pumps from truck to Field Services trailer.
Groundwater Pump Decontamination (Winter) Sign out and load vehicle	1. Ice/snow in CSA/slippery surfaces 2. Ice/snow covering vehicle windows/ poor visibility 3. Cold weather/exposure 4. Loading 30-gal carboys of DI water/pinch points, backstrain 5. Shifting loads/pinch points, equipment and vehicle damage	1. Be mindful of slippery surfaces. Use ice melt or sand to improve traction. 2. Remove all snow and ice from vehicle before moving vehicle (ice scraper, snow brush) 3. Dress in layers, wear a hat, stay hydrated, take breaks in vehicle to warm up 4. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. Use hand truck to move carboys of DI water. 5. Tie down all loads securely (rope, bungee cords, load bars) 6. Partner, liftgate, hand truck
Driving vehicle from site to site and to CSA decon shed	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas and when backing up. Review potential hazards at each sampling location.
Accessing Decon Shed	1. Ice covering sump, standing water/slipping. 2. Pump control units/electrocution 3. Contact with potentially contaminated water. 4. Activating sump heaters	1. Assess shed floor areas. Be sure that sump pump is plugged in and operating. Wear overboots. 2. Keep all electric cords out of water. 3. Wear nitrile gloves 4. Hooks, GFCI
Moving pumps	1. Moving pumps from truck to Decon shed, back to truck, and finally placed in Field Services trailer.	1. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. Use hand truck to move pumps from truck to Field Services trailer.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Groundwater Sampling (Summer)		
Signout and load vehicle	1. Warm/Hot weather/sun exposure, dehydration 2. Insects/Ticks-Lime Disease, Bees and Wasps 3. Poison Ivy, Sumac/itching rash 4. Loading heavy equipment/pinch points, backstrain 5. Shifting loads/pinch points, equipment and vehicle damage	1. Keep exposed skin covered or use sun block, drink plenty of water. 2. Ticks – See Tick AHA 3. Be aware of bees nests under well covers, trees, etc. 4. Wear appropriate clothing, use Ivy Block 5. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. 6. Tie down all loads securely (rope, bungee cords, load bars)
Driving vehicle from site to site	1. Traffic/unmindful drivers (tourists and increased military activity on base during the summer months) 2. Road conditions/ruts, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas
Accessing and opening well	1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 2. PID readings > 5ppm 3. Contact with potentially contaminated water.	1. Know the limitations of all hand tools. Use socket wrench and, if necessary, bolt cutters to remove old, rusty locks 2. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 3. Wear nitrile gloves 4. PID
Setting up Site/Exclusion Zone	1. Uneven ground, holes, stumps, extension cords/slips, trips and falls 2. Site visitors/unauthorized site entrants 3. Electrical hazards/shock from generator 4. Generator/noise hazard, spill hazard	1. Recon site, flag potential trip hazards (flags, cones), organize site to minimize walking areas 2. Establish suitable exclusion zone (caution tape, rope) 3. Use GFCI and grounding rods 4. Place generator at extension cord length distance down wind of site and place generator on bermed poly sheeting
Water level measurement	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	1. Share physical aspects of job with partner 2. Recoil meter slowly as the probe reaches meter
Sample Collection	1. Placing or removing pump from well/pinch points, muscle strain 2. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 3. Tape gun – sharp edge	1. Be aware of hands as pump is lowered and recoiled, don't allow pumphead to fly out of well. 2. Hold sample containers away from face when filling and wear proper PPE Nitrile gloves 3. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Site Breakdown	1. Moving drums of purge water/pinch points, muscle strain	1. Use partner and lift gate to move drums from ground to truck bed
Groundwater Sampling (Winter)		
Signout and load vehicle	1. Ice/snow in CSA/slippery surfaces 2. Ice/snow covering vehicle windows/ poor visibility 3. Cold weather/exposure 4. Loading heavy equipment/pinch points, backstrain 5. Shifting loads/pinch points, equipment and vehicle damage	1. Be mindful of slippery surfaces. Use ice melt or sand to improve traction. 2. Remove all snow and ice from vehicle before moving vehicle (snow brush, ice scraper) 3. Dress in layers, wear a hat, stay hydrated, take breaks in vehicle to warm up 4. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. 5. Tie down all loads securely (rope, bungee cords, load bars)
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas
Accessing and opening well	1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 2. PID readings > 5ppm 3. Contact with potentially contaminated water.	1. Know the limitations of all hand tools. Use socket wrenches and, if necessary, bolt cutters to remove old, rusty locks 2. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 3. Wear nitrile gloves
Setting up Site/Exclusion Zone	1. Uneven ground, holes, stumps, extension cords/slips, trips and falls 2. Site visitors/unauthorized site entrants 3. Electrical hazards/shock from generator 4. Generator/noise hazard, spill hazard	1. Recon site, flag potential trip hazards (flags, cones), organize site to minimize walking areas 2. Establish suitable exclusion zone (tape, rope) 3. Use GFCI and grounding rods 4. Place generator at extension cord length distance down wind of site and place generator on bermed poly sheeting
Water level measurement	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	1. Share physical aspects of job with partner 2. Recoil meter slowly as the probe reaches meter
Sample Collection	1. Placing or removing pump from well/pinch points, muscle strain 2. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 3. Tape gun – sharp edge	1. Be aware of hands as pump is lowered and recoiled, don't allow pumphead to fly out of well. 2. Hold sample containers away from face when filling and wear proper PPE 3. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Site Breakdown	1. Moving drums of purge water/pinch points, muscle strain	1. Use partner and lift gate to move drums from ground to truck bed
Surface Water Sampling		
Sign out and load vehicle	1. Warm/Hot weather/sun exposure, dehydration 2. Insects/Ticks-Lime Disease, Bees and Wasps 3. Poison Ivy, Sumac/itching rash	1. Keep exposed skin covered or use sun block, drink plenty of water continually. 2. Ticks – See Tick AHA 3. Be aware of bees nests under well covers, trees, etc. 4. Wear appropriate clothing, use Ivy Block
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, puddles/poor traction 3. Maneuvering in tight areas, narrow bog roads/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas and when backing up.
Collecting samples	1. Steep banks, grass, brush, and running or ponding water/slipping, tripping and drowning. 2. Site visitors/unauthorized site entrants 3. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 4. Tape gun – sharp edge	1. Carefully assess easiest path to sample location. Wear personal floatation devise (PFD) for larger bodies of water, dry suits, waders, or over-boots. Have a lifeline ready for bog or stream sampling. 2. Establish suitable exclusion zone. 3. Hold sample containers away from face when filling and wear nitrile gloves and safety glasses 4. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun
Synoptic Water Levels (Summer)		
Signout and load vehicle	1. Warm/Hot weather/sun exposure, dehydration 2. Insects/Ticks-Lime Disease, Bees and Wasps 3. Poison Ivy, Sumac/itching rash	1. Keep exposed skin covered or use sun block, drink plenty of water. 2. Vigilant tick checks and used duct tape and deet to prevent ticks from crawling on person. Be aware of bees nests under well covers, trees, etc. 3. Wear appropriate clothing, use Ivy Block
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas
Accessing and opening well	1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 2. PID readings > 5ppm 3. Contact with potentially contaminated water.	1. Know the limitations of all hand tools. Use socket wrench and, if necessary, bolt cutters to remove old, rusty locks 2. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 3. Wear nitrile gloves 4. Be prepared to retreat if insects are nesting under well covers

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Water level measurements	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	1. Share physical aspects of job with partner, recoil meter slowly as the probe reaches meter
Synoptic Water Levels (Winter)		
Signout and load vehicle	1. Ice/snow in CSA/slippery surfaces 2. Ice/snow covering vehicle windows/ poor visibility 3. Cold weather/exposure	1. Be mindful of slippery surfaces. Use ice melt or sand to improve traction. 2. Remove all snow and ice from vehicle before moving vehicle 3. Dress in layers, wear a hat, stay hydrated, take breaks in vehicle to warm up
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas
Accessing and opening well	1. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 2. PID readings > 5ppm 3. Contact with potentially contaminated water.	1. Know the limitations of all hand tools. Use socket wrench and, if necessary, bolt cutters to remove old, rusty locks 2. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 3. Wear nitrile gloves
Water level measurements	1. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	1. Share physical aspects of job with partner 2. Recoil meter slowly as the probe reaches meter
Residential Well Sampling		
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage 4. Thickly settled residential areas/potential for children and pedestrians to be present.	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into and out of tight areas 4. Be mindful of small children, bicycles, balls, carriages, etc in residential neighborhoods 5. Ensure vehicle has CH2M HILL sign on both sides
Wiorking outside	1. Warm/Hot weather/sun exposure, dehydration 2. Insects/Ticks-Lime Disease, Bees and Wasps 3. Poison Ivy, Sumac/itching rash	1. Keep exposed skin covered or use sun block, drink plenty of water. 2. Vigilant tick checks and use tape/gators and spray to prevent ticks from crawling on person. Be aware of possible bee's nests 3. Wear appropriate clothing, use Ivy Block

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Working on Private property	1. Personal property/belongings 2. Pets 3. Home owner and/or guests	1. Clearly identify yourself to the homeowner as an AFCEE contractor with the IRP program; offer them your base ID and a copy of the postcard they were mailed. 2. Wear CH2M HILL shirts when possible to help identify you. 3. Always use the buddy system and keep an eye on your partner at all times. One person may not enter a house alone. 4. Upon entering a house and within earshot of the home owner, radio back to FS telling them which address you've entered. Wait for a copy. Do the same upon leaving a house. 5. Watch out for pets. Do not approach a pet unless it approaches you first. If the homeowner is present, ask about pets – what kind? Temperament? Not fast movements. 6. Keep any eye out for danger signs (drugs, excessive alcohol, guns, abuse, squalor). If you feel uncomfortable for any reason, politely excuse yourself and leave immediately. Tell the homeowner you don't have enough ice and radio the same message back to FS so FS knows you may be in trouble. Try not to turn your back on the homeowner while leaving. 7. Have radios for emergency communications 8. Be good stewards of property (don't leave puddles of water, leave hoses as you found them, don't assume you can put sampling equipment on furniture, don't leave trash, park considerately, etc.). 9. If the homeowner is not present, leave behind the card indicating you were there and collected a sample.
Purging holding tank at outdoor spigot	1. Flooding or polling water	1. Use hose to dispense purge water away from house and move around to prevent pooling. 2. Bend with knees not back when detaching/attaching hoses
Purging holding tank at indoor sink	1. Property issues	1. Wipe feet before entering house. Good stewards of personal property. 2. Do not enter house without your buddy (see "Working on Private Property".
Sample collection	1. Sample preservatives/vapors released while adding water or preservatives splashing on skin.	1. Hold sample bottles at arm's length away from face when filling and wear nitrile gloves and safety glasses.
Sample Preparation & Packaging		
Managing Prep and Pack in a heavy traffic area.	1. Weather Conditions: Rainy, snowy days 2. Spilled DI water / slipping causing bodily injury 3. Debris on floor/slip, trip and fall.	1. Mop floor, keep slip preventive rugs in area. 2. Keep doorway and walkway clean.

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Preparation of sample containers	1. Handling of chemicals/spilling of chemicals on skin, clothes or eyes.	1. Never leave open chemicals unattended. 2. Know location of nearest eyewash station. 3. Wear proper PPE. (nitrile gloves, safety glasses, acid apron) 4. Keep prep and pack area well ventilated (open window) 5. Know location of MSDS, absorbent spill cloth, Hazmat spill kit 6. Make sure all caps are secure 7. Know location of MSDS forms
Receiving pre-preserved bottles	1. Glass containers/broken glass, cuts to hands 2. Packaging material / acid leak	1. Use caution when opening package 2. Wear proper PPE (nitrile gloves, safety glasses)
Receiving coolers from the field	1. Heavy coolers/back injury 2. Ticks, insects/Lyme Disease, spider bites and stings 3. Poison Ivy, Sumac/ rash	1. Bend at knees, ask for assistance 2. Use handtruck when necessary 3. Use caution when taking contents out of cooler. Inspect coolers for ticks/spiders 4. Apply ivy block
Preparing coolers for delivery	1. Strapping machine/ tripping over unrolled tape. 2. Tape gun/cuts to hands 3. Heavy coolers/back injury	1. Make sure strapping machine is properly rolled. 2. Use caution, be aware of cutting edge; To extent possible, break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun 3. Bend at knees, ask for assistance 4. Use handtruck as necessary
Neutralizing sampling containers	1. Handling of chemicals/spilling of chemicals on skin, clothes, and eyes. 2. Disposal of glass containers/cuts, broken glass.	1. Wear proper PPE (nitrile gloves, glasses, acid apron, absorbent cloth) 2. Dispose of glass waste in IDM box. 3. Follow proper procedures for neutralizing samples in Tech procedure 028.
Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)
Air compressor		

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Hoists/harnesses/lanyards	Prior to use/monthly at minimum	Confined Space Entry Training
LOTO equipment (locks, tags)	Prior to use	LOTO training
PPE (glasses with side shields, nitrile gloves, hard hats, leather gloves, etc.)	Prior to use/daily	PPE training
Spill Kits	Monthly	NA
Air monitoring Equipment	Calibrated and inspected by Property/Field Services prior to use	Follow Manufacturer's instruction
Ladder	Monthly	Tailgate Topic
Vehicles	Daily	NA
Hand Tools	Prior to use	Tailgate Topic
Electrical Cords	Prior to use	Tailgate Topic
Grounding cables	Prior to use	Tailgate Topic

	PRINT NAME	SIGNATURE	
Manager Name:	_____	_____	**Date/Time:**_____
HSM Name:	_____	_____	**Date/Time:**_____
Employee Name(s):	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
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	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____
	_____	_____	**Date/Time:**_____

Activity: Groundwater Sampling	**Date: January 2008**
	Project: WPNSTA YORKTOWN, Cheatham Annex, Areas of Concern Site Investigation
Description of the work: Sample preparation, collection, packaging, shipment, and water level surveys	**Project Manager: Laura Lampshire**
	Field Services Manager:
	Health & Safety Manager: Steve Beck

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Groundwater Sampling (Winter)		
Load Vehicle	6. Ice/snow in CSA/slippery surfaces 7. Ice/snow covering vehicle windows/ poor visibility 8. Cold weather/exposure 9. Loading heavy equipment/pinch points, backstrain 10. Shifting loads/pinch points, equipment and vehicle damage	6. Be mindful of slippery surfaces. Use ice melt or sand to improve traction. 7. Remove all snow and ice from vehicle before moving vehicle (snow brush, ice scraper) 8. Dress in layers, wear a hat, stay hydrated, take breaks in vehicle to warm up 9. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. 10. Tie down all loads securely (rope, bungee cords, load bars)
Driving vehicle from site to site	4. Traffic/unmindful drivers. 5. Road conditions/ruts, snow, ice, puddles/poor traction 6. Maneuvering in tight areas/potential vehicle or personnel damage	4. Drive defensively. 5. Slow vehicle speeds to match road conditions. 6. Use a spotter to maneuver into tight areas
Accessing and opening well	4. Over tightened bolts, rusty locks/slipping causing cuts/abrasions to hands. 5. PID readings > 5ppm 6. Contact with potentially contaminated water.	4. Know the limitations of all hand tools. Use socket wrenches and, if necessary, bolt cutters to remove old, rusty locks 5. Allow well to vent, if readings continue over 5 ppm then recap and advise management. 6. Wear nitrile gloves
Setting up Site/Exclusion Zone	5. Uneven ground, holes, stumps, extension cords/slips, trips and falls 6. Site visitors/unauthorized site entrants 7. Electrical hazards/shock from generator 8. Generator/noise hazard, spill hazard	5. Recon site, flag potential trip hazards (flags, cones), organize site to minimize walking areas 6. Establish suitable exclusion zone (tape, rope) 7. Use GFCI and grounding rods 8. Place generator at extension cord length distance down wind of site and place generator on bermed poly sheeting

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Water level measurement	2. Winding of meter/repetitive motion, probe recoiling too quickly striking personnel, hunching over well	3. Share physical aspects of job with partner 4. Recoil meter slowly as the probe reaches meter
Sample Collection	4. Placing or removing pump from well/pinch points, muscle strain 5. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 6. Tape gun – sharp edge	4. Be aware of hands as pump is lowered and recoiled, don't allow pump-head to fly out of well. 5. Hold sample containers away from face when filling and wear proper PPE 6. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun
Site Breakdown	2. Moving drums of purge water/pinch points, muscle strain	2. Use partner and lift gate to move drums from ground to truck bed
Sample Preparation & Packaging		
Managing Prep and Pack in a heavy traffic area.	4. Weather Conditions: Rainy, snowy days 5. Spilled DI water / slipping causing bodily injury 6. Debris on floor/slip, trip and fall.	3. Mop floor, keep slip preventive rugs in area. 4. Keep doorway and walkway clean.
Preparation of sample containers	2. Handling of chemicals/spilling of chemicals on skin, clothes or eyes.	8. Never leave open chemicals unattended. 9. Know location of nearest eyewash station. 10. Wear proper PPE. (nitrile gloves, safety glasses, acid apron) 11. Keep prep and pack area well ventilated (open window) 12. Know location of MSDS, absorbent spill cloth, Hazmat spill kit 13. Make sure all caps are secure 14. Know location of MSDS forms
Receiving pre-preserved bottles	3. Glass containers/broken glass, cuts to hands 4. Packaging material / acid leak	3. Use caution when opening package 4. Wear proper PPE (nitrile gloves, safety glasses)
Receiving coolers from the field	4. Heavy coolers/back injury 5. Ticks, insects/Lyme Disease, spider bites and stings 6. Poison Ivy, Sumac/ rash	5. Bend at knees, ask for assistance 6. Use handtruck when necessary 7. Use caution when taking contents out of cooler. Inspect coolers for ticks/spiders 8. Apply ivy block

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Preparing coolers for delivery	4. Strapping machine/ tripping over unrolled tape. 5. Tape gun/cuts to hands 6. Heavy coolers/back injury	5. Make sure strapping machine is properly rolled. 6. Use caution, be aware of cutting edge; To extent possible, break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun 7. Bend at knees, ask for assistance 8. Use handtruck as necessary
Neutralizing sampling containers	3. Handling of chemicals/spilling of chemicals on skin, clothes, and eyes. 4. Disposal of glass containers/cuts, broken glass.	4. Wear proper PPE (nitrile gloves, glasses, acid apron, absorbent cloth) 5. Dispose of glass waste in IDM box. 6. Follow proper procedures for neutralizing samples in Tech procedure 028.
Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)
Low-flow pump, Flow-through Cell, Water Quality Meters, Water Level Probe, Air compressor, and generator (possibly).	Prior to use/daily	Equipment usage training
PPE (glasses with side shields, nitrile gloves, hard hats, leather gloves, etc.)	Prior to use/daily	PPE training
Air monitoring Equipment	Calibrated and inspected by Property/Field Services prior to use	Follow Manufacturer's instruction

	PRINT NAME	SIGNATURE
Manager Name:	_____	_____
Date/Time:	_____	
HSM Name:	_____	_____
Date/Time:	_____	
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
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Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____
Employee Name:	_____	_____

PRE-TASK SAFETY PLAN (PTSP)
OR
STAC CARD

CH2MHILL

Pre-Task Safety Plan (PTSP)

DAILY PRE-TASK SAFETY PLAN (PTSP)

Project: _____ Location: _____Date:_____

Site Safety Officer _____ Job Activity: _____

Task Personnel:

_____
_____
_____
_____
_____

List Tasks:

_____
_____
_____
_____
_____

Tools/Equipment/Materials required (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools, cords, generators, compressed gases, regulated chemical products, etc.):

_____
_____
_____
_____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (Check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	___Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__Heights/fall> 6’	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

_____
_____
_____
_____

DAILY PRE-TASK SAFETY PLAN (PTSP)

Hazard Control Measures (Check all that apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	**Protective Systems** __ Locate buried utilities __ Competent person __ Daily inspections __ Sloping __ Shoring __ Trench box __ Barricades	**Fire Protection** __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment __Combustible materials storage __Chemical Storage	**Electrical** __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected __Insulated tools/gloves
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	**Air Monitoring** __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	**Proper Equipment** __ Aerial lift/ladders/scaffolds __ Forklift/ Heavy equipment __ Backup alarms __ Hand/power tools __ Crane w/current inspection __ Proper rigging __ Operator qualified	**Welding & Cutting** __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue provisions	**Medical/Emerg. Response** __ First-aid & BBP kit __ Eye wash __ FA-CPR training __ Route to hospital	**Heat/Cold Stress** __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	**Vehicle/Traffic** __ Traffic Awareness __Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work __Local/Environmental	**Demolition** __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	**Inspections** __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __Cranes and rigging __Other per Field Safety Plan	**Training** __ Hazwaste __ Construction __Equipment __ Competent person __ Task-specific (AHA) __ Hazcom
FieldNotes:_____ _____ _____			

Supervisor signature:_____ Date:_____

CH2MHILL

SAFETY HAZARD ANALYSIS CARD

Name/Company: _____

Date/Time: _____

Job Description: _____

Daily Safety Goal: _____

PRE-TASK CHECKLIST

SAFETY EQUIPMENT (Check all that apply)

- ❑ PPE
- ❑ Equipment in HSP/FSI available

List: _____

_____

_____

- ❑ Inspected/in good condition
- ❑ Trained in use
- ❑ Fall protection
- ❑ Inspect before use
- ❑ Trained in use
- ❑ Monitoring Equipment
- ❑ Equipment in HSP/FSI available
- ❑ Inspected/maintained
- ❑ Within calibration range

PERMITS

- ❑ Confined space
- ❑ Lock-out/Tagout
- ❑ Hot work/welding
- ❑ Electrical
- ❑ Excavation/Drilling

EXAMPLE HAZARD AND CONTROL MEASURES

(Use to help you complete the reverse side)

OVERHEAD WORK (People/equipment above workers)

- ❑ Barricades
- ❑ Signage
- ❑ Flaggers

WORKING FROM HEIGHTS

- ❑ Personnel trained
- ❑ Fall protection equipment available
- ❑ Guardrails and/or railings
- ❑ Safety net
- ❑ Ladder
- ❑ Inspect before use
- ❑ Proper placement

SPILLS

- ❑ Spill Prevention Plan
- ❑ Secondary containment available
- ❑ Spill kit available

HEAVY EQUIPMENT (Drill rigs, backhoes, excavators, etc)

- ❑ Personnel trained
- ❑ Site-specific plan in place
- ❑ Maintenance/inspection checklist available
- ❑ Equipment on firm, level surface
- ❑ Competent person onsite (excavation)
- ❑ Dig permit obtained
- ❑ Underground utilities identified
- ❑ Overhead utilities identified
- ❑ Safety equipment identified in HSP/FSI available
- ❑ Able to work outside of operating radius (People/equipment above workers)

TOOLS

- ❑ Correct tool for job
- ❑ Inspected and maintained
- ❑ Proper explosion rating
- ❑ Guards in place

ELECTRICAL

- ❑ Power tools & extension cord inspection
- ❑ Qualified personnel work on/near energized equipment
- ❑ Lockout/tagout equipment available
- ❑ Equipment grounded
- ❑ GCIFs in use
- ❑ Safe clearances maintained

LIFTING

- ❑ Assistance required
- ❑ Mechanical lift (dolley, crane, chain fall, etc)**CHEMICAL**
- ❑ Trained
- ❑ MSDS available and reviewed
- ❑ Medically monitored
- ❑ PPE available per the HSP/FSI
- ❑ Air sampling/equipment available per the HSP/FSI

GENERAL

- ❑ Heat stress management planned (rest-work schedules, liquid available, work hours shifted to cooler hours, etc)
- ❑ Aisle-ways clear
- ❑ Fire extinguishers available
- ❑ Good housekeeping maintained
- ❑ Trash containers used and emptied
- ❑ Containers labeled
- ❑ Safety glasses/goggles used when flying objects/particulars present

OFFICE/ERGONOMICS

- ❑ Neutral position when working on a computer
- ❑ Slip, trip, and fall hazards removed
- ❑ Drawers closed when not in use
- ❑ Top drawers closed before bottom drawers opened

DRIVING

- ❑ Seat belt fastened
- ❑ Mirrors and headsets adjusted
- ❑ Valid drivers license for vehicle type

OTHER

- ❑ _____
- ❑ _____
- ❑ _____

WHAT AM I DOING? (List Tasks)	WHAT ARE THE POSSIBLE HAZARDS OF THE TASK I'M DOING? (List Potential Hazards)	WHAT WILL I DO TO REDUCE THE LIKELIHOOD OR SEVERITY OF THE HAZARD? (List Control Measures)

HS&E
CH2MHILL

SAFE WORK OBSERVATION FORM

CH2MHILL

Safe Work Observation Form		
Project:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- Identify and reinforce safe work practices/behaviors
- Identify and improve on at-risk practices/acts
- Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

LOSS/NEAR LOSS INVESTIGATION

(Refer to the Master HASP)

INITIAL MEDICAL TREATMENT FORM

(Refer to the Master HASP)

PROJECT-SPECIFIC CHEMICAL PRODUCT HAZARD COMMUNICATION FORM

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: WPNSTA YORKTOWN, Cheatham Annex, Areas of Concern Site Investigation

Project Number: 358846

MSDSs will be maintained at the following location(s):
Field Vehicle

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Isobutylene	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
pH buffers	< 500 ml	Support Zone			
MSA Sanitizer	< 1 liter	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HSE-107 *Hazard Communication* for more detailed information.

CHEMICAL-SPECIFIC TRAINING FORM

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 358846
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 11

HS&E SELF ASSESSMENT CHECKLISTS

- *Drilling*
- *Respiratory Protection*
- *Waste Characterization, Sampling and Analysis*
- *Cadmium*
- *Arsenic*
- *Lead*

CH2MHILL

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards (complete Section 1).
☐ Evaluate CH2M HILL support functions related to drilling activities (complete Section 2)
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling safety requirements (complete entire checklist).
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-204.

SECTION 1 - SAFE WORK PRACTICES (4.1)

	Yes	No	N/A	N/O
1. Personnel cleared during rig startup	☐	☐	☐	☐
2. Personnel clear of rotating parts	☐	☐	☐	☐
3. Personnel not positioned under hoisted loads	☐	☐	☐	☐
4. Loose clothing and jewelry removed	☐	☐	☐	☐
5. Smoking is prohibited around drilling operation	☐	☐	☐	☐
6. Personnel wearing appropriate personal protective equipment (PPE), per written plan	☐	☐	☐	☐
7. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐

SECTION 2 - SUPPORT FUNCTIONS (4.2)

FORMS/PERMITS (4.2.1)

8. Driller license/certification obtained	☐	☐	☐	☐
9. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
10. Water withdrawal permit obtained, where required	☐	☐	☐	☐
11. Dig permit obtained, where required	☐	☐	☐	☐

UTILITY LOCATING (4.2.2)

12. Location of underground utilities and structures identified	☐	☐	☐	☐

SECTION 2 (Continued)

	Yes	No	N/A	N/O
WASTE MANAGEMENT (4.2.3)				
13. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (4.2.4)				
14. Waste disposed of according to project's written safety plan	☐	☐	☐	☐
15. Appropriate decontamination procedures being followed, per project's written safety plan	☐	☐	☐	☐
DRILLING AT ORDNANCE EXPLOSIVES (OE)/UNEXPLODED ORDNANCE (UXO) SITES (4.2.5)				
16. OE plan prepared and approved	☐	☐	☐	☐
17. OE/UXO avoidance provided, routes and boundaries cleared and marked	☐	☐	☐	☐
18. Initial pilot hole established by UXO technician with hand auger	☐	☐	☐	☐
19. Personnel remain inside cleared areas	☐	☐	☐	☐
SECTION 3 - DRILLING SAFETY REQUIREMENTS (4.3)				
GENERAL (4.3.1)				
20. Only authorized personnel operating drill rigs	☐	☐	☐	☐
21. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
22. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (4.3.2)				
23. Location of underground utilities and structures identified	☐	☐	☐	☐
24. Safe clearance distance maintained from overhead power lines	☐	☐	☐	☐
25. Drilling pad established, when necessary	☐	☐	☐	☐
26. Drill rig leveled and stabilized	☐	☐	☐	☐
27. Additional precautions taken when drilling in confined areas	☐	☐	☐	☐
DRILL RIG TRAVEL (4.3.3)				
28. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
29. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
30. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
31. Safe clearance distance maintained while traveling under overhead power lines	☐	☐	☐	☐
32. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (4.3.4)				
33. Kill switch clearly identified and operational	☐	☐	☐	☐
34. All machine guards are in place	☐	☐	☐	☐
35. Rig ropes not wrapped around body parts	☐	☐	☐	☐
36. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
37. Drill operation stopped during inclement weather	☐	☐	☐	☐
38. Air monitoring conducted per written safety plan for hazardous atmospheres	☐	☐	☐	☐
39. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG SITE CLOSURE (4.3.5)				
40. Ground openings/holes filled or barricaded	☐	☐	☐	☐
41. Equipment and tools properly stored	☐	☐	☐	☐
42. All vehicles locked and keys removed	☐	☐	☐	☐
DRILL RIG MAINTENANCE (4.3.6)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 meters (Australia) or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐

SECTION 4

Complete this section for all items checked "No" in previous sections. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ Project Manager: _____

CH2MHILL

H&S Self-Assessment Checklist: RESPIRATORY PROTECTION

This checklist is provided as a method of verifying compliance with the OSHA respiratory protection standard. It shall be used at locations where CH2M HILL personnel are using respiratory protection, or are required to perform oversight of a subcontractor using respiratory protection, or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of respiratory protection nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Completed checklists must be sent to the appropriate regional health and safety program manager for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to (check only one of the boxes below):

☐ Evaluate CH2M HILL compliance with its respiratory protection program (SOP HS-08)
☐ Evaluate a CH2M HILL subcontractor's compliance with its respiratory protection program
Subcontractor's Name: _____

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-08.

SECTION 1	Yes	No	N/A	N/O
TRAINING (6.1)				
1. Respirator users have completed appropriate training on the respirator to be used	☐	☐	☐	☐
2. Training is current within the past 12 months	☐	☐	☐	☐
3. Attachment 1 of SOP HS-08 distributed to employees using respirators voluntarily	☐	☐	☐	☐
MEDICAL EVALUATION (6.2)				
4. Respirator users completed medical evaluation protocol	☐	☐	☐	☐
5. Respirator use does not exceed any physician's written recommendation limitations	☐	☐	☐	☐
6. Respirator users know to report any medical signs or symptoms related to respirator use	☐	☐	☐	☐
FIT TESTING (6.3)				
7. Respirator users of tight-fitting facepieces have passed a fit test	☐	☐	☐	☐
8. Fit test is current within the past 12 months	☐	☐	☐	☐
9. Respirator users know to have new fit test performed if any change affects respirator fit	☐	☐	☐	☐

SECTION 1 (Continued)	Yes	No	N/A	N/O
RESPIRATOR SELECTION (6.4)				
10. All feasible engineering controls have been considered in reducing exposure levels	☐	☐	☐	☐
11. Appropriate respiratory protection and limitations are specified in HSP/FSI	☐	☐	☐	☐
12. Cartridge or canister change-out schedule is specified in HSP/FSI	☐	☐	☐	☐
RESPIRATOR USE (6.5)				
13. Respirator use is limited to those specified in HSP/FSI	☐	☐	☐	☐
14. HSM notified of changes in site conditions that may alter effectiveness of specified respirators	☐	☐	☐	☐
15. Respirator users of tight-fitting facepieces are cleanly shaven	☐	☐	☐	☐
16. Respirator users of tight-fitting facepieces perform user seal check before each use	☐	☐	☐	☐
17. Cartridges or canisters replaced according to change-out schedule in HSP/FSI	☐	☐	☐	☐
18. Respirator users informed to report any gas or vapor breakthrough to SSC/DSC	☐	☐	☐	☐
19. SSC/DSC knows to report any gas or vapor breakthrough to HSM	☐	☐	☐	☐
20. Personnel not entering IDLH areas until standby-person established with appropriate equipment	☐	☐	☐	☐
RESPIRATOR INSPECTION (6.6)				
21. Respirators in regular use are inspected before each use and during cleaning	☐	☐	☐	☐
21. Emergency response respirators are inspected and documented monthly	☐	☐	☐	☐
22. Defective respirators are taken out of service or repaired	☐	☐	☐	☐
RESPIRATOR CLEANING AND DISINFECTING (6.7)				
23. Respirators in regular use are cleaned and disinfected as necessary	☐	☐	☐	☐
24. Emergency and transferred respirators are cleaned and disinfected after use	☐	☐	☐	☐
RESPIRATOR STORAGE (6.8)				
25. Respirators are properly stored to prevent contamination and deformation	☐	☐	☐	☐
26. Emergency respirators are accessible and clearly marked as emergency respirators	☐	☐	☐	☐
RESPIRATOR REPAIRS (6.9)				
27. Respirator repair is limited to routine maintenance	☐	☐	☐	☐
28. Respirators beyond routine repair are removed from service	☐	☐	☐	☐
BREATHING AIR SUPPLIED BY CYLINDER (6.10.1)				
29. Cylinders are marked with NIOSH approval label	☐	☐	☐	☐
30. Certificate of analysis meets Grade D specifications	☐	☐	☐	☐
31. Certificate of analysis is kept onsite	☐	☐	☐	☐
BREATHING AIR SUPPLIED BY COMPRESSOR (6.10.2)				
32. Breathing air meets Grade D specifications	☐	☐	☐	☐
33. Compressor intake is located away from exhaust gases	☐	☐	☐	☐
34. Compressor is provided with sorbent filters	☐	☐	☐	☐
35. Sorbent filter change-out documentation is kept on the compressor	☐	☐	☐	☐
36. High temperature or carbon monoxide alarm provided on oil-lubricated compressors	☐	☐	☐	☐
37. If high temperature alarm is used alone, carbon monoxide levels are monitored	☐	☐	☐	☐
38. Practical measures taken to control carbon monoxide levels on non oil-lubricated compressors	☐	☐	☐	☐

H&S Self-Assessment Checklist: RESPIRATORY PROTECTION

SECTION 2

Complete this section for all items checked “No” in Section 1. Deficient items must be corrected in a timely manner.

Item #	**Corrective Action Planned or Taken**	**Date Corrected**

Auditor: _________________________________ Project Manager: ______________________________________

CH2MHILL

HS&E Self-Assessment Checklist—Waste Characterization, Sampling and Analysis

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP.

This checklist is to be used at locations where: 1) CH2M HILL employees will be managing wastes generated on project sites and/or 2) CH2M HILL provides oversight of subcontractor personnel who are managing wastes generated at project sites.

The Safety Coordinator (SC) may consult with subcontractors when completing this checklist, but shall not direct the means and methods of waste characterization, sampling and analysis operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Person filling out checklist: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL compliance with its waste characterization, sampling and analysis standard (SOP-79).

☐ Evaluate a CH2M HILL subcontractor's compliance with the waste characterization, sampling and analysis standard and its requirements

Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-408

	Yes	No	N/A	N/O
GENERAL WASTE CHARACTERIZATION INFORMATION (6.0)				
1. Personnel told not to sign waste documentation (e.g., manifests) unless specifically authorized by the client in writing.	☐	☐	☐	☐
2. Waste Management Plan developed and available to all project personnel (see HSE-78).	☐	☐	☐	☐
3. Waste characterized before it is generated.	☐	☐	☐	☐
4. Waste characterized by Client using generator information.	☐	☐	☐	☐
5. Waste volumes estimated.	☐	☐	☐	☐
6. Disposal facility sampling and analytical requirements identified.	☐	☐	☐	☐
7. Disposal facility evaluated (see HSE-78).	☐	☐	☐	☐
8. Waste stream characterization documented in project file.	☐	☐	☐	☐
IDENTIFY ANALYTICAL TEST METHODS (7.1)				
9. Nature and quantity of the waste determined.	☐	☐	☐	☐
10. Analyses required for transport, treatment, and disposal determined.	☐	☐	☐	☐
11. Detection limits identified.	☐	☐	☐	☐
12. Provide disposal facility with analytical results.	☐	☐	☐	☐
13. Analytical test methods identified.	☐	☐	☐	☐

SAMPLING (7.2)				
14. Developed a sampling plan.	☐	☐	☐	☐
15. Field activities recorded in a logbook.	☐	☐	☐	☐
16. Exceptions to sampling plan documented in field logbook.				
17. Each container labeled with the project name, number, sample ID number, date and time,	☐	☐	☐	☐
18. The label on the container is covered with clear tape to prevent loss. collected sampler's name, sample preserves, analysis to be performed.	☐	☐	☐	☐
CHAIN OF CUSTODY (COC)				
19. Sample shipping containers sealed with two custody seals.	☐	☐	☐	☐
20. Custody seals placed over the left and rights sides of the container's cover (cooler).	☐	☐	☐	☐
21. Each seal signed and dated (with time).	☐	☐	☐	☐
22. Seals are covered with clear tape to prevent loss.	☐	☐	☐	☐
23. Custody seals placed on sample container immediately after collection.	☐	☐	☐	☐
24. Custody seals must be placed in a manner that they must be broken to open sample container.	☐	☐	☐	☐
25. The sample is in custody (in view or physical possession, it has not been tampered with, it is retained in a secured area with restricted access, it is placed in a container and secured with an official seal such that it cannot be reached without breaking the seal).	☐	☐	☐	☐
CHAIN OF CUSTODY FORM INSTRUCTIONS (7.2.5)				
26. Chain of Custody form completed per instructions	☐	☐	☐	☐
RECORDS (7.2.6)				
27. Original COC submitted to the lab along with final data packages.	☐	☐	☐	☐
28. Official copy of COC form sent to the project chemist and lab with sample shipment.	☐	☐	☐	☐
29. Changes to analytical requests on COC form or the PO made in writing to the lab.	☐	☐	☐	☐
30. A copy of written change sent to PM, lab, and placed in project files.	☐	☐	☐	☐
31. Reasons for change are included in sample log and project file.	☐	☐	☐	☐
32. Sample logbooks, sample logs, and COC forms sent to PM at completion of project activities.	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist—Waste Characterization, Sampling and Analysis

Complete this section for all items checked “No” in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ___________________________________ Project Manager: _______________________________

CH2MHILL

Standard of Practice HSE-504

HS&E Self-Assessment Checklist—Cadmium

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP.

This checklist is to be used at locations where: (1) CH2M HILL employees may be exposed to cadmium hazards and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to cadmium operations.

SSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of cadmium operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to cadmium hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with the cadmium standard and its requirements.
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-504

SECTION 1

	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Surfaces and materials suspected of being cadmium are treated as such unless tested.	☐	☐	☐	☐
2. Regulated areas have been established where required.	☐	☐	☐	☐
3. Personnel entering into regulated areas have been trained and medically qualified.	☐	☐	☐	☐
4. Warning signs are displayed at entry and approaches to regulated areas.	☐	☐	☐	☐
5. High-speed abrasive tools are not used unless fitted with engineering controls.	☐	☐	☐	☐
6. Materials containing cadmium are not sprayed on unless controls limit airborne concentration.	☐	☐	☐	☐
7. Personnel do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.	☐	☐	☐	☐
8. Personnel do not launder work clothes with ordinary clothes.	☐	☐	☐	☐
9. PPE is selected based on exposure monitoring results and the competent person.	☐	☐	☐	☐
10. Disposable coveralls and enhanced personal hygiene are used around cadmium-contained soil.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
EXPOSURE ASSESSMENTS (3.2.2)				
11. An exposure assessment representing each job classification and area has been completed.	☐	☐	☐	☐
12. Initial determination air monitoring data supporting the exposure assessment is available.	☐	☐	☐	☐
13. During the initial determination, PPE is appropriate for the type of activity and concentration.	☐	☐	☐	☐
14. Personnel are provided PPE, hygiene facilities, and training during the initial determination.	☐	☐	☐	☐
15. Additional exposure assessments are conducted when any changes occur.	☐	☐	☐	☐
16. Where historical data is used in the assessment, data was collected within the past 12 months.	☐	☐	☐	☐
COMMUNICATION OF HAZARDS (3.2.3)				
17. Training on the Hazard Communication Standard has been met.	☐	☐	☐	☐
18. The written compliance program is available to all affected employees.	☐	☐	☐	☐
19. A written emergency plan for cadmium releases has been developed and implemented.	☐	☐	☐	☐
20. Danger signs have been posted in areas above the PEL.	☐	☐	☐	☐
21. Warning labels are placed on shipping and storage containers containing any cadmium.	☐	☐	☐	☐
22. Notification of owners, tenants, and other contractors has been made.	☐	☐	☐	☐
23. Affected employees are notified within 5 days of air monitoring results, in writing and posting.	☐	☐	☐	☐
CONTROL METHODS (3.2.4)				
24. Engineering, work practice, & administrative controls are implemented in areas above the PEL.	☐	☐	☐	☐
25. Where such controls do not reduce exposure below PEL, they are used with respirators	☐	☐	☐	☐
26. The mechanical ventilation has been assessed to control cadmium exposures.	☐	☐	☐	☐
27. A written compliance program is established and implemented prior to commencing work.	☐	☐	☐	☐
28. Employee rotation is not used to control exposures.	☐	☐	☐	☐
29. Regulated areas are established where airborne concentration exceed the PEL	☐	☐	☐	☐
30. Only authorized employee have access to regulated areas.	☐	☐	☐	☐
31. High-speed abrasive tools & equipment are not used unless equipped with engineering controls.	☐	☐	☐	☐
32. Materials containing cadmium are not sprayed on unless controls limit airborne concentration	☐	☐	☐	☐
33. All surfaces are clean of cadmium dust accumulation.	☐	☐	☐	☐
34. Vacuums are equipped with HEPA filters.	☐	☐	☐	☐
35 Compressed air is not used to remove cadmium from surfaces unless equipped w/HEPA system.	☐	☐	☐	☐
36. Employees are not allowed to eat, drink, or smoke in regulated areas.	☐	☐	☐	☐
37. Change areas are available when regulated areas are in use.	☐	☐	☐	☐
38. PPE is not worn by employees off the worksite.	☐	☐	☐	☐
39. Showers and wash facilities are available to employees working in regulated areas.	☐	☐	☐	☐
40. Eating facilities, free of cadmium contamination, are provided for employees.	☐	☐	☐	☐
PERSONAL PROTECTIVE EQUIPMENT (3.2.5)				
41. Respirators are used as required by this SOP.	☐	☐	☐	☐
42. A respiratory protection program is implemented that meets the requirements of this SOP.	☐	☐	☐	☐
43. Respirators are selected based on the airborne concentration of cadmium.	☐	☐	☐	☐
44. PAPRs have been made available to employees who request them.	☐	☐	☐	☐
45. All appropriate PPE is supplied to the employees at no cost.	☐	☐	☐	☐
46. Clean and dry protective clothing and equipment are supplied to employees at least weekly.	☐	☐	☐	☐
47. Damaged protective clothing and equipment is repaired or replaced immediately.	☐	☐	☐	☐
48. When removing clothing, employees do not blow, shake, or otherwise disperse cadmium.	☐	☐	☐	☐
49. All protective clothing and equipment is removed at the end of the shift in change areas only.	☐	☐	☐	☐
50. Clothing to be laundered is sealed in labeled containers.	☐	☐	☐	☐
51. Vendors and persons laundering contaminated clothing are informed in writing of the hazards.	☐	☐	☐	☐
DISPOSAL METHODS (3.2.6)				
31. Waste containing cadmium recycled or disposed appropriately.	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ________________________________ Project Manager: ____________________________

CH2MHILL

HS&E Self-Assessment Checklist – Arsenic

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP.

This checklist is to be used at the following locations: (1) where CH2M HILL employees are exposed to arsenic, or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to arsenic.

The SSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of arsenic operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to arsenic hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with the arsenic standard and its requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-501

SECTION 1

PERSONNEL SAFE WORK PRACTICES (3.1)

	Yes	No	N/A	N/O
1. Areas that exceed the PEL have been designated as regulated areas	☐	☐	☐	☐
2. Personnel meet medical and training requirements	☐	☐	☐	☐
3. No eating, drink, and/or smoking are allowed in the regulated areas.	☐	☐	☐	☐
4. Warning signs have been posted at all entrances to the regulated areas	☐	☐	☐	☐
5. Selection of PPE is based on most relevant exposure monitoring data	☐	☐	☐	☐
6. Personnel working near arsenic-contaminated soil or material shall use wet methods and work practices to control dust; wear disposable coveralls and exercise personal hygiene practices	☐	☐	☐	☐
7. Contact lenses are not worn when working with arsenic	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
EXPOSURE ASSESSMENTS (3.2.2)				
8. Initial air monitoring conducted over full shift for each job classification.	☐	☐	☐	☐
9. Air sampling conducted every six months when exposure limit (EL) ≥ AL but < PEL	☐	☐	☐	☐
10. Air sampling of employees conducted quarterly when EL ≥ PEL.	☐	☐	☐	☐
11. Additional air monitoring has been collected when there are any changes in operation	☐	☐	☐	☐
COMMUNICATION OF HAZARDS (3.2.3)				
12 Training on the Hazard Communication Standard has been met.	☐	☐	☐	☐
13 CH2M HILL personnel have completed the Arsenic Training Module	☐	☐	☐	☐
14 Training on the Fact Sheet, HSP and OSHA standard has been met.	☐	☐	☐	☐
15 Employees have been informed of air monitoring results within 5 days after receipt of results.	☐	☐	☐	☐
16. Where PEL is exceeded, affected employees have been notified of results and control measures to be utilized to reduce exposure below the PEL.	☐	☐	☐	☐
17. Storage or shipping containers have been properly labeled	☐	☐	☐	☐
18. Written compliance program is available to all affected employees	☐	☐	☐	☐
CONTROL METHODS (3.2.4)				
19. Engineering controls and work practices have been utilized to reduce exposures below the PEL.	☐	☐	☐	☐
20. When controls are unable to reduce exposures below the PEL, respiratory protection is utilized.	☐	☐	☐	☐
21. Regulated areas have been established and demarcated where exposures exceed the PEL	☐	☐	☐	☐
22. Only authorized personnel with respiratory protection may enter regulated areas.	☐	☐	☐	☐
23. Where EL ≥ PEL, a written compliance program is implemented prior to commencing Work.	☐	☐	☐	☐
24. The compliance program is based on the most recent air monitoring/sampling results.	☐	☐	☐	☐
25 The compliance program is updated for new exposure monitoring data or every six months	☐	☐	☐	☐
26. All surfaces are free of accumulation of arsenic	☐	☐	☐	☐
27. Cleaning methods minimize airborne arsenic activity	☐	☐	☐	☐
28. Where vacuuming is used, vacuums are used and emptied as to minimize airborne arsenic	☐	☐	☐	☐
29. A written housekeeping and maintenance plan is in place and maintained	☐	☐	☐	☐
30. Compressed air not used to remove arsenic from surfaces	☐	☐	☐	☐
31. Employees do not eat, drink, smoke, chew tobacco/gum, or apply cosmetics in regulated areas	☐	☐	☐	☐
32. Change areas provided where EL ≥ PEL or where employees are subject to eye or skin irritation	☐	☐	☐	☐
33. Employee not allowed to leave workplace wearing clothing worn during work shift	☐	☐	☐	☐
34. Shower facilities installed and used with cleaning agents and towels, where feasible	☐	☐	☐	☐
35. Hand washing facilities provided for use by employees prior to eating, drinking, smoking, etc.	☐	☐	☐	☐
36. Eating facilities free of arsenic provided for employees working in regulated areas	☐	☐	☐	☐

PERSONAL PROTECTIVE EQUIPMENT (3.2.5)

37. Respirators are used in areas where EL ≥ PEL.	☐	☐	☐	☐
38 Respirator cartridges are replaced at the end of shift or service life indicator, where available	☐	☐	☐	☐
39. The selection of the appropriate respirator is based on the airborne arsenic concentration	☐	☐	☐	☐
40. PAPRs are provided to employees who request such a respirator	☐	☐	☐	☐
41. PPE is supplied at no cost to employees	☐	☐	☐	☐
42. Employee exposed to arsenic tri-chloride wear impervious clothing	☐	☐	☐	☐
43 Clean and dry protective clothing is provided weekly. Daily if EL ≥ 100 $\mu g/m^3$	☐	☐	☐	☐
44. Protective clothing is repair or replaced if found to be ineffective	☐	☐	☐	☐
45. Contaminated protective clothing is removed from change areas at the end of the shift	☐	☐	☐	☐
46. All clothing requiring laundering is packaged in sealed, labeled containers	☐	☐	☐	☐
47. Personnel or vendors who launder contaminated clothing are formally informed of the hazards	☐	☐	☐	☐

CH2MHILL

HS&E Self-Assessment Checklist—Arsenic

SECTION 3 Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.		
Item #	**Corrective Action Planned/Taken**	**Date Corrected**

Auditor: _____ Project Manager: _____

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP.

This checklist is to be used at locations where: (1) CH2M HILL employees are exposed to lead operations and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to lead operations.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of lead operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to lead hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with the lead standard and its requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-508.

SECTION 1

PERSONNEL SAFE WORK PRACTICES (3.1)	Yes	No	N/A	N/O
1. Work activities identified where there is a potential for lead exposure.	☐	☐	☐	☐
2. Surfaces tested where lead may be present.	☐	☐	☐	☐
3. Regulated areas have been identified and marked.	☐	☐	☐	☐
4. Personnel entering into regulated areas have been trained and medically qualified.	☐	☐	☐	☐
5. No eating, drinking, smoking, chewing, or applying cosmetics in regulated areas.	☐	☐	☐	☐
6. Respiratory protection and other controls selected as per direction of competent person.	☐	☐	☐	☐
7. Work progresses from areas of less contamination to areas of higher contamination	☐	☐	☐	☐
8. Water is added to soil prior to and during ground intrusive work to minimize dust generation	☐	☐	☐	☐
9. Personnel in vicinity of ground intrusive activities are wearing disposable coveralls or equal	☐	☐	☐	☐
10. Personnel exercising enhanced personal hygiene near contaminated soil operations	☐	☐	☐	☐

SECTION 2

	Yes	No	N/A	N/O
EXPOSURE ASSESSMENTS (3.2.2)				
11. The exposure assessment has been completed.	☐	☐	☐	☐
12. Air monitoring data supporting the exposure data is available.	☐	☐	☐	☐
13. PPE is appropriate for the type of activity and concentration.	☐	☐	☐	☐
14. Personnel have been provided PPE, hygiene facilities, biological monitoring, and training during initial exposure determination.	☐	☐	☐	☐
15. An assessment has been conducted for each process, personnel, or control.	☐	☐	☐	☐
16. New assessment conducted when a change occurs in process, personnel, or controls.	☐	☐	☐	☐
17. Air monitoring results above the AL but below the PEL have been sampled in the last 6 months.	☐	☐	☐	☐
18. Air monitoring results above the PEL have been sampled in the last 3 months.	☐	☐	☐	☐
19. The exposure assessment based on theoretical calculations, historical data, or other information has been verified.	☐	☐	☐	☐
COMMUNICATION OF HAZARDS (3.2.3)				
20. Training on the lead standard and Appendix A and B of the lead standard has been met.	☐	☐	☐	☐
21. The Written Compliance Program is available.	☐	☐	☐	☐
22. Warning Signs have been posted in areas above the PEL	☐	☐	☐	☐
23. Notification of owners, tenants, and contractors has been made.	☐	☐	☐	☐
CONTROL METHODS (3.2.4)				
24. Engineering and work practices are implemented in areas at or above the PEL.	☐	☐	☐	☐
25. The mechanical ventilation has been assessed to control lead exposures.	☐	☐	☐	☐
26. Where administrative controls are used, a job rotation schedule has been implemented.	☐	☐	☐	☐
27. A written compliance program is established and implemented.	☐	☐	☐	☐
28. All surfaces are clean of lead dust accumulation.	☐	☐	☐	☐
29. Vacuums are equipped with HEPA filters.	☐	☐	☐	☐
30 Compressed air is not used to remove lead or control lead dust.	☐	☐	☐	☐
31. Employees not allowed to eat, drink, or smoke in regulated areas.	☐	☐	☐	☐
32. Change areas are available when regulated areas are in use.	☐	☐	☐	☐
33. PPE used in lead operations not worn by employees off the worksite.	☐	☐	☐	☐
34. Personal hygiene facilities (showers and wash facilities) are available in areas above the PEL.	☐	☐	☐	☐
35. Employees required to wash hands and face at end of shift and prior to eating, smoking, etc.	☐	☐	☐	☐
36. Eating facilities, free of lead contamination, provided and readily accessible.	☐	☐	☐	☐
PERSONAL PROTECTIVE EQUIPMENT (3.2.5)				
37. Respirators are used in areas at or above the PEL.	☐	☐	☐	☐
38. The selection of the appropriate respirator is based on the airborne lead concentration.	☐	☐	☐	☐
39. All other required PPE (coveralls, gloves, goggles, etc) and equipment provided to employees.	☐	☐	☐	☐
40. PAPRs have been made available to employees who request them.	☐	☐	☐	☐
41. Clean & dry protective clothing provided weekly; daily to employees exposed over 200 □g/m^3	☐	☐	☐	☐
42. Clothing to be laundered is labeled with "Caution" signs.	☐	☐	☐	☐
43. Businesses and personnel laundering contaminated clothing have been informed of lead hazard	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: _____ **Project Manager:** _____

CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 12

Fact Sheets

&

MATERIALS SAFETY DATA SHEETS

CH2MHILL

Arsenic
Standard of Practice HSE-501

Arsenic Fact Sheet

Uses and Occurrences

The manufacture and transportation of arsenic compounds; use in the manufacture of herbicide, pesticide, fungicides, and defoliants; use in the manufacture and handling of calcium arsenate; use in the manufacture of electrical semiconductors, diodes, and solar batteries; as an additive for food and drinking water for animals; use as a preharvest desiccant, sugarcane ripener, soil sterilant, or for timber thinning; use as a bronzing or decolorizing addition in glass manufacturing; use in the production of opal glass and enamels; use as an addition to alloys to increase hardening and heat resistance; during smelting of ores; during the cleanup of soil contaminated with arsenic; military applications; and general handling, storage, and use of arsenic.

Physical Characteristics

Appearance:	Gray metal or white powder
Odor:	Garlic-like when heated
Flammable:	None
Flash Point:	None
Flammable Range:	None
Specific gravity:	5.73 for arsenic metal, 2.16 for arsenic trioxide
Stability:	Stable
Incompatibilities:	Heat, hydrogen gas, and oxidizing agents
Melting Point:	Sublimes at 613°C; -8.5°C for arsenic trioxide
Boiling Point:	Sublimes at 613°C; 130°C for arsenic trioxide

Signs and Symptoms of Exposure

Short term (Acute):	Nausea, vomiting, diarrhea, weakness, loss of appetite, cough, chest pain, giddiness, headache, and breathing difficulty.
Long term (Chronic):	Numbness and weakness in the legs and feet, skin and eye irritation, hyperpigmentation, thickening of palms and soles (hyperkeratosis), contact dermatitis, skin sensitization, warts, ulceration and perforation of the nasal septum

Modes of Exposure

Inhalation:	Dusts and Vapors
Absorption:	Liquid
Ingestion:	Dusts and Liquid

Exposure Limits

Action level	5 μg/m^3
PEL	10 μg/m^3
STEL	None
TLV	10 μg/m^3

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonably achievable
AL > EL, EL < PEL	Implement portions of the OSHA Arsenic standard and Training
EL > PEL	Implement all portions of the OSHA Arsenic Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety Glasses; contact lenses should **not** be worn
Skin:	Chemical protective gloves and body protection
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure

First Aid

Inhalation:	Move to fresh air; seek medical attention promptly
Skin:	Quick drenching with water; wash skin with soap and water; seek medical attention promptly
Eyes	Flush with water for 15 minutes, lifting the lower and upper lids occasionally; seek medical attention promptly
Ingestion:	Seek medical attention promptly

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Cadmium
Standard of Practice HSE-504

Cadmium Fact Sheet

Uses and Occurrences

Coatings on metals; nickel-cadmium storage batteries; power transmission wire; pigments in ceramic glazes, enamels, and fungicides; corrosion-resistant coatings on marine, aircraft, and motor vehicles; manufacture of nuclear reactor rods; and welding electrodes and solder.

Physical Characteristics

Appearance:	Soft, blue-white, malleable, lustrous metal or grayish-white powder; some compounds may appear as a brown, yellow, or red powdery substance.
Odor:	None.
Flammable:	Noncombustible.
Flash Point:	Not Applicable.
Flammable Range:	Not Applicable.
Specific gravity:	8.64 (metal dust).
Stability:	Very stable.
Incompatibilities:	Nitric acid, boiling concentrated hydrochloric and sulfuric acids; contact of cadmium metal dust with strong oxidizers or with elemental sulfur, selenium, and tellurium may cause fires and explosion.
Melting Point:	321°C (metal dust).

Signs and Symptoms of Exposure

Short Term (Acute): Dust and Fume: Irritation of nose and throat; inhalation may cause a delayed onset of cough, chest pain, sweating, chills, shortness of breath, and weakness. Death may occur.
Dust: Ingestion may cause nausea, vomiting, diarrhea, and abdominal cramps.

Long Term (Chronic): Dust and Fume: Repeated or prolonged exposure may cause loss of sense of smell, ulceration of the nose, shortness of breath (emphysema), kidney damage, and mild anemia. Exposure to cadmium has been reported to cause an increase incidence of cancer of the prostate in men.

Modes of Exposure

Inhalation:	Dusts and fumes.
Absorption:	None.
Ingestion:	Dusts and solids.

Exposure Limits

Action level	2.5 μg/m$^{3.}$
PEL	5.0 μg/m^{3} .
STEL	None.
PEL-C	None.
TLV	10.0 μg/m^3 ; 2.0 μg/m^3 (respirable fraction).

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonable achievable
AL > EL, EL < PEL	Implement portions of the OSHA Cadmium standard and Training
EL > PEL	Implement all portions of the OSHA Cadmium Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Splash proof or dust resistant goggles; face shield.
Skin:	Protective coveralls, gloves, and footwear.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air; seek medical attention immediately.
Skin:	Remove clothing and shoes; wash with soap or mild detergent and large amounts of water.
Eyes	Flush with water immediately, lifting the upper and lower eyelids; seek medical attention immediately.
Ingestion:	Under no circumstances should therapeutic chelation be administered; seek medical attention immediately.

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Lead
Standard of Practice HSE-508

Lead Fact Sheet

Uses and Occurrences

Lead can be found in the following: construction materials for tank linings and piping; component of lead-acid storage batteries; lead solder; plastics; steel; and pigments for paints. Lead can also be found in waste rock associated with mining activities, wood debris or stock used for electrical co-generation activities, and soil and waste associated with manufacturing activities. Elevated levels of naturally occurring lead may also be found in the soil in certain parts of this country.

Physical Characteristics

Appearance:	Bluish-white, slivery, gray metal. Very soft and easily malleable
Odor:	None
Flammable:	Noncombustible
Flash Point:	Not Applicable
Flammable Range:	Not Applicable
Specific gravity:	11.35
Stability:	very stable
Incompatibilities:	hot nitric acid, boiling concentrated hydrochloric and sulfuric acids
Melting Point:	327°C

Signs and Symptoms of Exposure

Skin and Eye: Irritation

Ingestion and Inhalation (Acute Overexposure): Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise that develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects that take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease that arise after periods of exposure as short as days or as long as several years.

Ingestion and Inhalation (Chronic Overexposure):Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain.

Modes of Exposure

Inhalation:	Dusts and fumes
Skin Absorption:	None
Ingestion:	Dusts and solids

Exposure Limits

Action level	0.03 mg/m^3
PEL	0.05 mg/m^3
STEL	None
PEL-C	None
TLV	0.05 mg/m^3

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL less than Action Level (AL)	Maintain exposure as low as reasonably achievable
EL greater than AL and less than PEL	Implement portions of the OSHA Lead Standard (i.e., initial medical monitoring) and Training
EL greater than PEL	Implement all portions of the OSHA Lead Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety Glasses
Skin:	Coveralls or disposable coveralls to keep lead off clothing and to prevent the spread of lead contamination.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air, contact a physician
Skin:	Wash with water
Eyes	Flush with water
Ingestion:	Contact a physician

PENTANE

1. Product Identification

Synonyms: Normal Pentane; n-Pentane; Amyl hydride
CAS No.: 109-66-0
Molecular Weight: 72.15
Chemical Formula: CH3(CH2)3CH3
Product Codes:
J.T. Baker: 9331, 9333, T007
Mallinckrodt: 1916, 6145, 6170, 6172, V557

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Pentane	109-66-0	98 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Vapors have a mild narcotic effect. Symptoms of overexposure may include drowsiness and irritation of the respiratory passages. Greater exposure may cause unconsciousness and death.

Ingestion:

Tends to vaporize when swallowed causing aspiration into the lungs. The result can be a rapid fall in oxygen content with asphyxia and consequent brain damage or cardiac arrest.

Skin Contact:

Causes skin irritation, cracking or flaking due to dehydration and defatting action.

Eye Contact:

Very high vapor concentrations and liquid may cause irritation, redness, and pain.

Chronic Exposure:

Prolonged skin contact may cause drying, cracking, and dermatitis.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin conditions or impaired respiratory function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Wash clothes before reuse. Get medical attention if irritation develops or persists.

Eye Contact:

Wash thoroughly with running water. Get medical advice if irritation develops.

5. Fire Fighting Measures

Fire:

Flash point: -49C (-56F) CC
Autoignition temperature: 260C (500F)
Flammable limits in air % by volume:
lel: 1.5; uel: 7.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Water may be ineffective. Water spray may be

used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Vapor explosion hazard exists indoors, outdoors, or in sewers.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. DANGER! DO NOT OPEN Unless Contents Are At Room temperature (72F) or Below. Allow at least 24 hours for material to cool to room temperature before opening container. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)
-ACGIH Threshold Limit Value (TLV):
600 ppm (TWA)
NIOSH (REL) TWA 350 mg/m3, 1800 mg/m3Ceiling
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred

because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has questionable warning properties.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Clear, colorless solution.

Odor:

Mild, gasoline-like.

Solubility:

Insoluble in water.

Specific Gravity:

0.63 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

36C (97F)

Melting Point:

-130C (-202F)

Vapor Density (Air=1):

2.5

Vapor Pressure (mm Hg):

426 @ 20C (68F)

Evaporation Rate (BuAc=1):

28.6

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Inhalation, rat, LC50: 364 g/m3/4H

```
---\Cancer Lists\------
Ingredient                        Known    Anticipated    IARC Category
--------------------------------   -----    -----------    -------------
Pentane (109-66-0)                 No          No            None
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. This material has an estimated bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of greater than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal

disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: PENTANES
Hazard Class: 3
UN/NA: UN1265
Packing Group: I
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: PENTANES
Hazard Class: 3
UN/NA: UN1265
Packing Group: I
Information reported for product/size: 20L

15. Regulatory Information

```
  \Chemical Inventory Status - Part 1\--------------------------
  Ingredient                                        TSCA  EC   Japan
Australia
  ----------------------------------------------  ----  ---  -----  ------
  Pentane (109-66-0)                                Yes  Yes   Yes      Yes

  --------\Chemical Inventory Status - Part 2\----------------------------
                                                          --Canada--
  Ingredient                                        Korea  DSL   NDSL  Phil.
  ----------------------------------------------  -----  ---   ----  -----
  Pentane (109-66-0)                                Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\--------
-SARA 302-    ------SARA 313------
  Ingredient                                  RQ    TPQ     List  Chemical
Catg.
  ---------------------------       -------  ---   -----   ----  ---------
  Pentane (109-66-0)                          No    No      No         No

  --------\Federal, State & International Regulations - Part 2\------------
                                                         -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Pentane (109-66-0)                          No          No         Yes
```

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: Yes
Reactivity: No          (Pure / Liquid)
```

Australian Hazchem Code: 3[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **4** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL OR FATAL IF SWALLOWED. HARMFUL IF INHALED. AFFECTS CENTRAL NERVOUS SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Avoid breathing vapor or mist.
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
DO NOT OPEN Unless Contents Are At Room Temperature (72F) or Below For At Least 24 Hours.
Label First Aid:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3, 8.
Disclaimer:
****
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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

HYDROCHLORIC ACID

OLIN CORPORATION -- HCL (MURIATIC ACID), CPE298002

==========
MSDS Safety Information
==========
FSC: 6810
NIIN: 00-045-8918
MSDS Date: 03/28/1997
MSDS Num: CHVMT
Product ID: HCL (MURIATIC ACID), CPE298002
MFN: 02
Responsible Party
Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Info Phone Number: 203-356-3449
Emergency Phone Number: 800-OLIN-911(1-800-654-6911)
Published: Y
==========
Contractor Summary
==========
Cage: 99530
Name: OLIN CORPORATION
Address: 501 MERRITT 7
Box: 4500
City: NORWALK CT 06856-4500
Phone: 203-750-3000/800-511-MSDS
==========
Item Description Information
==========
==========
Ingredients
==========
Cas: 7647-01-0
RTECS #: MW4025000
Name: HYDROCHLORIC ACID (SARA 302/313) (CERCLA)
% Wt: 8-38
OSHA PEL: C 5 PPM
ACGIH TLV: C 5 PPM
EPA Rpt Qty: 5000 LBS
DOT Rpt Qty: 5000 LBS

Cas: 7732-18-5
Name: WATER
% Wt: 62-93
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Name: SUP DAT: OCCUR TO ENTIRE GI TRACT, INCL STOM & INTESTINES,
CHARACTERIZED BY NAUS, VOMIT, DIARR, ABDOM PAIN,

Name: ING 3: BLEEDING, &/TISS ULCERATION. INGEST CAUSES SEVERE DAMAGE TO GI
TRACT W/POTENTIAL TO CAUSE PERFORATION.

Name: ING 4: CHRONIC: INHAL: RPTD/PRLNG EXPOS TO CONCS >ACCEPTED OCCUP LIMS
MAY CAUSE DENTAL DISCOLORATION & EROSION

Name: ING 5: OF TEETH. SKIN: RPTD CONT W/MIST HAS BEEN REPORTED TO CAUSE
CONT
DERM (SKIN RASH). PRLNG/RPT EXPOS W/LIQ

Name: ING 6: MAY CAUSE PERM DMG. INGEST: INGEST OF SIGNIFICANT AMTS IS
UNLIKELY
BECAUSE OF ITS ACUTE CORR ACTION.

Name: FIRST AID PROC: INHAL: IF PERS EXPERIENCES NAUS, HDCH/DIZZ, PERS
SHOULD
STOP WORK IMMED & MOVE TO FRESH AIR

Name: ING 8: UNTIL THESE SYMPS DISAPPEAR. IF BRTHG IS DFCLT, ADMIN OXYGEN,
KEEP
PERS WARM & AT REST. CALL MD. IN THE

Name: ING 9: EVENT THAT INDIVIDUAL INHALES ENOUGH VAP TO LOSE
CONSCIOUSNESS,
PERS SHOULD BE MOVED TO FRESH AIR AT ONCE

Name: ING 10: & MD SHOULD BE CALLED IMMED. IF BRTHG HAS STOPPED, ARTF RESP
SHOULD BE GIVEN IMMED. IN ALL CASES, ENSURE

Name: ING 11: ADEQUATE VENTILATION AND PROVIDE RESPIRATORY PROTECTION
BEFORE
THE PERSON RETURNS TO WORK.

Name: SPILL PROC: REQS. HAZ CONCS IN AIR MAY BE FOUND IN LOC SPILL AREA &
IMMED DOWNWIND. AIR RELEASE. VAPS MAY BE

Name: ING 13: SUPPRESSED BY USE OF WATER FOG/VAP SUPPRESSANT FOAM. DIKE &
CONTAIN ALL RUN-OFF WATER FOR TREATMENT AS

Name: ING 14: HAZ WASTE. WATER RELEASE: THIS MATL IS HVR/AIR & SOL IN
WATER. CONTAIN CONTAM WATER BY BLDG A DIKE OF

Name: ING 15: COMPATIBLE ABSORBS. VACUUM/PUMP MATL TO NEUT CONTR & TREAT.
LAND SPILL: COMPATIBLE ABSORBS: SAND, CLAY

Name: ING 16: SOIL & COMMERCIAL ABSORBS. SPILL RESIDUERS: DISP OF PER
GUIDELINES UNDER WASTE DISP. THIS MATL MAY BE

Name: ING 17: NEUT FOR DISP; YOU ARE REQUESTED TO CONT OCEAN AT 800-OLIN-
911
BEFORE BEGINNNING ANY SUCH OPERATION.
==========
Health Hazards Data
==========
LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
Skin: YES

Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: INHAL: MIST/VAP/HYDROGEN CHLORINE GAS MAY CAUSE IRRIT OF MUC MEMB & RESP TRACT W/SYMPS OF BURNING, CHOKING * COUGHING. AT EXPOS CONCS >TLV, DMG MAY OCCUR TO MUC MEMB (ULCERATIONS OF NOSE & THRO AT) & RESP TRACT. AT THESE HIGH CONCS, SEV BRTHG DFCLTYS MAY OCCUR WHICH MAY BE DELAYED IN ONSET & MAY (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT.
Signs And Symptoms Of Overexposure: HLTH HAZ: BE DUE TO PULM EDEMA (FLUID IN LUNG) /LARYNGEAL EDEMA/SPASM. SKIN: HYDROFLUORIC ACID MIST MAY RAPIDLY CAUSE SKIN INFLAMM & BURNS. DIRECT CONT OF LIQ WILL BE CORR TO SKIN & CAN CAUSE SEV IRRI T &/BURNS CHARACTERIZED BY REDNESS, SWELL & SCAB FORM. POTENTIAL FOR SCARRING & ULCERATION OF CONTACTED TISS (SUP DAT)
Medical Cond Aggravated By Exposure: RESPIRATORY AND CARDIOVASCULAR DISEASE.
First Aid: EYES: IMMED FLUSH W/LGE AMTS OF WATER FOR AT LEAST 15 MIN, OCCAS LIFTING UPPER & LOWER EYELIDS. CALL MD AT ONCE. SKIN: IMMED FLUSH W/WATER FOR AT LEAST 15 MIN. CALL MD. IF CLTHG COMES IN CONT W/PROD, IT SHOULD BE REMOVED IMMED & LAUNDERED BEFORE REUSE. INGEST: IMMED DRINK LGE QTYS OF WATER. DO NOT INDUCE VOMIT. CALL MD AT ONCE. DO NOT GIVE ANYTHING BY MOUTH IF PERS IS UNCON/HAVING CONVLS.

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Handling and Disposal
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Spill Release Procedures: FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300. REPORTABLE QUANTITY: THIS PROD IS SUBJECT TO REPORTABLE QTY W/RESPECT TO HYDROFLUORIC ACID. RQ'S ARE SUBJECT TO CHANGE & REFERENCE SHOU LD BE MADE TO 40 CFR 302.4 FOR CURRENT
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: CARE MUST BE TAKEN TO PVNT ENVIRON CONTAM FROM USE OF MATL. THE USER HAS THE RESPONSIBILITY TO DISP OF UNUSED MATL, RESIDUES & CONTRS IN COMPLIANCE W/ALL RELEVANT LOC, STATE & FED LAWS & REGS REGARDIN G TREATMENT, STOR & DISP FOR HAZ & NON HAZ WASTES
Handling And Storage Precautions: DO NOT TAKE INTERNALLY. AVOID CONT W/SKIN, EYES & CLTHG. AVOID BRTHG MIST/VAP. STORE IN COOL, CLEAN, WELL-VENTED AREA. DO NOT STORE >100F (>38C).
Other Precautions: DO NOT EXPOSE TO DIRECT LIGHT. SHELF LIFE LIMITATIONS: 1 YEAR. GLASS/POLYETHYLENE CONTRS REC. WHEN SHIPPED W/OXIDIZERS, MUST BE SEPARATED BY 18 INCHES, W/WOOD PALLETS & ABSORB MATL IN BETWEEN.
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Fire and Explosion Hazard Information
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Extinguishing Media: ON SMALL FIRES, USE DRY CHEMICAL OR CARBON DIOXIDE. ON LARGE FIRE, USE WATER.
Fire Fighting Procedures: WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). USE WATER TO COOL CONTAINERS EXPOSED TO FIRE.
Unusual Fire/Explosion Hazard: NOT COMBUSTIBLE BUT CONTACT WITH COMMON METALS

PRODUCES FLAMMABLE HYDROGEN GAS. MAY ALSO RELEASE CHLORINE GAS BY REACTION
WITH OXIDIZING AGENTS.

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Control Measures

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Respiratory Protection: NONE SPECIFIED BY MANUFACTURER.ALLY REQUIRED. IF VAPORS, MISTS, OR AEROSOLS ARE GENERATED, WEAR A NIOSH APPROVED FULL FACEPIECE, EQUIPPED WITH CHEMICAL CARTRIDGES APPROVED FOR HYDROGEN CHLORIDE.

Ventilation: N/R EXHST VENT IS REC IF VAPS, MIST/AEROSOLS ARE GENERATED.OTHERWISE, USE GOOD GENERAL ROOM VENTILATION.

Protective Gloves: NEOPRENE GLOVES.

Eye Protection: ANSI APRV CHEM SFTY GOGGS&FFACE SHLD(FPN

Other Protective Equipment: ANSI APPRVD EMER EYEWASH & DELUGE SHOWER (FP N).
BOOTS, APRON.FULL IMPERMEABLE SUIT REC IF EXPOS TO LGE PORTION OF BODY.

Work Hygienic Practices: UPON CONTACT WITH SKIN OR EYES, WASH OFF WITH WATER.

Supplemental Safety and Health: MATLS TO AVOID: METALLIC OXIDES, MAGNESIUM, OLEUM, PERCHLORIC ACID, ZINC. EFTS OF OVEREXP: ALSO EXISTS. EYE: EXPOS TO MIST MAY RSLT IN IRRIT &/SEV BURNS W/PERM DMG & POSS LOSS OF SIGHT. DIRECT CONT W/ LIQ WILL BE CORR TO EYE W/RSLTG SEV BURNS, POTENTIAL VISUAL
IMPAIRMENT/LOSS OF SIGHT. INGEST: IRRIT &/BURNS CAN

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Physical/Chemical Properties

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B.P. Text: >212F,100C

M.P/F.P Text: -101F,-74C

Vapor Pres: <210 @ 20C

Vapor Density: 1.3

Spec Gravity: 1.035-1.188

PH: <1

Evaporation Rate & Reference: APPROX 1 (WATER=1)

Solubility in Water: COMPLETE

Appearance and Odor: CLEAR, COLORLESS LIQUID; PUNGENT, SUFFOCATING ODOR

Percent Volatiles by Volume: 100

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Reactivity Data

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Stability Indicator: YES

Stability Condition To Avoid: HEAT, EXPOSURE TO SUNLIGHT.

Materials To Avoid: ALKALINE MATLS, ALUMINUM, AMINES, CARBONATES, IRON, SULFURIC ACID, HYDROXIDES, LEATHER & OTHER FABRICS, (SUP DAT)

Hazardous Decomposition Products: FLAMM HYDROGEN GAS BY REACTION W/MANY METALS
(E.G. ALUMINUM). CHLORINE GAS IS RELEASED BY REACTION W/OXIDIZING AGENTS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

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Toxicological Information

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Ecological Information

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MSDS Transport Information
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Regulatory Information
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Other Information
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HAZCOM Label
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Product ID: HCL (MURIATIC ACID), CPE298002
Cage: 99530
Company Name: OLIN CORPORATION
Street: 501 MERRITT 7
PO Box: 4500
City: NORWALK CT
Zipcode: 06856-4500
Health Emergency Phone: 800-OLIN-911; (1-800-654-6911)
Label Required IND: Y
Date Of Label Review: 06/23/1998
Status Code: C
Label Date: 06/23/1998
Origination
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Slight
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: INHAL: MIST/VAP/HCL GAS MAY CAUSE IRRIT OF MUCOUS MEMB & RESP TRACT W/BURN SYMPS, CHOKE & COUGH. AT EXPOS >TLV, MAY DMG MUC MEMB & RESP TRACT. AT HIGH CONC, SEV BRTHG DFCLTYS WHICH MAY BE DELAY ED IN ONSET & BE DUE TO PULM EDEMA, LARYNGEAL EDEMA/SPASM. SKIN: HCL ACID MIST MAY CAUSE INFLAM & BURNS. DIRECT CONT OF LIQ IS CORR CAUSING SEV IRRIT &/BURNS & ULCER OF CONTACTED TISS. EYE: EXPOS TO M IST MAY CAUSE IRRIT &/SEV BURNS W/PERM DMG & POSS SIGHT LOSS. INGEST: IRRIT &/BURNS CAN OCCUR TO GI TRACT. CHRONIC: RPTD/PRLNG EXPOS TO HI CONC MAY CAUSE DENTAL DISCOLOR & EROSION. SKIN: DERM. PERM DM G. INGEST: INLIKELY BECAUSE OR ACUTE CORR ACTION.

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The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or
viability by or to any person or persons outside the Department of Defense
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utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department Of Defense or other government situation.

NITRIC ACID

SPEX INDUSTRIES INC -- NITRIC ACID BLANK, PLBLK-HN03 -- 6850-00N020537

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MSDS Safety Information

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FSC: 6850
MSDS Date: 03/04/1988
MSDS Num: BLRMY
LIIN: 00N020537
Tech Review: 08/02/1995
Product ID: NITRIC ACID BLANK, PLBLK-HN03
Responsible Party
Cage: 07977
Name: SPEX INDUSTRIES INC
Address: 3880 PARK AVENUE
City: EDISON NJ 08820 US
Info Phone Number: 201-549-7144
Emergency Phone Number: 201-549-7144
Preparer's Name: LINDA OLCHVARY
Review Ind: N

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Contractor Summary

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Cage: 07977
Name: SPEX CERTIPREP INC
Address: 203 NORCROSS AVE
City: METUCHEN NJ 08840 US
Phone: 732-549-7144

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Ingredients

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Cas: 7697-37-2
RTECS #: QU5775000
Name: NITRIC ACID (SARA III)
% by Wt: 5
OSHA PEL: 2 PPM/4 STEL
ACGIH TLV: 2 PPM/4 STEL; 9192
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS
Ozone Depleting Chemical: N

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Health Hazards Data

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LD50 LC50 Mixture: LC50:(INHALE/RAT) 224 PPM(NO_2)/30M
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: CONC NITRIC ACID MAY BE FATAL IF TOO MUCH IS INHALED/ABSORBED THRU SKIN.CONC NITRIC ACID VAP/MIST IS IRRITANT OF EYES, MUC MEMB & SKIN.IN CONT W/EYES, PRODUCES SEVERE BURNS WHICH MAY

RESULT IN PERMANE NT DMG & VISUAL IMPAIRMENT.ON SKIN, LIQ/CONC VAP PRODUCES IMMED, SEVERE & PENETRATING BURNS; CONC (SEE EFTS OF OVEREXP)

Explanation Of Carcinogenicity: NOT RELEVANT

Signs And Symptoms Of Overexposure: HLTH HAZ:SOLN CAUSES DEEP ULCERS & STAINS SKIN BRIGHT YELLOW/YELLOWISH BROWN COLOR.VAP & MIST MAY ERODE EXPSD TEETH W/PRLNGD EXPOS.INGEST OF LIQ WILL CAUSE IMMED PAIN & BURNS OF MOUTH, ESOPHAGUS & GI TRACT.INHAL MAY BE FATAL CAUSING SPASM,INFLAM & EDEMA OF LARYNX & BRONCHI, CHEM PNEUM & PULM EDEMA. SYMP (SUPP DATA)

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES OCCASIONALLY LIFTING UPPER AND LOWER EYELIDS. SKIN: REMOVE CONTAMINATED CLOTHING, THEN FLUSH WITH WATER FOR AT LEAST 15 MINUTES. WASH CLOTHING THOROUGHLY BEFORE REUSE. INHAL: MOVE TO FRESH AIR. IF IRRITATION CONTINUES, CALL MD IMMEDIATELY. INGEST: CALL MD IMMEDIATELY (FP N).

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Handling and Disposal

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Spill Release Procedures: VENT AREA. DILUTE SPILL W/WATER & NEUT W/ SODA ASH, LIMESTONE, ETC. WIPE UP & PUT IN A SEALED CNTNR FOR PROPER DISP. WASH SPILL SITE OFF W/WATER AFTER MATL PICK UP IS COMPLETE. WEAR CHEM RESISTANT GLA SSES, GLOVES & CLTHG. WEAR NIOSH/MSHA APPRVD RESP.

Neutralizing Agent: SEE SPILL/RELEASE PROCEDURES.

Waste Disposal Methods: CONTACT LOCAL HAZARDOUS OR CHEMICAL WASTE DISPOSAL AGENCY FOR REGULATIONS. DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N).

Handling And Storage Precautions: CONCENTRATED NITRIC ACID WILL ATTACK SOME FORMS OF PLASTICS, RUBBER AND COATINGS. STORE AT ROOM TEMPERATURE. KEEP TIGHTLY SEALED WHEN NOT IN USE.

Other Precautions: HAVE IMMEDIATE AVAILABILITY OF AN EYE WASH IN CASE OF EMERGENCY. AVOID INHALATION, INGESTION AND CONTACT WITH EYES AND SKIN.

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Fire and Explosion Hazard Information

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Flash Point Text: NOT COMBUSTIBLE

Extinguishing Media: APPROPRIATE TO SURROUNDING FIRE CONDITIONS.

Fire Fighting Procedures: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). CONC HNO3 REACTS EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS SUCH AS; ALCOHOL, WOOD, (SEE SUPP DATA)

Unusual Fire/Explosion Hazard: CONC HNO3 IS NOT COMBUST, BUT IS STRONG OXIDIZER & ITS HEAT OF RXN W/REDUCING AGENTS/COMBUST MAY CAUSE IGNIT. CAN REACT W/METALS TO RELEASE FLAM HYDROGEN GAS.

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Control Measures

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Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR.

Ventilation: USE IN A CHEMICAL FUME HOOD.

Protective Gloves: CHEMICAL RESISTANT GLOVES.

Eye Protection: CHEM WORK GOGG/FULL LENGTH FACESHLD(FPN)

Other Protective Equipment: CHEMICAL RESISTANT CLOTHING. EYE WASH IN CASE OF EMERGENCY AND A LAB COAT. DELUGE SHOWER (FP N).

Work Hygienic Practices: WASH CAREFULLY AFTER USE.

Supplemental Safety and Health: FIRE FIGHT PROC:TURPENTINE/METAL POWDERS/ HYDROGEN SULFIDE/ETC. MATLS TO AVOID: ALCOHOL/WOOD/TURPENTINE, METAL POWDERS/HYDROGEN SULFIDE/ETC. CONT W/STRONG BASES WILL CAUSE VIOLENT SPLATTERING.EFTS OF OVEREXP:INCL BURNING SENSATION, COUGH, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HDCH, NAUS & VOMIT.

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Physical/Chemical Properties
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HCC: C1
Spec Gravity: APPROXIMATELY 1
Solubility in Water: SOLUBLE
Appearance and Odor: TRANSPARENT WITH AN ACRID ODOR.
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Reactivity Data
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Stability Indicator: YES
Stability Condition To Avoid: ELEVATED TEMPERATURES MAY CAUSE CONTAINERS TO BURST AND LIBERATE TOXIC NOX.
Materials To Avoid: CONC HNO3 IS A POWERFUL OXIDIZING AGENT. IT REACTS EXPLO W/COMBUST ORG/READILY OXIDIZABLE MATLS SUCH AS; (SUPP DATA)
Hazardous Decomposition Products: WILL RELEASE TOXIC NITROGEN OXIDE FUMES AND VAPORS.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT
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Toxicological Information
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Ecological Information
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MSDS Transport Information
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Regulatory Information
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Other Information
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Transportation Information
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Responsible Party Cage: 07977
Trans ID NO: 25204
Product ID: NITRIC ACID BLANK, PLBLK-HN03
MSDS Prepared Date: 03/04/1988
Review Date: 01/17/1992
Article W/O MSDS: N
Multiple KIT Number: 0
Unit Of Issue: NK
Container QTY: NK
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Detail DOT Information
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DOT PSN Code: KFD
DOT Proper Shipping Name: NITRIC ACID
DOT PSN Modifier: OTHER THAN RED FUMING, WITH NOT MORE THAN 70 PERCENT NITRIC ACID
Hazard Class: 8
UN ID Num: UN2031
DOT Packaging Group: II

Label: CORROSIVE
Special Provision: B2,B47,B53,T9,T27
Non Bulk Pack: 158
Bulk Pack: 242
Max Qty Pass: FORBIDDEN
Max Qty Cargo: 30 L
Vessel Stow Req: D
Water/Ship/Other Req: 44,66,89,90,110,111
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Detail IMO Information
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IMO PSN Code: KPF
IMO Proper Shipping Name: NITRIC ACID
IMO PSN Modifier: ,OTHER THAN RED FUMING,ALL CONCENTRATIONS
IMDG Page Number: 8195
UN Number: 2031
UN Hazard Class: 8
IMO Packaging Group: I/II
Subsidiary Risk Label: -
EMS Number: 8-03
MED First Aid Guide NUM: 610
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Detail IATA Information
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IATA PSN Code: RWI
IATA UN ID Num: 2031
IATA Proper Shipping Name: NITRIC ACID
IATA PSN Modifier: ,OTHER THAN RED FUMING, WITH 20% OR LESS NITRIC ACID
IATA UN Class: 8
IATA Label: CORROSIVE
UN Packing Group: II
Packing Note Passenger: 807
Max Quant Pass: 1L
Max Quant Cargo: 30L
Packaging Note Cargo: 813
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Detail AFI Information
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AFI PSN Code: RWI
AFI Symbols: T
AFI Proper Shipping Name: NITRIC ACID
AFI PSN Modifier: ,OTHER THAN RED FUMING, WITH LESS THAN 20% NITRIC ACID
AFI Hazard Class: 8
AFI UN ID NUM: UN2031
AFI Packing Group: II
AFI Label: CORROSIVE
Back Pack Reference: A12.11
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HAZCOM Label
==========
Product ID: NITRIC ACID BLANK, PLBLK-HN03
Cage: 07977
Company Name: SPEX CERTIPREP INC
Street: 203 NORCROSS AVE
City: METUCHEN NJ
Zipcode: 08840 US
Health Emergency Phone: 201-549-7144

Date Of Label Review: 10/18/1991
Label Date: 10/18/1991
Chronic Hazard IND: N
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: CORROSIVE & FATAL IF TOO MUCH IS INHALED/ABSORBED THRU SKIN. CAUSES SEVERE EYE BURNS WHICH MAY RESULT IN PERMANENT DMG & VISUAL IMPAIRMENT. CAUSES SKIN BURNS, DEEP ULCERS & YELLOW/YELLOWISH BRO WN STAINS ON SKIN. SWALLOWING LIQ WILL CAUSE IMMEDIATE PAIN & BURNS OF MOUTH, ESOPHAGUS & GI TRACT. INHAL MAY BE FATAL CAUSING SPASM, INFLAM & EDEMA OF LARYNX & BRONCHI, CHEM PNEUMONIA & PULM EDEMA. A VOID INHAL, INGEST & EYE/SKIN CONTACT. CHRONIC EFTS: VAPOR & MIST MAY ERODE EXPOSED TEETH WITH PROLONGED EXPOSURE.
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ISOBUTYLENE

AIRGAS INC -- ISOBUTYLENE-C4H8

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MSDS Safety Information

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FSC: 6665
NIIN: 01-214-8247
MSDS Date: 01/16/1998
MSDS Num: CLCRL
Product ID: ISOBUTYLENE-C4H8
MFN: 01
Responsible Party
Cage: UO451
Name: AIRGAS INC
Address: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA 19087-5240
Info Phone Number: 1-610-687-5253
Emergency Phone Number: (800)424-9300
Resp. Party Other MSDS No.: DOCUMENT NUMBER: 1031
Chemtrec IND/Phone: (800)424-9300
Published: Y

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Preparer Co. when other than Responsible Party Co.

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Cage: 0KBF5
Name: CHEMICAL SAFETY ASSOCIATES INC
Address: 9163 CHESAPEAKE DR
City: SAN DIEGO CA 92123-1002

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Contractor Summary

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Cage: UO451
Name: AIRGAS INC
Address: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA 19087-5240
Phone: 1-610-687-5253
Cage: 7Z016
Name: KAMPI COMPONENTS CO., INC.
Address: 210 RT 13
Box: 721
City: BRISTOL PA 19007-3517
Phone: 215-736-2000
Contract Number: SP0440-00-M-JA63

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Item Description Information

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Item Manager: S9G
Item Name: CALIBRATION GAS CYL
Specification Number: NONE
Type/Grade/Class: NONE
Unit of Issue: EA
UI Container Qty: 1
Type of Container: CYLINDER

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Ingredients
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Cas: 115-11-7
RTECS #: UD0890000
Name: ISOBUTYLENE
> Wt: 90.

Name: MAXIMUM IMPURITIES
< Wt: 1.
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Health Hazards Data
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Route Of Entry Inds - Inhalation: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: THE MOST SIGNIFICANT HAZARD IS OXYGEN-DEFICIENT
ATOMSPHERES. AT HIGH CONCENTRATIONS UNCONSCIOUSNESS OR DEATH MAY OCCUR.
CONTACT WITH LIQUIDFIED GAS OR RAPIDLY EXPANDING GASES MAY CAUSE FROSTBIT E.
ISOBUTYLENE ALSO HAS SOME DEGREE OF ANESTHETIC ACTION AND CAN BE MILDLY
IRRITATING TO THE MUCOUS MEMBRANES. CHRONIC: NO KNOWN ADVERSE HEALTH EFFECTS
ASSOCIATED WITH CHRONIC EXPOSURE TO ISOBUTYLENE. TARGET ORGANS: RESPIRATORY
SYSTEM.
Explanation Of Carcinogenicity: ISOBUTYLENE IS NOT FOUND ON THE FOLLOWING
LISTS: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER
CONSIDERED TO BE NOR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE
AGENCIES.
Signs And Symptoms Of Overexposure: INHALATION: SYMPTOMS OF OXYGEN DEFICIENCY
INCLUDE RESPIRATORY DIFFICULTY, HEADACHES, RINGING IN EARS, DIZZINESS,
DROWSINESS, UNCONSCIOUSNESS, NAUSEA, VOMITING, AND DEPRESSION OF ALL THE
SENSES. UNDER SOME CIRCUSTANCES OF OVEREXPOSURE, DEATH MAY OCCUR.
First Aid: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO
ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. AT A MINIMUM,
SELF-CONTAINED BREATHING APPARATUS AND FIRE-RETARDANT PERSONAL PROTECTIVE
EQUIPMENT SHOULD BE WORN. FIRE PROTECTION MUST BE PROVIDED DURING RESCUE
SITUATIONS. REMOVE VICTIMS(S) TO FRESH AIR. TRAINED PERSONNEL SHOULD
ADMINISTER OXYGEN AND/OR CARDIO-PULMONARY RESUS CITATION, IF NECESSARY. IN
CASE OF FROSTBITE, PLACE FROSTBITEN PART IN WARM WATER. (CONTD. SEE OTHER
INFORMATION)
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Handling and Disposal
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Spill Release Procedures: UNCONTROLLED RELEASES SHOULD BE COVERED BY TRAINED

PERSONNEL USING PRE-PLANNED PROCEDURES. PROPER PROTECTIVE EQUIPMENT SHOULD BE
USED. ADEQUATE FIRE PROTECTION MUST BE PROVIDED. MINIMUM PERSONAL PROTE CTIVE
EQUIPMENT SHOULD BE LEVEL B: FIRE RETARDANT PROTECTIVE CLOTHING, GLOVES
RESISTANT TO TEARS AND SELF CONTAINED BREATHING APPARATUS. USE NON-SPARKING
TOOLS AND (CONTD. SEE "WASTE DISPOSAL))
Waste Disposal Methods: WASTE DISPOSAL MUST BE IN ACCORDANCE WITH APPROPRIATE
FEDERAL, STATE, AND LOCAL REGULTIONS. RETURN CYLINDERS WITH ANY RESIDUAL
PRODUCT TO AIRGAS INC. DO NOT DISPOSE OF LOCALLY. (CONTD. FROM "SPILL REL
EASE") EQUIPMENT. IF NOT ABLE TO STOP RELEASE, ALLOW GAS TO RELEASE IN PLACE
OR REMOVE TO A SAFE ARE A AND ALLOW GAS TO RELEASE.
Handling And Storage Precautions: STORE IN COOL(,< 125F), DRY,
WELL-VENTILATED AREA AWAY FROM SOURCES OF HEAT, IGNITION, DIRECT SUNLIGHT.
COMPRESSED GASES PRESENT SAFETY HAZARD. STORE AWAY FROM OXIDIZERS, OXIGEN,
CHLORINE, FLUORINE, H EAVILY TRAFFICKED AREAS, EMERGENCY EXITS. POST "NO
SMOKING OR NO OPEN FLAMES " SIGNS.
Other Precautions: ELECTRICAL EQUIPMENT SHOULD BE NON-SPARKING. MOVE CYLINDERS
WITH HAND TRUCK. DO NOT DRAG, ROLL, DROP, STRIKE EACH OTHER. SECURE FIRMLY.
DO NOT HEAT CYLINDER OR USE OILS OR GREASE ON GAS-HANDLING FITTI NGS OR
EQUIPMENT. USE DESIGNATED CGA FITTINGS. DO NOT USE ADAPTERS. USE CHECK VALVE
OR TRAP IN DISCH ARGE LINE.
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Fire and Explosion Hazard Information
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Flash Point Method: CC
Flash Point: <-10.C, 14.F
Autoignition Temp: =465.C, 869.F
Lower Limits: 1.8
Upper Limits: 9.6
Extinguishing Media: EXTINGUISH ISOBUTYLENE FIRES BY SHUTTING OFF THE SOURCE OF
THE GAS. USE WATER SPRAY OR A FOAM AGENT TO COOL FIRE-EXPOSED CONTAINERS,
STRUCTURES AND EQUIPMENT.
Fire Fighting Procedures: STRUCTURAL FIREFIGHTERS MUST WEAR SELF-CONTAINED
BREATHING APPARATUS AND FULL PROTECTIVE EQUIPMENT. THE BEST FIRE-FIGHTING
TECHNIQUE MAY BE SIMPLY TO LET THE BURNING GAS ESCAPE FROM THE PRESSURIZED CY
LINDER, TANK CAR, OR PIPELINE. STOP THE LEAK BEFORE EXTINGUISHING FIRE.
LEAKING GAS COULD EXPLOSIVELY RE-IGNITE.
Unusual Fire/Explosion Hazard: WHEN INVOLVED IN A FIRE, THIS MATERIAL MAY
IGNITE AND PRODUCE TOXIC GASES, INCLUDING CARBON MONOXIDE AND CARBON DIOXIDE.

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Control Measures
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Respiratory Protection: MAINTAIN OXYGEN LEVELS ABOVE 19.5% IN THE WORKPLACE.
USE SUPPLIED AIR RESPIRATORY PROTECTION IF OXYGEN LEVELS ARE BELOW 19.5% OR
DURING EMERGENCY RESPONSE TO A RELEASE OF ISOUTYLENE. IF RESPIRATORY PR
OTECTION IS REQUIRED, FOLLOW THE REQUIREMENTS OF THE FEDERAL OSHA RESPIRATORY
STANDARD (29 CFR 1910.134) OR EQUIVALENT STATE STANDARDS.
Ventilation: USE ADEQUATE VENTILATION. LOCAL EXHAUST VENTILATION IS PERFERRED,
BECAUSE IT PREVENTS ISOBUTYLENE DISPERSION INTO THE WORKPLACE BY EMLIMINATING
IT AT THE SOURCE
Protective Gloves: RESISTANT TO TEARS. USE LOW-TEMPERATURE PROTECTIVE GLOVED
(E.G., KEVLAR)
Eye Protection: SPLASH GOGGLES OR SAFETY GLASSES.
Other Protective Equipment: USE BODY PROTECTION . TRANSFER OF LARGE QUANTITIES
UNDER PRESSURE MAY REQUIRE PROTECTIVE EQUIPMET TO PROTECT FROM SPLASHES OF
LIQUIDFIED PRODUCT AS WELL AS FIRE RETARANAT ITEMS.
Work Hygienic Practices: AS WITH ALL CHEMICALS, AVOID GETTING ISOBUTYLENE IN
YOU. DO NOT EAT OR DIRNK WHILE HANDLING CHEMICALS. BEWARE OF ANY SIGNS OF
DIZZINESS OR FATIGUE; EXPOSURES TO FATAL CONCENTRATIONS OF ISOBUTYLENE COULD
Supplemental Safety and Health: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER.
IF WARM WATER NOT AVAILABLE, OR IMPRACTICAL TO USE, WRAP AFFECTED PARTS
GENTLY IN BLANKETS. (SEE OTHER INFORMATION)
==========
Physical/Chemical Properties
==========
HCC: G2
Boiling Point: =-6.9C, 19.6F
Melt/Freeze Pt: =-140.C, -220.F
Vapor Pres: 39 PSIA
Vapor Density: 0.15LB/FT3
Spec Gravity: 1.997
PH: NA
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID/ GAS WITH THE UNPLEASANT ODOR OF BURNING
COAL.

==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: CONTACT WITH INCOMPATIBLE MATERIALS AND EXPOSURE

TO HEAT, SPARKS, AND ORTHER SOURCES OF IGNITION. CYLINDERS EXPOSED TO HIGH
TEMPERATURES OR DIRECT FLAME CAN RUPTURE OR BURST.
Materials To Avoid: STRONG OXIDIZERS (E.G., CHLORINE, BROMINE PENTAFLUORIDE,
OXYGEN, OXYGEN DIFLUORIDE, AND NITROGEN TRIFLUORIDE).
Hazardous Decomposition Products: WHEN IGNITED IN THE PRESENCE OF OXYGEN, THIS
GAS WILL BURN TO PRODUCE CARBON MONOXIDE AND CARBON DIOXIDE.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: WILL NOT OCCUR.
==========
Toxicological Information
==========
Toxicological Information: LC50 (RAT, INHALATION): 620 G/M3/ 4 HOURS; LC50
(MOUSE, INHALATION): 415 G/M3/ 2 HOUR. ISOBUTYLENE IS NOT FOUND ON FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, AND THEREFORE IS NEITHER CONSIDERED TO BE N OR SUSPECTED TO BE A CANCER-CAUSING AGENT BY THESE AGENCIES. PRODUCT MAY BE
MILDLY IRRITATING TO THE MUCOUS MEMBRANES. IN ADDITION, CONTACT WITH RAPIDLY
EXPANDING GASES CAN CAUSE FROSTBITE TO EXPOSED TISSUE. ISOBUTYLENE IS NOT
KNOWN TO CAUSE SENSITIZATION IN HUMANS. NO MUTAGENIC EFFECTS, NO EMBRYOTOXIC
EFFECTS, NO TERATOGENIC EFFECTS, NO REPRODUCTIVE TOXICITY EFFECTS HAVE BEEN
DESCRIBED FOR BUTYLENE.

==========
Ecological Information
==========
Ecological: ENVIRONMENTAL STABILITY: THIS GAS WILL BE DISSIPATED RAPIDLY IN
WELL-VENTILATED AREAS. EFFECTS OF MATERIAL ON PLANTS OR ANIMALS: ANY ADVERSE
EFFECT ON ANIMALS WOULD BE RELATED TO OXYGEN-DEFICIENT ENVI RONMENTS. NO
ADVERSE EFFECT IS ANTICIPATED TO OCCUR TO PLANT LIFE, EXCEPT FOR FROST
PRODUCED IN THE PRESENCE OF RAPIDLY EXPANDING GASES. EFFECT OF CHEMICAL ON
AQUATIC LIFE: NO EVIDENCE IS CURRENTLY AV AILABLE ON THE EFFECTS OF
ISOBUTYLENE ON AQUATIC LIFE.
==========
MSDS Transport Information
==========
Transport Information: THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101
BY THE U.S. DEPARTMENT OF TRANSPORTATION. PROPER SHIPPING NAME: ISOBUTYLENE;
CLASS: 2.1 (FLAMMABLE GAS); UN 1055; PKG: N/A; DOT LABELS REQUIRED:
FLAMMABLE GAS; NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):
115. ALTERNATE DESCRIPTION: PSN: PETROLEUM GASES, LIQUIDFIED; CLASS: 2.1
(FLAMMABLE GAS); UN 1075; PKG N/A; DOT LABEL REQUIRE D: FLAMMABLE GAS; NORTH

AMERICAN EMERGENCY GUIDEBOOK NUMBER: 115; MARINE POLLUTANT: ISOBUTYLENE IS
NOT CLASSIFIED BY THE DOT AS A MARINE POLLUTANT (AS DEFINED BY 49 CFR
172.101, APPENDIX B). CANADA: SAME AS ABOVE.

==========

Regulatory Information

==========

Sara Title III Information: ISOBUTYLENE IS NOT SUBJECT TO THE REPORTING
REQUIREMENTS OF SECTION 302, 304, AND 313 OF TITLE I I I OF THE SUPERFUND
AMENDMENTS AND REAUTHORIZATION ACT. U.S. SARA THRESHOLD PLANNING QUANTITY:
N/A. U. S. CERCLA REPORTABLE QUANTITY (RQ): NOT APPLICIABLE.ING RE
Federal Regulatory Information: ISOBUTYLENE IS LISTED ON THE U.S. TSCA
INVENTORY. ISOBUTYLENE IS SUBJECT TO REPORTING REQUIREMENTS OF SECTION 112(R)
OF THE CLEAN AIR ACT. THRESHOLD QUANTITY FOR THIS GAS IS 10,000 LB. DEPENDING
ON SP ECIFIC OPERATIONS INVOLVING USE OF ISOBUTYLENE, REGULATIONS OF THE
PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS MAY BE APPLICABLE (29
CFR 1910.119) UNDER THIS REGULATION ISOBUTYLENE IS NOT LISTED IN APPENDIX A;
HOWEVER, ANY PROCESS THAT INVOLVES A FLAMMABLE GAS ON-SITE, IN ONE LOCATION,
I N QUANTITIES OF 10,000 LB (4,553 KG) OR GREATER IS COVERED UNDER THIS
REGULATION UNLESS IT IS USED AS A FUEL.
State Regulatory Information: CALIFORNIA SAFE DRINKING WATER AND TOXIC
ENFORCEMENT ACT (PROPOSITION 65): ISOBUTYLENE IS NOT ON THE CALIFORNIA
PROPOSITION 65 LISTS. PRODUCT COVERED UNDER FOLLOWING STATE REGULATIONS: AK:
DESIGNATED TOXIC AND HAZARDOUS SUBSTANCES. CA: PERMISSIBLE EXPOSURE LIMITS
FOR CHEMICAL CONTAMINANTS; FL:SUBSTANCE LIST; MA: SUBSTANCE LIAT; MN:LIST OF
HAZARDOUS SUBSTANCES; NJ: RIGHT TO KNOW HAZARDOUS SUBSTANCE LIST; PA:
HAZARDOUS SUBSTANCE LIST; RI: HAZARDOUS SUBSTANCE LIST; TX: HAZARDOUS
SUBSTANCE LIST: WV: HAZARDOUS SUBSTANCE LIST; WI: TOXIC AND HAZARDOUS
SUBSTANCES.

==========

Other Information

==========

Other Information: (CONTD. FROM FIRST AID) DO NOT USE HOT WATER. IF WARM WATER
NOT AVAILABLE, WRAP AFFECTED PARTS IN BLANKETS. ALTERNATIVELY, IF FINGERS OR
HANDS ARE FORTBITTEN, PLACE IN ARMPIT. HAVE VICTIM GENTLY EXERC ISE AFFECTED
PARTS WHILE BEING WARMED. SEEK MEDICAL ATTENTION. TAKE COPY OF LABEL AND
MSDS TO PHYSICIAN WITH VICTIM. NFPA RATING: HEALTH: 1; FLAMMIBILITY: 4;
REACTIVITY: 0. RATINGS: HEALTH: 1; FLAMMABILITY: 4; REACTIVITY: 0;
PROTECTIVE EQUIPMENT: B. CANADIAN W SYMBOLS: CLASS A: COMPRESSED GAS; CLASS
B1: FLAMMABLE GAS.

==========
Transportation Information
==========
Responsible Party Cage: UO451
Trans ID NO: 156921
Product ID: ISOBUTYLENE-C4H8
MSDS Prepared Date: 01/16/1998
Review Date: 05/14/2001
MFN: 1
Multiple KIT Number: 0
Unit Of Issue: EA
Container QTY: 1
Type Of Container: CYLINDER
Additional Data: TRANSPORTATION DATA PER MANUFACTURER'S MSDS.
==========
Detail DOT Information
==========
DOT PSN Code: HTR
DOT Proper Shipping Name: ISOBUTYLENE
DOT PSN Modifier: SEE ALSO PETROLEUM GASES, LIQUEFIED
Hazard Class: 2.1
UN ID Num: UN1055
Label: FLAMMABLE GAS
Special Provision: 19
Packaging Exception: 306
Non Bulk Pack: 304
Bulk Pack: 314,315
Max Qty Pass: FORBIDDEN
Max Qty Cargo: 150 KG
Vessel Stow Req: E
Water/Ship/Other Req: 40
==========
Detail IMO Information
==========
IMO PSN Code: IRQ
IMO Proper Shipping Name: ISOBUTYLENE
IMDG Page Number: 2147
UN Number: 1055
UN Hazard Class: 2(2.1)
IMO Packaging Group: -
Subsidiary Risk Label: -
EMS Number: 2-07
MED First Aid Guide NUM: 310
==========
Detail IATA Information
==========
IATA PSN Code: OHI
IATA UN ID Num: 1055
IATA Proper Shipping Name: ISOBUTYLENE
IATA UN Class: 2.1
IATA Label: FLAMMABLE GAS
Packing Note Passenger: FORB
Max Quant Pass: FORB
Max Quant Cargo: 150KG
Packaging Note Cargo: 200
Exceptions: A1

==========
Detail AFI Information
==========
AFI PSN Code: OHI
AFI Proper Shipping Name: ISOBUTYLENE
AFI Hazard Class: 2.1
AFI UN ID NUM: UN1055
Special Provisions: P4
Back Pack Reference: A6.3, A6.5

==========
HAZCOM Label
==========
Product ID: ISOBUTYLENE-C4H8
Cage: UO451
Assigned IND: Y
Company Name: AIRGAS INC
Street: 259 RADNOR-CHESTER RD SUITE 100
City: RADNOR PA
Zipcode: 19087-5240
Health Emergency Phone: (800)424-9300
Label Required IND: Y
Date Of Label Review: 05/14/2001
Status Code: A
Label Date: 05/14/2001
Origination Code: F
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: Severe
Reactivity Hazard: None
Hazard And Precautions: FLAMMABLE LIQUID AND GAS UNDER PRESSURE. CAN FORM
EXPLOSIVE MIXTURES WITH AIR. MAY CAUSE FROSTBITE. KEEP AWAY FROM HEAT (<
125F), FLAMES, AND SPARKS. STORE AND USE WITH ADEQUATE VENTILATION. MOST
SIGN
IFICANT HAZARD IS OXYGEN-DEFICIENT ATOMSPHERES.
==========

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METHYL ALCOHOL

1. Product Identification

Synonyms: Wood alcohol; methanol; carbinol
CAS No.: 67-56-1
Molecular Weight: 32.04
Chemical Formula: CH3OH
Product Codes:
J.T. Baker: 5217, 5370, 5794, 5807, 5811, 5842, 5869, 9049, 9063, 9065, 9066, 9067, 9069, 9070, 9071, 9073, 9075, 9076, 9077, 9091, 9093, 9096, 9097, 9098, 9263, 9822, 9893, V654
Mallinckrodt: 3004, 3006, 3016, 3017, 3018, 3024, 3041, 3701, 4295, 5160, 8814, H080, H488, H603, H985, V079, V571

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl Alcohol	67-56-1	100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.
Ingestion:
Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness. Usual fatal dose: 100-125 milliliters.
Skin Contact:
Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.
Eye Contact:
Irritant. Continued exposure may cause eye lesions.
Chronic Exposure:
Marked impairment of vision has been reported. Repeated or prolonged exposure may cause skin irritation.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 12C (54F) CC
Autoignition temperature: 464C (867F)
Flammable limits in air % by volume:
lel: 6.0; uel: 36
Flammable Liquid and Vapor!
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks or flames. Sensitive to static discharge.
Fire Extinguishing Media:
Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition source and flash back.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed

for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Methyl Alcohol:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA)
- ACGIH Threshold Limit Value (TLV):
200 ppm (TWA), 250 ppm (STEL) skin

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details. Use explosion-proof equipment.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Characteristic odor.

Solubility:
Miscible in water.

Specific Gravity:
0.8

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
64.5C (147F)
Melting Point:
-98C (-144F)
Vapor Density (Air=1):
1.1
Vapor Pressure (mm Hg):
97 @ 20C (68F)
Evaporation Rate (BuAc=1):
5.9

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents such as nitrates, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber, and coatings. May react with metallic aluminum and generate hydrogen gas.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Methyl Alcohol (Methanol) Oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; Irritation data-standard Draize test: skin, rabbit: 20mg/24 hr. Moderate; eye, rabbit: 100 mg/24 hr. Moderate. Investigated as a mutagen, reproductive effector.

```
--------\Cancer Lists\-----------------------------------------------------
                                    ---NTP Carcinogen---
Ingredient                          Known    Anticipated    IARC Category
---------------------------------   -----    -----------    -------------
Methyl Alcohol (67-56-1)             No          No            None
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days.

When released into water, this material is expected to readily biodegrade. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into air, this material is expected to have a half-life between 10 and 30 days. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHANOL
Hazard Class: 3
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: METHANOL
Hazard Class: 3, 6.1
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Methyl Alcohol (67-56-1)                         Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
```

```
                                                          --Canada--
  Ingredient                                        Korea  DSL   NDSL  Phil.
  ----------------------------------------------  -----  ---   ----  -----
  Methyl Alcohol (67-56-1)                         Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\----------------
                                                -SARA 302-    ------SARA 313------
  Ingredient                                    RQ    TPQ     List  Chemical Catg.
  ----------------------------------------  ---   -----   ----  --------------
  Methyl Alcohol (67-56-1)                  No    No      Yes        No

  --------\Federal, State & International Regulations - Part 2\----------------
                                                          -RCRA-    -TSCA-
  Ingredient                                    CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Methyl Alcohol (67-56-1)                  5000       U154       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: No
Reactivity: No          (Pure / Liquid)
```

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

Label Precautions:

Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Keep container closed.
Use only with adequate ventilation.
Keep away from heat, sparks and flame.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 8.

Disclaimer:

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.
CAS No.: Not applicable.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox®	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.
J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain.

Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:
Dry chemical, foam, water or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this

material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
15 mg/m3 total dust, 5 mg/m3 respirable fraction for nuisance dusts.
- ACGIH Threshold Limit Value (TLV):
10 mg/m3 total dust containing no asbestos and < 1% crystalline silica for Particulates Not Otherwise Classified (PNOC).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face dust/mist respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece dust/mist respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White powder interspersed with cream colored flakes.

Odor:
No information found.

Solubility:
Moderate (1-10%)

Specific Gravity:
No information found.

pH:

No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
No information found.
Conditions to Avoid:
No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

```
--------\Cancer Lists\-----------------------------------------------
                                  ---NTP Carcinogen---
Ingredient                        Known    Anticipated    IARC Category
--------------------------------  -----    -----------    -------------
Alconox®                           No          No            None
proprietary detergent mixture
```

12. Ecological Information

Environmental Fate:
This product is biodegradable.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\----------------------------
Ingredient                                   TSCA  EC   Japan  Australia
-----------------------------------------  ----  ---  -----  ---------
Alconox®                                     Yes  No    No       No
proprietary detergent mixture

--------\Chemical Inventory Status - Part 2\----------------------------
                                                       --Canada--
Ingredient                                   Korea  DSL   NDSL  Phil.
-----------------------------------------  -----  ---   ----  -----
Alconox®                                      No    No    Yes    No
proprietary detergent mixture

--------\Federal, State & International Regulations - Part 1\-----------
                                        -SARA 302-    ------SARA 313------
Ingredient                              RQ    TPQ     List  Chemical Catg.
-----------------------------------  ---   -----   ----  --------------
Alconox®                                No    No      No         No
proprietary detergent mixture

--------\Federal, State & International Regulations - Part 2\-----------
                                                     -RCRA-    -TSCA-
Ingredient                              CERCLA     261.33     8(d)
-----------------------------------  ------     ------    ------
Alconox®                                No         No         No
proprietary detergent mixture


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: No          (Pure / Solid)
```

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

Label Precautions: Avoid contact with eyes. Keep container closed. Use with adequate ventilation.

Avoid breathing dust.Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 16.

Disclaimer:

****

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Prepared by: Environmental Health & Safety
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CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 13

WASTE MANAGEMENT PLANNING

Waste Characterization, Sampling and Analysis – USA

1.0 Introduction

This appendix provides federal requirements for projects conducted within the U.S. and its territories. Contact the regional ECC for specific state and local requirements.

2.0 Regulatory Review

The Resource Conservation and Recovery Act (RCRA, 40 CFR 258-279) regulates the generation, storage, transportation, treatment and disposal of solid and hazardous waste. States or local agencies may have hazardous waste requirements more restrictive than the Federal standard.

The Toxic Substances Control Act (TSCA, 40 CFR 761) regulates the manufacture, use, storage, treatment, and disposal of toxic substances, including PCBs. States or local agencies may have requirements more restrictive than the Federal standard.

The Clean Air Act (CAA, 40 CFR 61) regulates the emission of hazardous air pollutants, including asbestos and provides management standards to control emissions. States or local agencies may have requirements more restrictive than the Federal standard.

3.0 Responsibilities

3.1 Environmental Compliance Coordinator (ECC)

The ECC is responsible for providing resources to assist Project Managers to interpret environmental requirements and implement the policies and procedures in this appendix.

4.0 CH2M HILL Policy

It is CH2M HILL policy to manage wastes in compliance with applicable regulations. Since waste characterization is the client's legal responsibility, **CH2M HILL will not sign documentation (e.g., manifests) that suggests CH2M HILL is assuming the client's waste characterization responsibility.** If a client requests this service, the approval process described in the Hazardous Waste Policy for U.S. Projects (Attachment A-1) must be followed.

5.0 Definitions

5.1 Acute Hazardous Waste

Acute hazardous waste is designated with an "H" in the *Hazard Code* column in Tables 40 CFR 261.31 (F-list) and 261.33 (P-list).

5.2 Asbestos Containing Material (ACM)

ACM contains greater than 1 percent asbestos determined by polarized light microscopy.

5.3 Container

A container is any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled. Containers include roll-off boxes, drums, and portable tanks.

5.4 Debris

Debris is any solid material exceeding a 60 mm particle size that is intended for disposal and that is a manufactured object, plant or animal matter, or natural geologic material.

5.5 EPA Identification Number

The EPA Identification Number is a unique number assigned by EPA or a state agency to a generator, transporter, and treatment, storage, or disposal facility that manages hazardous waste.

5.6 Environmental Media

Environmental media includes substances occurring in the natural environment, such as groundwater or soil.

5.7 Facility

A facility is all contiguous land, structures, appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

5.8 Hazardous Waste

Hazardous waste is a solid waste that is not excluded from regulation and: 1) is listed as a hazardous waste, and/or 2) exhibits any of the characteristics of hazardous waste, i.e., ignitability, corrosivity, reactivity, and TCLP toxicity. States may have additional wastes or criteria for state-specific "hazardous" wastes.

5.9 Hazardous Waste Manifest

The hazardous waste manifest (Environmental Protection Agency (EPA) Form 8700-22) is the shipping document for tracking shipments of hazardous waste from the generator's facility to the final disposal facility. The manifest is originated and signed by the generator, and must also be signed by transporters and disposal facilities.

5.10 Munitions and Explosives

Munitions and explosives consist of various types of ordnance such as ammunition, ammunition components, chemical or biological warfare materials that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried or fired. "Military munitions" are munitions and explosives that are or have been under the control of various federal agencies such as the DOE and DOD.

5.11 Polychlorinated Biphenyls (PCBs)

PCBs are chemicals in which the biphenyl molecule has been chlorinated and are commonly used in electrical equipment. PCBs may be regulated under TSCA, depending upon concentration.

5.12 Solid Waste

Solid waste is any discarded material regardless of physical state (solid, liquid, or containerized gases). Solid wastes are considered discarded if they are abandoned, recycled, or are inherently waste-like.

5.13 State-Regulated/Special/Industrial Wastes

State-regulated/special/industrial wastes are identified by state agencies for regulation separate from wastes identified by EPA.

5.14 Universal Waste

Universal wastes include batteries, agricultural pesticides, thermostats, and mercury-containing lamps. These wastes are subject to less stringent requirements than RCRA hazardous waste if they are managed in a regulation-specified manner.

5.15 Unexploded Ordnance (UXO)

UXO includes military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

6.0 Waste Characterization

This section provides fundamental information on how to characterize wastes in accordance with RCRA, the Toxic Substance Control Act (TSCA), and other applicable laws and regulations. Consult your regional Environmental Compliance Coordinator for specific state and local requirements.

CH2M HILL may assist a client with waste characterization if specified in the project scope of work. The following procedures provide general information to assist with our limited scope. However, **CH2M HILL personnel must not sign documentation (such as manifests) that may indicate that CH2M HILL intends to assume the client's waste characterization responsibilities.** If a client requests this service, the approval process described in the Hazardous Waste Policy for U.S. Projects (Attachment A-1) must be followed.

6.1 Hazardous Waste Determination

Generators must determine if waste is hazardous by using process knowledge (e.g., historical data or information in MSDS) or testing the waste using standard EPA methods. With this information, a waste is characterized by asking the following questions:

1. Is it a solid waste?
2. Is it excluded?
3. Is it a listed hazardous waste?
4. Is it "contained in" environmental media or debris?
5. Does it exhibit a hazardous characteristic?

Regulated wastes will carry a specific "waste code" for identification. Hazardous wastes are subject to strict management standards as discussed in HSE-80 (Hazardous Waste Management). The following sections discuss each question to characterize waste.

6.1.1 Is it a Solid Waste?

Almost everything is considered solid under RCRA, including liquids and compressed gases. Solid material becomes solid waste when it is discarded by being abandoned through accumulation, storage, disposal, or treatment or by being recycled.

6.1.2 Is it Excluded?

Some wastes are excluded from regulation as solid and hazardous waste. Solid waste exclusions are found in 40 CFR 261.4. Common solid waste exclusions include domestic sewage and industrial wastewater. Materials that are not solid waste *cannot* be hazardous waste.

Hazardous waste exclusions are found in 40 CFR 261.4. Common hazardous waste exclusions include mining overburden returned to the mine, and wastes from extraction or production of crude oil or natural gas. Evaluate all waste streams for a solid or hazardous waste exclusion and document all exclusions in the project file.

6.1.3 Is it Listed Hazardous Waste?

A solid waste is hazardous if it is included on one of three lists: F-list (40 CFR 261.31), K-list (261.32), and P- and U-lists (261.33). The lists are based on the source of the waste as shown in Table 6-1. Evaluate the source of all project waste streams to determine if a listed waste code applies. Document all waste code determinations in the project file.

Table 6-1 Listed Wastes

WASTE CODE	SOURCE OF WASTE	DESCRIPTION
F-list	Non-Specific Source	Generic wastes produced by any industrial manufacturing processes. Examples include spent solvents from degreasing.
K-list	Specific Source	Wastes from specifically identified industries. Examples include petroleum refining wastes or wood preserving wastes.
P- list (acutely hazardous) U-list (toxic)	Commercial Chemical Products	Pure chemical products or manufacturing intermediates listed in 40 CFR 261.33 or are the sole active ingredient in a mixture. Examples include MEK or TCE.

6.1.4 Is it "Contained-in" Environmental Media or Debris?

Environmental media and debris can become a hazardous waste if it "contains" (i.e., is contaminated) with a listed waste. Evaluate all project waste streams to determine if one of the following "contained-in" rules cause the waste stream to be regulated as a listed hazardous waste.

The "contained-in policy" regulates environmental media that contains listed hazardous waste. Environmental media is regulated as hazardous waste if it is contaminated with an F-, K-, P- or U-listed waste, regardless of the amount of contamination. The waste code can be removed from soil or groundwater by demonstrating that contamination is below health-based standards (e.g., following treatment) and obtaining a "contained-in decision" (also known as a "contained-out" decision) from the state or EPA. Document all determinations and contained-in decisions in the project file.

The "contained-in rule" (also known as the debris rule) applies to debris. It states that debris such as concrete, asphalt, or wood is regulated as hazardous waste if it contains listed hazardous waste. This determination can be removed through treatment to the alternative treatment standards for hazardous debris in 40 CFR 268.45. Treatment technologies include surface extraction such as pressure washing or spalling, depending upon the type of debris. Contact the regional ECC for assistance with "contained-in" rules.

6.1.5 Does it Exhibit a Hazardous Characteristic?

A solid waste is a hazardous waste if it exhibits the following four characteristics:

- Ignitability (D001)
- Corrosivity (D002)
- Reactivity (D003)
- Toxicity (D004-43)

Ignitable wastes (D001) are generally liquids with a flash point of less than 140 degrees F, such as mineral spirits. Other ignitable wastes are non-liquids that can cause fire under standard temperature and pressure, ignitable compressed gases, and ignitable oxidizers (chlorates).

Corrosive wastes (D002) are liquids with a pH < 2 or > 12.5, such as lead acid batteries, hydrochloric acid or sodium hydroxide. Soil cannot be a corrosive waste because it is not aqueous. Note however, that some states regulate corrosive solids.

Reactive wastes (D003) are wastes that are normally unstable and react violently such as a lithium sulfur dioxide battery, heated aerosol cans, or ordnance.

Toxic wastes are liquids or solids that contain a regulated amount of any one of 39 toxic compounds; the waste codes assigned to these compounds are D004 through D043. This determination is usually made by sampling and analysis using the Toxicity Characteristic Leaching Procedure (TCLP). Waste leachate concentrations exceeding the regulatory limits are assigned the corresponding D004 through D043 waste code(s). Table 6-2 lists the constituents applicable to the toxicity characteristic. Evaluate all project waste streams to determine if a D-code will apply.

Table 6-2 Toxicity Characteristic Criteria

Waste Code	Constituent	TCLP Maximum (mg/l)
	Metals	
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium (total)	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
	Insecticides/ Herbicides	
D012	Endrin	0.02
D013	Lindane	0.4
D014	Methoxychlor	10.0
D015	Toxaphene	0.5
D016	2,4-D	10.0
D017	2,4,5-TP Silvex	1.0

	Organics	
D018	Benzene	0.5
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100
D022	Chloroform	6.0
Waste Code	**Constituent**	**TCLP Maximum (mg/l)**
D023	o-Cresol*	200.0
D024	m-Cresol*	200.0
D025	p-Cresol*	200.0
D026	Cresols*	200.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D031	Heptachlor (and epoxide)	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D039	Tetrachloroethylene	0.7
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D043	Vinyl chloride	0.2

6.2 Underlying Hazardous Constituents

Wastes that are determined to be hazardous under Section 6.1 must also be evaluated for the presence of underlying hazardous constituents. These must be evaluated so that the waste can be fully treated to meet the Land Disposal Restrictions (LDRs, 40 CFR 268). The presence of underlying hazardous constituents can be determined through process knowledge, MSDS review, or sampling and analysis. Consult the regional ECC for assistance in determining if your project waste stream contains underlying hazardous constituents.

6.3 State-Specific Wastes

Many states have more stringent requirements than EPA and regulate additional wastes as hazardous or special wastes. Some examples include low-level PCB waste or petroleum-contaminated soil. Contact the regional ECC to evaluate state regulations and guidance to determine if project waste streams are regulated as state-specific wastes.

6.3 TSCA Waste Classification

PCB wastes are regulated under the Toxic Substances Control Act (TSCA, 40 CFR 761). As a general rule, if the concentration of PCBs in the waste is greater than 50 ppm, or if the original PCB source has a concentration greater than 50 ppm, the waste is regulated under TSCA. Refer to the PCB Management SOP (HSE-82) for more information.

6.4 Universal Waste Determination

Universal wastes include batteries, agricultural pesticides, thermostats, and mercury-containing lamps, and are regulated under 40 CFR 273. These wastes are subject to less stringent requirements than RCRA hazardous waste if they are managed in the regulatory specified manner. Refer to the Universal Waste SOP (HSE-83) for these requirements.

6.5 Asbestos

Asbestos is regulated under the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAPs). Waste asbestos or wastes containing asbestos must be removed, packaged, labeled and managed of in accordance with 40 CFR 61, Subpart M. Refer to the Asbestos SOP (HSE-42).

6.6 UXO/OEW

Unexploded ordnance/ordnance explosive waste (UXO/OEW) is regulated under RCRA. See the UXO/OEW SOP (HSE-91) for more information.

6.7 Radioactive Waste

If radioactive wastes will potentially be generated at a client site, contact the CH2M HILL Radioactive Waste Expert, Dave McCormack/SEA.

7.0 Waste Sampling and Analysis

This section identifies the requirements for sampling and analysis for wastes generated on U.S. projects. The following should be considered for sampling and analysis activities:

- Avoid resampling by evaluating regulatory and treatment, storage, or disposal facility (TSDF) requirements during project planning
- Ensure that test method detection levels meet regulatory limits
- Supplement laboratory testing with field test kits
- Use total constituent data where possible instead of TCLP to reduce costs
- Develop a sampling and analysis plan for the collection of representative samples

7.1 Identifying Analytical Test Methods

Potential analyses include:

- Totals
- TCLP
- Paint filter test
- Ignitability
- Corrosivity
- Reactivity
- PCBs

7.1.1 Waste Nature and Quantity

Under RCRA Land Disposal Restrictions (LDRs), underlying hazardous constituents must also be identified in a hazardous waste. Underlying hazardous constituents must also be treated to meet LDRs prior to land disposal. Therefore, any inquiries into the nature of the waste should identify underlying constituents that may not cause the waste to be hazardous. Also evaluate the waste to determine if listed hazardous waste is “contained-in” environmental media or debris (See Section 6.1.4). This determination can greatly effect the volume of hazardous waste generated.

7.1.2 Legal Requirements

RCRA requires that samples be representative of the waste stream. Representative sampling is easily accomplished in homogenous waste streams such as no-phase liquids. However, determining

representative samples in a heterogeneous waste stream such as contaminated soil is more difficult. The following are EPA resources for determining representative sampling:

- Samplers and Sampling Procedures for Hazardous Waste Streams. 1980. U.S. EPA, Municipal Environmental Research Laboratory, Cincinnati, Ohio 45268, EPA-600/2-80-018. 70 pp. Publication is free. Order by calling EPA, Cincinnati Environmental Research Information Center (513) 569-7562.
- Sampling and Sampling Plans. Test Methods for Evaluating Solid Waste, Volume II: Field Manual, Physical/Chemical Methods, 3rd Edition, SW-846, Part III, Chapter 9, pp. 9-1 to 9-79. November 1986. EPA, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.
- Characterization of Hazardous Waste Sites—A Methods Manual: Volume II. Available Sampling Methods, 2nd Edition. December 1984. EPA, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada 89114, EPA 600/4-84-076.
- Characterizing Heterogeneous Wastes: Methods and Recommendations. February 1992. EPA, Office of Research and Development, Washington, D.C. 20460, EPA/600/R-92/033.

Commercial laboratories should be used for waste analyses. Field test kits may be used to minimize the cost of screening waste streams in the field. However, these *test kits should not be used as a sole source for hazardous waste determination*.

In some cases, total concentration analysis may be used to characterize a waste stream for the toxicity characteristic (D004-43) instead of running TCLP analysis. To use totals analysis, the waste must be entirely solid, or must contain less than 0.5 percent liquid. For ***solids*** with no liquid fraction, the TCLP leaches 100 grams of sample with 2,000 grams of leaching solution, providing a maximum of 20 times dilution of constituents in the sample. Therefore the conservative "20-Times" rule is to compare total constituent results to the TCLP regulatory limit times 20 to determine if the waste is hazardous. If less than 20x, the waste is below the regulatory limit, if above 20x, you must assume it is a hazardous waste for that constituent, or perform TCLP to make a final determination. For ***liquid*** wastes which have less than 0.5 percent solids, compare the results directly to the TC regulatory limit, with no multiplier. Note that for both liquids and solids, total constituent data can be more conservative than TCLP, especially for metals.

7.1.3 Detection Limits

Consult with the laboratory to identify the detection limits of the proposed test methods and compare them to the corresponding regulatory level, such as the TCLP limit. Although most detection limits will meet TCLP levels, some test methods cannot meet some regulatory levels, such as PCB concentrations in drinking water.

7.1.4 Disposal Facility Requirements

All facilities require waste characterization whether it be by analyses such as Toxicity Characteristic Leaching Procedure (TCLP) or by generator knowledge. Some facilities will also require additional analyses, such as total organic carbon (TOC) or chemical oxygen demand (COD), while others require testing only to meet certain permit requirements or no testing at all. Contact the proposed treatment/disposal facilities to determine their specific requirements.

HAZARDOUS WASTE POLICY for U.S. PROJECTS

Revision 2.0, January 1996

2.2.1 INTRODUCTION

This document presents the CH2M HILL policy for pursuing and performing projects involving hazardous and toxic wastes, and is effective on the date of issue. It applies to all projects involving the management or remediation of hazardous wastes or toxic substances that are governed by U.S. federal and state laws or regulations. This policy replaces the CH2M HILL, INC. policy issued in May 1993, and presents the prescribed process to follow for screening project opportunities involving hazardous or toxic materials. ***This policy is applicable to all project opportunities pursued or performed in all business groups.***

Properly done, hazardous and toxic waste work is challenging, profitable business and represents an investment in our firm's future success. Because this work can involve higher risks and exposures than most of our other work, we must use great care in marketing our services, screening potential projects, negotiating our contracts, and performing our work. We should accept only project work for which we are qualified and for which we have qualified and available people. We should not accept work for which the risks are too great. Most importantly, we must make sure that the health and safety of our employees is not compromised.

This policy represents a significant departure from its earlier versions. It reflects the competitive forces we encounter in the marketplace on a daily basis, and also considers the current legal and practice environment in which we pursue and perform project work involving hazardous and toxic materials. This hazardous waste policy makes the assignment of stewardship and the decision-making process for projects pursuit, except where special approval is required, similar to the decision-making process for pursuing other types of projects.

The policy requires careful screening of all opportunities involving hazardous or toxic materials. The screening process triggers one of several formal bid/no-bid or go/no-go assessments and assigns stewardship depending on the issues identified in the evaluation of the specific project opportunity.

2.2.2 PROJECTS REQUIRING SPECIAL APPROVAL

As a matter of policy, the following types of projects may not be undertaken without special approval as described below:

1. **Hazardous Waste Generator or Transporter**. We will not accept projects or conduct tasks that will cause us to be classified as a generator or transporter of hazardous wastes. For example, we will not sign hazardous waste manifests.
2. **Environmental Impairment Liability (EIL) Insurance Investigations**. We will not accept projects involving EIL investigations or assessments.
3. **Standard Setting**. We will not accept projects that require us to certify, or to express an opinion regarding "safe" levels of contamination; i.e., we will not become "standard setters."
4. **Asbestos Remediation Work**. We will not accept projects involving "stand-alone" asbestos remediation. We can accept assignments involving asbestos remediation that is performed by qualified subcontractors.

Special approval may be obtained from a team comprising the following people:

1. A lawyer from the Legal & Insurance Department.
2. The Regional Manager from the affected region.
3. The Project Delivery Director or Director of Operations from the appropriate business group.

4. If the project opportunity is from a multi-regional client, then the Operations Manager from the appropriate business group will be added to the special approval team.

If you have questions, or you need additional information, contact Dan Smith in the Legal & Insurance Department/COR ext. 2452, David Miller/COR ext. 2411, or Bill Dehn/FGL/COR ext. 2315.

Appendix B
Quality Assurance Project Plan

Final

Site Inspection Quality Assurance Project Plan for Areas of Concern

Cheatham Annex (CAX)
Williamsburg, Virginia

Contract Task Order 0174

October 2008

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Atlantic Division

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Virginia Beach, Virginia

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Attachment (provided electronically on attached CD-ROM)

A Field SOPs, Analytical Laboratory SOPs, Valid Values

Abbreviations and Acronyms

AOC	Areas of Concern
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CAX	Cheatham Annex
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action, Navy
CLP	Contract Laboratory Program
COC	chain of custody
CTO	Contract Task Order
DoD	Department of Defense
DPT	Direct Push Tool
DQI	data quality indicator
EDS	Environmental Data Services
EIS	Environmental Information Specialist
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FTL	Field Team Leader
GPS	global positioning system
IDW	investigation-derived waste
IR	Installation Restoration
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MPC	Measurement Performance Criteria
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Navy
NIRIS	Navy IR Information Solution
PCB	polychlorinated biphenyl
PQO	project quality objective
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	quality control
QL	quantitation limit
RBC	risk-based concentration

SI	Site Inspection
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TOC	total organic carbon
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
μg/L	micrograms per Liter
U.S.	United States
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

Introduction

This site-specific Quality Assurance Project Plan (QAPP) is being submitted to provide a systematic data collection and analysis structure for the Site Investigation of the Areas of Concern (AOCs) at Cheatham Annex, Williamsburg, Virginia, as a supplement to the *Work Plan for Site Investigation of Various Cheatham Annex Areas of Concern*, CH2M HILL, 2007 (referred to as "Work Plan" in this document). The site investigation will be conducted as a single field mobilization at AOCs 1, 2, 6, 7, and 8. In accordance with the Uniform Federal Policy for QAPPs (UFP-QAPP, March 2005), this QAPP includes 37 worksheets that detail various aspects of the environmental investigation process and serves as guidelines for the field work and data quality. The site-specific laboratory and field standard operating procedures (SOPs) are located in Attachment 1 of this QAPP (on CD).

The United States Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic, is conducting the Site Investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA work is being conducted with the United States Environmental Protection Agency (USEPA) Region III as the lead regulatory agency.

This document will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for intended uses. The laboratory information cited in this QAPP is for the analytical laboratories that are currently contracted to provide analytical services for this investigation. Because of the size of scope of this project, the analytical services for this investigation were split between two laboratories. GPL Laboratories will perform explosives, toxicity characteristic leaching procedure (TCLP) and pesticides analysis. Katahdin Analytical Services will provide volatiles, semivolatiles, metals, and wet chemistry analytical services. Additionally, data validation services were also split between two companies. Environmental Data Services (EDS) will validate explosives and pesticide data. DataQual Environmental Services will validate volatiles, semivolatiles, metals, and wet chemistry data.

A summary of the physical characteristics of the CAX AOCS, previous investigations, and more is provided in the Work Plan.

QAPP Worksheet #1—Title and Approval Page
(UFP-QAPP Section 2.1)

Site Name/Project Name: CAX Areas of Concern
Site Location: Cheatham Annex, Williamsburg, Virginia

Document Title: Site Investigation of Cheatham Annex Areas of Concern (AOCs)

Lead Organization: United States Navy

Preparer's Name and Organizational Affiliation: Megan Hilton, CH2M HILL

Preparer's Address, Telephone Number, and E-mail Address: 5700 Cleveland Street, Suite 101, Virginia Beach, VA 23462, (401) 619-2657, megan.hilton@ch2m.com

Preparation Date (Day/Month/Year): October 2008

Investigative Organization's Project Manager/Date:_____
Signature

Printed Name/Organization: Laura Lampshire/CH2M HILL

NAVFAC Remedial Project Manager/Date:_____
Signature

Printed Name: Christopher Murray

USEPA Remedial Project Manager/Date:_____
Signature

Printed Name: Susanne Haug

VDEQ Project Manager/Date:_____
Signature

Printed Name: Wade Smith

Document_Control_Numbering_System : _____

QAPP Worksheet #2—QAPP Identifying Information
(UFP-QAPP Section 2.2.4)

Site Name/Project Name: Cheatham Annex AOCs Site Investigation

Title: CAX AOCs UFP-QAPP

Site Location: Cheatham Annex (CAX), Williamsburg, Virginia

Revision Number: 0

Site Number/Code: Various AOCs

Revision Date: September 2007

Operable Unit: Various AOCs

Contractor Name: CH2M HILL

Contractor Number: N62470-02-D-3052

Contract Title: Navy CLEAN III

Work Assignment Number: N62470-02-D-3052 CTO-0174

1. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

2. Identify approval entity: U.S. Navy

3. The QAPP is (select one): ☐Generic ☒Project Specific

4. List dates of scoping sessions that were held: April 25, 2007, November 15, 2007

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
N/A	

6. List organizational partners (stakeholders) and connection with lead organization:
   U.S. Navy (NAVFAC, Mid-Atlantic), Lead Agency, USEPA Region III, Lead Regulatory Agency, Department of Defense (DoD), Land Owner

7. List data users:
   U.S. Navy (NAVFAC, Mid-Atlantic), Lead Agency, USEPA Region III, Lead Regulatory Agency; Department of Defense (DoD), Land Owner, and their contractors

8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

QAPP Worksheet #2

QAPP Identifying Information (continued)

Identify where each required QAPP element is located in the QAPP (provide section, worksheet, table, or figure number) or other project planning documents (provide complete document title, date, section number, page numbers, and location of the information in the document). Type "NA" for the QAPP elements that are not applicable to the project. Provide an explanation in the QAPP.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	#1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	iii vi
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	#3 #4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	#5 #6 #7 #8

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	#10 #9 #10 Figures 2-1 through 2-12 of SI Work Plan
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	#11 #12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	#13 #13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	#14 #15 #16
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table	#17 #17, Figures 3-1 through 3-6 of SI Work Plan #13, 17, 18 #19

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.3 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.4 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	#20 Attachment 1, #21 #21 #22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Attachment 1, #23 #23 #24 #25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	Attachment 1, #26, 27 #19 #26 #27

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	#28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	#29 #30 n/a
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	#31 #31 #32 #32
4.2 QA Management Reports	- QA Management Reports Table	#33
4.3 Final Project Report		

QAPP Worksheet #2

QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	#34 #35 #36 #37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3—Distribution List

(UFP-QAPP Manual Section 2.3.1)

List those entities to whom copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments will be sent.

☐ Worksheet Not Applicable (State Reason)

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Christopher Murray	Remedial Project Manager	NAVFAC Mid-Atlantic	(757) 444-3811	(757) 444-5822	Christopher.r.murray@navy.mil	Administrative Record number will be assigned upon QAPP approval
Suzanne Haug	Remedial Project Manager	USEPA Region III	(215) 814-3357	(215) 814-3051	Haug.Susanne@epamail.epa.gov	Administrative Record number will be assigned upon QAPP approval
Wade Smith	FUDS Project Manager	VDEQ	(804) 698-4125	(804) 698-4234	Wmsmith@deq.virginia.gov	Administrative Record number will be assigned upon QAPP approval
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785		Bonnie.capito@navy.mil	Administrative Record number will be assigned upon QAPP approval
Laura Lampshire	Project Manager	CH2M HILL	(301) 570-1042		Laura.lampshire@ch2m.com	Administrative Record number will be assigned upon QAPP approval
Cecilia Landin	Deputy Activity Manager	CH2M HILL	(757) 671-6266		Cecilia.Landin@ch2m.com	Administrative Record number will be assigned upon QAPP approval
Marlene Ivester	Activity Manager	CH2M HILL	(757) 873-1442 x34		Marlene.ivester@ch2m.com	Administrative Record number will be assigned upon QAPP approval

QAPP Worksheet #4—Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

☐ Worksheet Not Applicable (State Reason)

Organization: U.S. Navy

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Christopher Murray	Remedial Project Manager	(757) 444-3811		

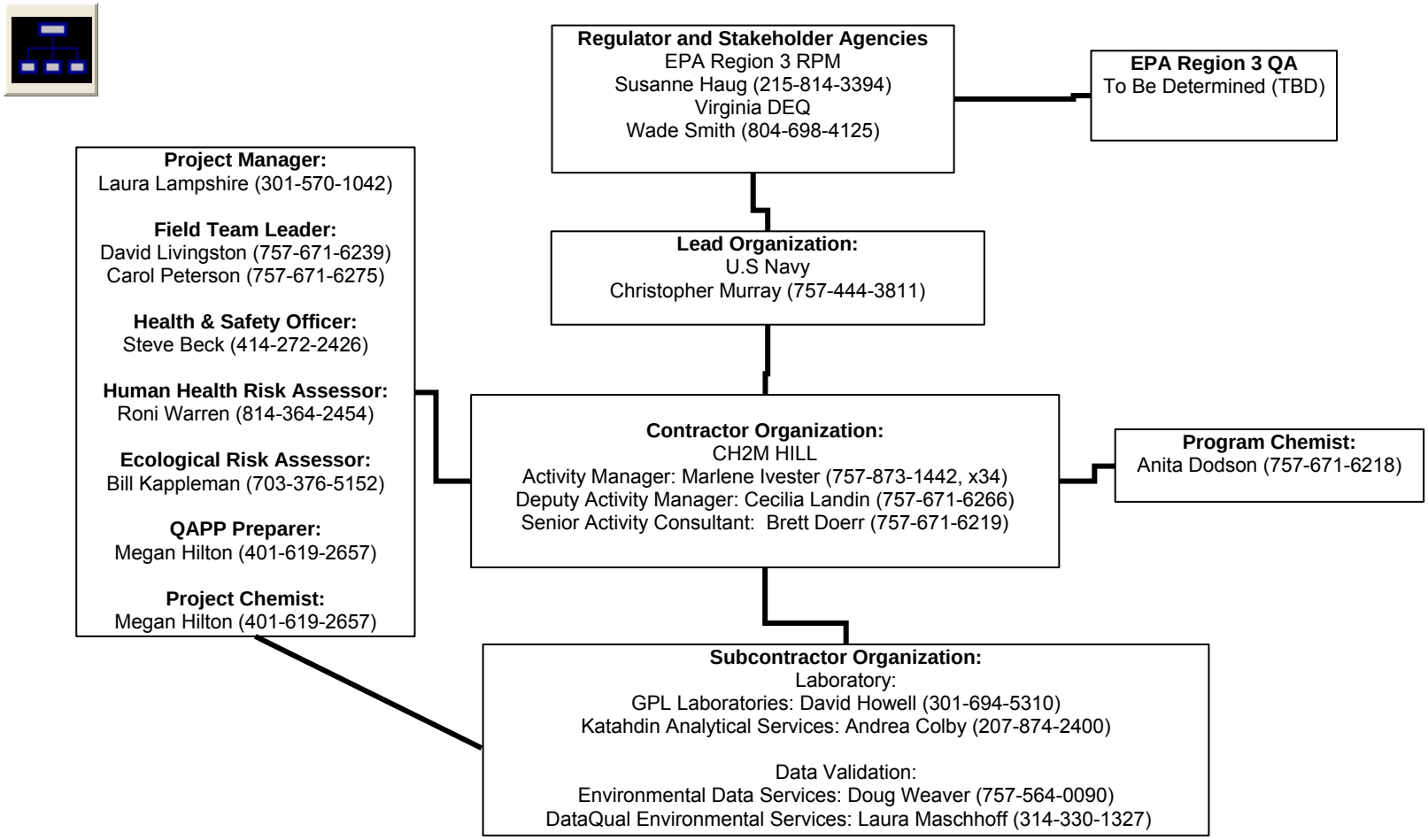
Organization: CH2M HILL

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Marlene Ivester	Activity Manager	(757) 873-1442, x34		
Cecilia Landin	Deputy Activity Manager	(757) 671-6266		
Laura Lampshire	Project Manager	(301) 570-1042		
Anita Dodson	Program Chemist	(757) 671-6218		
Paul Favara	Program Quality Manager	(352) 335-5877, x52396		
Megan Hilton	Project Chemist	(401) 619-2657		
Brett Doerr	Senior Activity Consultant	(757) 671-6219		
Steve Beck	Health and Safety Officer	(414) 272-2426 x277		
Carol Peterson	Field Team Leader (FTL)	(757) 671-6275		
David Livingston	Field Team Leader (FTL)	(757) 671-6239		

QAPP Worksheet #5—Project Organization Chart
(UFP-QAPP Manual Section 2.4.1)

Identify reporting relationships between all organizations involved in the project, including the lead organization and all contractor and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names and telephone numbers of all project managers, project team members, and/or project contacts for each organization.

☐ Worksheet Not Applicable (State Reason)



QAPP Worksheet #6—Communication Pathways
(UFP-QAPP Manual Section 2.4.2)

Describe the communication pathways and modes of communication that will be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure that will be followed when any project activity originally documented in an approved QAPP requires real-time modifications to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

☐ Worksheet Not Applicable (State Reason)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Communication with Navy (lead agency)	Navy RPM for WPNSTA Yorktown/CAX	Christopher Murray	(757) 444-3811	Primary point of contact for Navy; can delegate communication to other internal or external points of contact.
Communication with USEPA Region III (lead regulatory agency)	USEPA RPM	Susanne Haug	(215) 814-3394	Primary point of contact for EPA; can delegate communication to other internal or external points of contact.
Communication with VDEQ	FUDS Project Manager	Wade Smith	(804) 698-4125	Primary point of contact for VDEQ; can delegate communication to other internal or external points of contact.
Oversees Project Implementation (Activity level)	CH2M HILL Activity Manager, Cheatham Annex (WPNSTA Yorktown)	Marlene Ivester	(757) 873-1442 x34	Oversees project and will be informed of project status by the project manager, Laura Lampshire
Point of Contact with Navy, EPS and VDEQ	CH2M HILL Project Manager	Laura Lampshire	(301) 570-1042	All information and materials about the project will be forwarded to Christopher Murray (Navy RPM), Susanne Haug (USEPA), and Wade Smith (VDEQ)

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Manage all Project Phases	CH2M HILL Project Manager for CTO-0174	Laura Lampshire	(301) 570-1042	Laura Lampshire will be the primary point of contact and responsible for all technical, administrative, and field aspects of the project.
QAPP changes in the field	CH2M HILL Field Team Leader	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Documentation of deviations from the work plan made in the field logbook(s) and the PM will be notified. Deviations made only with approval from the PM.
Daily Field Progress Reports	CH2M HILL Field Team Leader	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Daily field progress reports will be either emailed or faxed to Laura Lampshire
Health and Safety	Site Safety Coordinator	David Livingston Carol Peterson	(757) 671-6239 (757) 671-6275	Responsible for adherence of team members to the site safety requirements described in the HASP.
Reporting Analytical Lab Data Quality Issues	Laboratory QA Officers	Yemane Yohannes/ GPL, Leslie Dimond/ Katahdin	(301) 694-5310/ (207) 874-2400	All QA/QC issues with project field samples will be reported by the subcontracted lab within 2 days, who will relay them to the EIS, Project Chemist, and Contractor Quality Assurance Officer.
Risk Assessment	CH2M HILL Human Health and Ecological Risk Assessors	Roni Warren, Bill Kappleman	814-364-2454, 703-376-5152	Risk Assessors will advise the project so that the data collected will be sufficient for performing a Risk Assessment.

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Data tracking from collection through upload to database	Environmental Information Specialist (EIS)	Chelsea Bennet	(757) 671-6208	EIS will track data from sample collection through upload to database, ensuring QAPP requirements are met by laboratory and field staff.
Field and Analytical Corrective Actions	Program Chemist Project Chemist Field Team Leader	Anita Dodson Megan Hilton David Livingston Carol Peterson	(757) 671-6218 (401) 619-2657 (757) 671-6239 (757)671-6275	The need for corrective action for field and analytical issues will be determined by the Field Team Leader, Project Chemist and/or Contractor Quality Assurance Officer. Corrective Action with laboratories will be coordinated by Project Chemist.
Release of Analytical Data	Project Chemist	Megan Hilton	(401) 619-2657	No analytical data can be released until validation is completed and the Project Chemist has approved the release.

QAPP Worksheet #7—Personnel Responsibilities and Qualification Table
(UFP-QAPP Manual Section 2.4.3)

Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Identify project team members with an asterisk (*). Attach resume to this worksheet or note the location of the resumes.

☐ Worksheet Not Applicable (State Reason)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Christopher Murray	Remedial Project Manager	NAVFAC Mid-Atlantic	Coordinates all environmental activities at CAX.	B.S. Environmental Science M.S. Environmental Engineering 10 years exp.
Marlene Ivester	Activity Manager	CH2M HILL	Responsible for ERP at CAX	B.A. English B.S. Geology M.S Business Administration 14 years exp.
Cecilia Landin	Deputy Activity Manager	CH2M HILL	Responsible for assisting CAX Activity Manager for ERP at CAX	B.S. Geology 8 years exp.
Laura Lampshire	Project Manager	CH2M HILL	Directs and oversees staff	B.S. Geology and Mathematics M.S. Geophysics 14 years exp.
Brett Doerr	Senior Consultant	CH2M HILL	Provides senior technical oversight	B.S. Chemistry M.S. Environmental Science 16 years exp.
Anita Dodson	Program Chemist	CH2M HILL	Responsible for audits, corrective action, checks of QA performance	B.S. Chemistry 14 years exp.

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Megan Hilton	Project Chemist	CH2M HILL	Performs oversight of laboratory and data validators, releases analytical data	B.S. Chemistry B.S. Environmental Science 2 years exp.
David Livingston	Field Team Leader	CH2M HILL	Supervises field sampling and coordinates all field activities	B.S. Biology 3 years exp.
Carol Peterson	Field Team Leader	CH2M HILL	Supervises field sampling and coordinates all field activities	B.S. Geology M.S. Geology 4 years exp.
Roni Warren	Human Health Risk Assessor	CH2M HILL	Technical expertise for Human Health Risk Assessment	M.S. Environmental Engineering B.S. Computer Science 17 years exp.
Bill Kappleman	Ecological Risk Assessor	CH2M HILL	Technical expertise for Ecological Risk Assessment	M.S. Wildlife Biology B.S. Wildlife Biology 21 years exp.
Steve Beck	Health and Safety Officer	CH2M HILL	Oversees H&S for field activities	M.S. Occupational Safety and Health 14 years exp.
Andrea Colby	Project Manager	Katahdin Analytical Services	Managing analytical projects from initiation to completion.	B.A. Biology 21 years exp.
Leslie Dimond	QA Officer	Katahdin Analytical Services	Responsible for Corrective Action and oversight of QA	B.A. Chemistry 14 years exp.
David Howell	VP of Sales and Marketing	GPL Laboratories	coordinate, negotiate and manage federal and commercial contracts	B.S. Chemistry, Biology 20 years exp.
Yemane Yohannes	QA Officer	GPL Laboratories	Responsible for Corrective Action and oversight of QA	B.A. Chemistry 22 years exp.
Nancy Weaver	Senior Chemist	Environmental Data Services	Responsible for the analytical data review and validation	B.S. Chemistry 21 years exp.

QAPP Worksheet #7
Personnel Responsibilities and Qualification Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications*
Doug Weaver	Contracts Manager	Environmental Data Services	Responsible for all contractual and administrative issues	B.S. Industrial Engineering 20 years exp.
Laura Maschhoff	President	DataQual Environmental Services	Program Manager/Organic	B.S. Biology 19 years exp.
Jackie Cleveland	Vice-President	DataQual Environmental Services	Program Manager/Inorganic	B.S. Chemistry 20 years exp.
Chelsea Bennet	EIS	CH2M HILL	Manages sample tracking, coordinates with laboratory and data-validator, data management	B.S. Biology 7 years exp.
Resumes of CH2M HILL employees on file with CH2M HILL Human Resources Department.				

QAPP Worksheet #8—Special Personnel Training Requirements Table
(UFP-QAPP Manual Section 2.4.4)

Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

☐ Worksheet Not Applicable (State Reason)

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Environmental Field Work at CAX AOCs	HAZWOPER 40 hour training 8 hour refreshers CPR/First Aid SSC-HW training	Various registered organizations	Project-specific	David Livingston (FTL), Carol Peterson (FTL), others TBD	FTL, Field team members, site-safety coordinators, all from CH2M HILL	CH2M HILL Human Resources Dept.

QAPP Worksheet #9—Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project.

☐ Worksheet Not Applicable (State Reason)

Project Name: CAX AOCs Site Investigation **Projected Date(s) of Sampling:** December 2007 **Project Manager:** Laura Lampshire	**Site Name:** CAX Areas of Concern **Site Location:** Cheatham Annex, Williamsburg, Virginia

Date of Session: April 25, 2007

Scoping Session Purpose: To summarize site conditions and discuss sampling strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Laura Cook	Deputy Activity Manager, WPNSTA Yorktown	CH2M HILL	757-671-6214	Laura.cook@ch2m.com	Overseeing UFP-QAPP production, project support
Marlene Ivester	Deputy Activity Manager, CAX	CH2M HILL	757-873-1442 x34	Marlene.ivester@ch2m.com	Overseeing UFP-QAPP production, project support
Laura Lampshire	Project Manager	CH2M HILL	301-570-1042	Laura.lampshire@ch2m.com	Work Plan production, project management

Comments/Decisions:

Each AOC was summarized, with review of the site conditions, historical sampling events and reports.

Discussed problems that exist and possible sampling strategies. Reviewed general Work Plan approach and document preparation.

Action Items:

Need to speak to risk assessors and senior consultants concerning number of samples and matrices to collect at each AOC. Need to justify any sampling that will not take place in this round (e.g. AOC 2).

Consensus Decisions:

n/a- mainly an informational session.

QAPP Worksheet #9
Project Scoping Session Participants Sheet (continued)

Project Name: CAX AOCs Site Investigation **Projected Date(s) of Sampling:** July 2008 **Project Manager:** Laura Lampshire	**Site Name:** CAX Areas of Concern **Site Location:** Cheatham Annex, Williamsburg, Virginia

Date of Session: November 15, 2007

Scoping Session Purpose: Review presentation of CAX AOC Draft Work Plan provided at Yorktown Partnering Meeting in Nov. 2007

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Wade Smith	FUDS Project Manager	CH2M HILL	757-671-8311 x 444	wmsmith@deq.virginia.gov	Primary point of contact for VDEQ
Linda Cole	Remedial Project Manager	CH2M HILL	757-873-1442 x34	Linda.cole@navy.mil	Primary point of contact for Navy
Robert Thomson	Remedial Project Manager		215-814-3357	Thomson.bob@epamail.epa.gov	Primary point of contact for EPA
Rebekah Ives	Yorktown Partnering Team Discussion Leader	CH2M HILL	757-671-6235	Rebekah.ives@ch2m.com	Recorder of Yorktown Partnering Meetings
Donna Caldwell	Activity Manager	CH2M HILL	757-873-1442, x28	Donna.caldwell@ch2m.com	Oversees project
Bill Friedmann (via phone)	Deputy Activity Manager	CH2M HILL	757-671-6223	William.friedmann@ch2m.com	Assists in overseeing project
Laura Lampshire (via phone)	Project Manager	CH2M HILL	301-570-1042	Laura.lampshire@ch2m.com	Work Plan production, project management

Comments/Decisions:

Laura Lampshire provided an informal Power Point presentation of the Draft CAX AOC SI Work Plan that is currently being prepared. Purpose of presentation was to provide Yorktown Partnering Team opportunity to review the preliminary Work Plan and provide input regarding the sampling design.

Action Items:

Donna Caldwell will confirm if the Waste Slag Material Area at AOC 6 was listed as a source area on the National Priorities List.

Laura Lampshire will add test pitting at AOC 7 and phthalate analyses at AOC 6.

QAPP Worksheet #9
Project Scoping Session Participants Sheet (continued)

Linda Cole will check to see if photographs (AOC 7) are in the administrative record, if not she will send copies to Rob. The photographs are part of a housekeeping report.

Consensus Decisions:

Robert Thomson (USEPA) requested that SVOC analyses be added to media being sampled at ACO 6 and that test pitting be conducted at AOC 7 to assist in delineation of debris disposal area(s). Partnering Team concurred.

QAPP Worksheet #10—Problem Definition
(UFP-QAPP Manual Section 2.5.2)

Clearly define the problem and the environmental questions that should be answered for the current investigation and develop the project decision "If…, then…" statements in the QAPP, linking data results with possible actions. The prompts below are meant to help the project team define the problem. They are not comprehensive.

☐ Worksheet Not Applicable (State Reason)

The problem to be addressed by the project: The objective of this project is to determine whether a release that has the potential to adversely affect human health or the environment has occurred at any of the CAX AOCs. See Section 1.1 of the SI Work Plan.
The environmental questions being asked: 1. Have there been any releases to the environment? 2. If releases are identified, do they pose a significant threat to public health and the environment, and 3. Are additional actions needed to address these releases?
Observations from any site reconnaissance reports: AOC 1: Contains an extensive amount of debris, as it was a former landfill. See Section 2.2.2 of the SI Work Plan. AOC 6: Ammonia Settling Pits, TNT catch basins, and 1918 Drum storage area has been found. See Section 2.4.2 of the SI Work Plan. AOC 7: 55-gallon drums and cans in several small dumps. See Section 2.5.1 of the SI Work Plan. AOC 8: Small amount of modern-era debris (candy wrappers, Styrofoam) found. See Sections 2.6.1 and 2.6.2 of the SI Work Plan.
A synopsis of secondary data or information from site reports: Reports from past studies (Site Inspection reports, etc.) at AOCs 1, 6, 7, and 8 are found at the web site: http://public.lantops-ir.org/sites/public/yorktown/Site%20Files/AdminRecords.aspx. Historical practices and past studies at these sites suggest the potential exists for soil, groundwater, and possibly sediment and surface water (at AOC 6) contamination.
The possible classes of contaminants and the affected matrices: AOC 1 – soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives) AOC 6 – soil (Metals, TOC, pH, Explosives, SVOCs), groundwater (Metals, Explosives, SVOCs), sediment (Metals, TOC, pH, grain size, Explosives, SVOCs), surface water (Metals, Explosives, SVOCs) AOC 7 – soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives) AOC 8 - soil (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives), groundwater (VOCs, Metals, SVOCs, Pesticides/PCBs, Explosives)
The rationale for inclusion of chemical and non-chemical analyses: See Section 3.2.2 of the Work Plan
Information concerning various environmental indicators: Discussion and site maps are found in Section 2 (Background) and Section 3 (Field Investigation Work Plan) of the SI Work Plan
Project decision conditions ("If..., then..." statements): See Figure 1-1 of the SI Work Plan

QAPP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements
(UFP-QAPP Manual Section 2.6.1)

Use this worksheet to develop project quality objectives (PQOs) in terms of type, quantity, and quality of data determined using a systematic planning process. Provide a detailed discussion of PQOs in the QAPP. List PQOs in the form of qualitative and quantitative statements. These statements should answer questions such as those listed below. These questions are examples only, however; they are neither inclusive nor appropriate for all projects.

☐ Worksheet Not Applicable (State Reason)

Who will use the data? The data will be used by the Navy (and its contractors) and the other stakeholder agencies to ensure the sites are adequately assessed and, if necessary, appropriate measures are taken to provide adequate protection of human health and the environment.
What will the data be used for? The data will be used to determine the nature and extent of contamination in environmental media from past Navy operations and the associated potential risks posed by the contamination, if any.
What type of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) The data collected will be representative of historical waste disposal activities at each AOC and will include (refer to Sections 3.2.1 and 3.2.2 of the SI Work Plan for specifics): • Surface soil, subsurface soil, groundwater, surface water, and sediment sample collection • VOC, SVOC, metals, explosives, pest/PCBs, TOC, pH, and grain size analyses • Aqueous Investigation Derived Waste (IDW) sample will be collected for analysis for full suite Toxicity Characteristic Leaching Procedure (TCLP) parameters (VOCs, SVOCs, pesticides, herbicides, and metals), reactivity to cyanide and sulfide, corrosivity as pH, and ignitability. • Adherence to the Standard Operating Procedures for laboratory and sampling techniques referenced in this UFP-QAPP Worksheets 21 and 23.
How "good" do the data need to be in order to support the environmental decision? The quality of the data will depend on their intended use. Project Action Limits (PAL's) will be requested such that the data will support a Human Health and Ecological Risk Assessment. PAL's are based on the most conservative screening values to ensure that the laboratory's Quantitation Limits (QLs) are low enough to provide results that can be compared to both Human Health or Ecological criteria.For risk assessments and high-level decisions, laboratory methods will meet CERCLA, EPA Region III, and Navy guidance and the data will be validated by a third-party validator using Region III and national functional guidance.
How much data are needed? (number of samples for each analytical group, matrix, and concentration) Figures 3.1 through 3.6 and Sections 3.2.1 through 3.2.2 of the SI Work Plan show/describe proposed sample locations for soil, groundwater, sediment, and surface water. Sample locations were selected consistent with the historical record based on the most likely locations for a release at the sites. The number of samples was selected to provide sufficient coverage to determine the presence of a release. Additional samples may be needed if a release potentially posing risk is identified as described on Figure 1-1. As described in section 3.2.1 of the SI Work Plan, the number of QA/QC samples is detailed in the Master Plans (Baker, 2005a).
Where, when, and how should the data be collected/generated? The data will be collected and generated in accordance with the procedures outlined in the CAX AOC SI WP and the SOPs contained in this QAPP. Fieldwork is tentatively scheduled to begin December 2007. Validated data would be received from a third-party validator approximately six weeks after the lab receives the samples.
Who will collect and generate the data? CH2M HILL field staff will collect the samples. Two analytical laboratories, Katahdin Analytical Services and GPL Laboratories, LLLP, will analyze the samples and generate data.
How will the data be reported? See Section 4.1.4 of the SI Work Plan
How will the data be archived? The data will be archived in accordance with federal law. At the end of the project, archived data will be returned to the Navy.

QAPP Worksheet #12-1—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface
Analytical Group	TCL Volatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/ SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ Katahdin SOP-7, SOP-9, SOP-10	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values> 5X QL: ± 100%	Field Duplicates	S + A
		Precision-Laboratory	± 30% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in SOP-9, Section 8.2	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in SOP-9, Section 8.2	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Methylene chloride, Acetone, 2-Butanone).	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP-9, section 7.4.3-7.4.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-2—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil
Analytical Group	TCL Semivolatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ Katahdin SOP-8	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD <100%	Field Duplicates	S + A
		Precision-Laboratory	RPD ≤ 50% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in SOP 8, Section 8.5	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in SOP 8, Section 8.5	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (bis-(2-ethylhexyl) phthalate)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP-8, Section 7.5.1-7.5.2 for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
EPA = U.S. Environmental Protection Agency
CLP = Contract laboratory program
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-3—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils	EPA CLP OLM04.3/ GPL #Q20	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	Data must meet the relative RT criteria and should meet acceptance criteria and spike recovery criteria in SOP Q20, Attachments 16 and 17.	Matrix spike/Matrix spike duplicate	A
		Accuracy/Bias-Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	all target compound < CRQL; surrogates must be within RT windows; surrogate recoveries must be within 30-150%	Method Blank, Sulfur Blank	A
		Contamination/ Bias	surrogates must be within RT windows; all target compounds < 0.5x CRQL	Instrument Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP Q20, Section 7.2.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
CRQL = Contract Required Quantitation Limit
EPA = U.S. Environmental Protection Agency
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
SOW = Statement of Work
TCL = Target Compound List

QAPP Worksheet #12-4—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	TAL Metals/ Cyanide
Concentration Level	ICP-AES (ILM05.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	EPA CLP ILM05.3 / Katahdin SOP-4, SOP-12	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values > 3X QL:RPD < 50%	Field Duplicates	S + A
		Precision-Laboratory	Values > 3X QL: RPD < 20	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 25% when sample concentration ≤ 4X the spike concentration	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 20% of true value	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Na,K, Ca and Mg)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP 4, Table 1 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
EPA = U.S. Environmental Protection Agency
CLP = Contract laboratory program
ICP = Inductively Coupled Plasma- Atomic Emission Spectroscopy
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TAL = Target Analyte List

QAPP Worksheet #12-5—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (plus PETN and 3,5-Dinitroaniline)
Concentration Level	Medium (SW-846 8330)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Soils, Sediment	SW-846 8330/ GPL #S1	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S1, Section 14.4; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S1, Section 14.3 for QC limits.	Laboratory Control Samples	A
		Accuracy/Bias - Contamination	No target analytes ≥ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S1, Section 14.1 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S1, Sections 8.4-8.5 for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
PETN = Pentaerythritol Tetranitrate
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-6—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	SW-846 8332/ GPL #S7	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S7 Section 13.3; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S7 Section 13.2 for QC limits.	Laboratory Control Samples	A
		Accuracy/ Bias - Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S7 Section 13.1 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S7 Section 10.-10.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-8—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium (SW-846 8330M)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
Soils, Sediment	SW-846 8330/ GPL #S4	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 35% for soil/sediment	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits in SOP S4, Section 13; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/ Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S4 Section 13 for QC limits.	Laboratory Control Samples	A
		Accuracy/ Bias - Contamination	No target analytes $\geq$ QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S4 Section 13 for QC limits.	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP S4, Section 8.3-8.4 for calibration criteria	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-9—Measurement Performance Criteria Table

Matrix	Surface Soil Subsurface Soil Sediment
Analytical Group	Wet Chemistry
Concentration Level	Medium (various)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Total Organic Carbon					
Soils, Sediment	Lloyd Kahn / Katahdin SOP-2	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 100%	Field Duplicates	S + A
		Precision-Laboratory	RPD ≤ 50% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A
pH					
Soils, Sediment	SW-846 9045C / Katahdin SOP-3	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 100%	Field Duplicates	S + A
		Accuracy/Bias	% Recovery 90-110%	Laboratory Control Samples	A
Grain Size					
Soils, Sediment	ASTM D422 / Test America LM-SL-D422	None	None	Replicate	S&A

[1]Reference number from QAPP Worksheet #21
[2]Reference number from QAPP Worksheet #23
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-10—Measurement Performance Criteria Table

Matrix	Groundwater
Analytical Group	TCL Volatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW	EPA CLP OLM04.3/ Katahdin SOP-7, SOP-9	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values> 5X QL: ± 50%	Field Duplicates	S + A
		Precision-Laboratory	± 20% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery provided in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Methylene chloride, Acetone, 2-Butanone).	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
SOP Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-11—Measurement Performance Criteria Table

Matrix	Groundwater
Analytical Group	TCL Semivolatiles
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW	EPA CLP OLM04.3/ Katahdin SOP-8	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	All Values> 5X QL, RPD < 70%	Field Duplicates	S + A
		Precision-Laboratory	RPD ≤ 30% when native conc. ≤ 50% analytical spike	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	% Recovery as stated in Worksheet 28	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (bis-(2-ethylhexyl) phthalate)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract Laboratory Program
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TCL = Target Compound List

QAPP Worksheet #12-12—Measurement Performance Criteria Table

Matrix	Groundwater
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Medium (OLM04.3)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
DPGW	EPA CLP OLM04.3/ GPL #Q20	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	Data should meet acceptance criteria and spike recovery criteria specified in the OLM04.3 SOW	Matrix spike/Matrix spike duplicate	A
		Accuracy/Bias-Contamination	No target analytes ≥ CRQL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	All target compounds < 0.5x CRQL	Instrument Blank	A
		Contamination/ Bias	All target compounds < CRQL; surrogates must be within RT window	Method Blank	A
		Contamination/ Bias	All target compounds < CRQL; surrogates must be within RT windows; surrogate recoveries must be within 30-150%	Sulfur Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract Laboratory Program
CRQL = Contract Required Quantitation Limit
EPA = U.S. Environmental Protection Agency
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
SOW = Statement of Work
TCL = Target Compound List

QAPP Worksheet #12-13—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	TAL Total Metals/ Cyanide TAL Dissolved Metals
Concentration Level	Lowest CRQL from ICP-MS and ICP-AES (ILM05.3)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	EPA CLP ILM05.3 / Katahdin SOP-4, SOP-11, SOP-17, SOP-19	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision-Overall	Values > 3X QL:RPD < 50%	Field Duplicates	S + A
		Precision-Laboratory	Values > 3X QL:	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 25% when sample concentration ≤ 4X the spike concentration	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	± 20% of true value	Laboratory Control Samples	A
		Accuracy/ Bias-Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants (Na,K, Ca and Mg)	Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks	S + A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
CLP = Contract laboratory program
CRQL = Contract Required Detection Limit
EPA = U.S. Environmental Protection Agency
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure
TAL = Target Analyte List

QAPP Worksheet #12-14—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	Explosives (plus PETN and 3,5-Dinitroaniline)
Concentration Level	Medium (SW-846 8330)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8330/ GPL #S1	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S1	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S1	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
PETN = Pentaerythritol Tetranitrate
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-15—Measurement Performance Criteria Table

Matrix	Groundwater Surface Water
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8332/ GPL #S7	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S7	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S7	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-16—Measurement Performance Criteria Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium (SW-846 8330M)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
DPGW, Surface Water	SW-846 8330M/ GPL #S4	Data Completeness	85% Overall	Data Completeness Check	S + A
		Precision- Overall	Data should meet RPD criteria of 25% for water/groundwater	Field Duplicate	S + A
		Precision- Lab	The spike recovery limits must be within the laboratory QC limits; RPD limits are 30%	Matrix Spike/Matrix Spike Duplicates	A
		Accuracy/Bias	The surrogate recovery must be within the laboratory QC limits; spike recovery limits must be within the laboratory QC limits. See SOP #S4	Laboratory Control Samples	A
		Accuracy/Bias-Contamination	No target analytes > QL	Equipment Rinsate Blank, Ambient Field Blank, Trip Blank	S + A
		Contamination/ Bias	no target compounds > the reporting limit; surrogate recovery must be within the laboratory QC limits. See SOP #S4	Method Blank	A
		Sensitivity	Calibration must meet criteria dictated in method. Please refer to SOP for calibration criteria.	Low Calibration Standard at the QL	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23
QC = Quality Control
QL = Quantitation Limit
RPD = Relative Percent Difference
SOP = Standard Operating Procedure

QAPP Worksheet #12-17—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-VOCs
Concentration Level	Medium (SW-846 1311/8260B)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
HSE-411	SW-846 1311, 8260B/ H7, M5	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Method Blank	A
		Accuracy/ Bias	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% Dibromofluoromethane: 85-115% Toluene-d8: 85-120%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; Retention times +/- 30 secs of CC	Internal Standards	A
		Accuracy/ Bias/ Precision	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-18—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-SVOCs
Concentration Level	Medium (SW-846 1311/8270C)

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
HSE-411	SW-846 1311, 8270C/ H7, P5	Bias/ Contamination	No target analytes > Quantitation Limit; Surrogates within: 2-Fluorobiphenyl: 46-108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Method Blank	A
		Accuracy/ Bias	Surrogates within: 2-Fluorobiphenyl: 46-108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Area counts –50% to +100% of initial calibration IS or continuing calibration IS area counts; Retention times +/- 30 secs of CC	Internal Standards	A
		Accuracy/ Bias/ Precision	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-19—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Pesticides
Concentration Level	Medium (SW-846 1311/8081A)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8081A/ H7, Q6	Bias/ Contamination	No target analytes > Quantitation Limit; surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Method Blank	A
		Accuracy/ Bias	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-20—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Herbicides
Concentration Level	Medium (SW-846 1311/8151A)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 8151A/ H7, Q10	Bias/ Contamination	No target analytes > Quantitation Limit; surrogate values within lab statistical QC limits: DCAA:61-136%	Method Blank	A
		Accuracy/ Bias	surrogates within: DCAA:61-136%	Surrogate Standards	A
		Accuracy/ Bias/ Precision	2,4-D: 61-136% 2,4,5-TP: 61-136%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias/ Precision	Same acceptance criteria as LCS/LCSD	Matrix Spike/ Matrix Spike Duplicate	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-21—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Metals
Concentration Level	Medium (SW-846 1311/6010B, 7470A)

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1311, 6010B, 7470A/ H7, H10, H12	Bias/ Contamination	No target analytes > ½ Quantitation Limit	Method Blank	A
		Accuracy/ Bias	%Recovery 75-125%	Post-Digestion Spike	A
		Accuracy/ Bias	%Difference 10%	ICP Serial Dilution	A
		Precision	Relative Percent Difference ≤20%	Duplicate	A
		Accuracy/ Bias/ Precision	%Recovery 80% - 120%	Laboratory Control Samples/ Laboratory Control Sample Duplicate	A
		Accuracy/ Bias	%Recovery 80% - 120%	Matrix Spike	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-22—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 7.3, 9014, 9034/ J13, J11, J43	Precision	RPD ≤ 15 %	Duplicate	A
		Accuracy/ Bias	Reactive sulfide Recovery 23.7% - 30.3%, Reactive cyanide Recovery 1.7% - 2.9%	Laboratory Control Sample	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-23—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Corrosivity
Concentration Level	Medium

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 7.2.2-1a/ J12	Precision	Relative Percent Difference ≤ 15%	Duplicate	A
		Accuracy/ Bias	± 0.10 pH units	Laboratory Control Sample (pH 7.0 buffer)	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #12-24—Measurement Performance Criteria Table

Matrix	Aqueous IDW
Analytical Group	Ignitability
Concentration Level	Medium

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
HSE-411	SW-846 1010/ N1	Precision	Relative Percent Difference ≤ 20%	Duplicate	A
		Accuracy/ Bias	% Recovery 80-120%	Laboratory Control Sample	A

[1]Reference number from QAPP Worksheet #21.

[2]Reference number from QAPP Worksheet #23

QAPP Worksheet #13—Secondary Data Criteria and Limitations Table
(UFP-QAPP Manual Section 2.7)

Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use.

☐ Worksheet Not Applicable (State Reason)

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
AOC 1 Historical Data	CH2M HILL and Baker Environmental, Inc., *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* May 10, 2001	Baker Environmental, Inc. Surface soil, subsurface soil, surface water, and sediment samples collected November 1999	Data used to determine the proposed sample locations for the SI Work Plan	None known
AOC 2 Historical Data	Baker Environmental, Inc., *Final Field Investigation Report, Site 1 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* September 7, 1999	Baker Environmental, Inc. Surface soil, subsurface soil, and groundwater samples collected October 1998	Data used to justify no further investigation needed at AOC 2 within the SI Work Plan	None known
AOC 2 Historical Data	CH2M HILL and Baker Environmental, Inc., *Final Field Investigation Report, Site 7 and AOC 2, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site,* March 29, 2001	Baker Environmental, Inc. Soil samples collected November 1999	Data used to justify no further investigation needed at AOC 2 within the SI Work Plan	None known
AOC 6 Historical Data	Weston, *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia,* August 9, 1999	Weston Waste source, surface water, sediment, and background soil samples collected January 1999	Data used to determine the proposed sample locations for the SI Work Plan	Cannot confirm from this report whether data was validated

QAPP Worksheet #14—Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

Provide a brief overview of the listed project activities.

☐ Worksheet Not Applicable (State Reason)

Sampling Tasks:

1. Collect groundwater samples using Direct Push Tool (DPT) at various locations.
2. Monitor groundwater quality parameters for pH, specific conductance, turbidity, dissolved oxygen, temperature, salinity, and oxidation-reduction potential. These parameters must be stabilized before a sample is collected.
3. Practice awareness of munitions and explosives of concern (MEC).
4. Soil sample locations will be marked prior to collection using a hand-held GPS.
5. Surface soil and subsurface soil samples will be collected using a stainless steel trowel or hand auger.
6. A visual description of the soil will be logged.
7. Surface water and sediment samples will be collected beginning downstream and working to upstream locations.
8. Take water quality readings before collecting surface water samples.
9. CH2M HILL will survey to the nearest one meter, soil, groundwater, surface water, and sediment sampling locations using GPS
10. CH2M HILL will decontaminate all field equipment when appropriate, according to the SOPs.
11. All Investigation- Derived Waste (IDW) from decon of sampling equipment generated during sampling will be managed.

Analysis Tasks:

- Katahdin will analyze environmental samples for TAL Total Metals/Cyanide, TAL Filtered Metals, TOC, pH, TCL SVOCs, and VOCs.
- Test America will be subcontracted by Katahdin to analyze environmental samples for Grain Size.
- GPL will analyze environmental samples for Explosives, TCL Pesticides and PCBs, full suite TCLP, reactivity, corrosivity, and ignitability.
- Laboratories will process, prepare, and analyze groundwater, surface water, soil, IDW and sediment samples according to Contract Laboratory Program (CLP), SW-846, or other methodologies as applicable.
- Laboratories will possess United States Navy (NFESC) approval for analytical methods, if available.
- Laboratories will be responsible for any second-tier subcontracted analyses to other labs. This includes turnaround times, deliverables, and data quality.
- All analyses and sample custody procedures will be performed in accordance will the laboratories' Standard Operating Procedures, referenced in Worksheet #23 and supplied as an attachment on CD.

Quality Control Tasks:

- Implement SOPs for field and analytical laboratory activities being performed (see Worksheets 21 and 23).
- Quality Control/ Quality Assurance (QA/QC) samples will be collected in the field and sent to the laboratory to ensure proper field sampling and analytical techniques (see Worksheet 20).
- Analytical results will be reviewed by a third party data validator (TBD).
- Any deviations from Quality Control tasks will be submitted as an addendum to this QAPP and filed as Corrective Action if necessary.

QAPP Worksheet #14—Summary of Project Tasks (continued)

Secondary Data: See Worksheet #13
Data Management Tasks: • Analytical data will be entered into CH2M HILL's Navy CLEAN SNEDD format by the laboratories, using Valid Values lists (supplied as attachment on CD). • Data Validators will receive the EDD and apply data qualifiers as necessary. • The EDD and hardcopy data package will be reviewed by the Project Chemist in order to verify the usability of the data. • The EDD will be placed in CH2M HILL's Endat system Oracle database and in Navy IR Information Solution (NIRIS) database.
Documentation and Records: See Worksheet 29.
Assessment/Audit Tasks: See Worksheets 31 and 32.
Data Review Tasks: Data will be reviewed initially by third party subcontractors, then by CH2M HILL staff. • See Worksheet 35 and 36 for data validation tasks • See Worksheet 37 for data usability assessment tasks.

QAPP Worksheet #15-1—Reference Limits and Evaluation Table

Note for all matrices and parameters: PAL's are based on the most conservative screening values to ensure that the laboratory's QLs are low enough to provide results that can be compared to both Human Health or Ecological criteria .

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	16000	Residential RBCs	3200	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.09	Residential RBCs	0.045	0.01	0.001
Bromomethane	74-83-9	110	Residential RBCs	22	0.01	0.001
Chloroethane	75-00-3	220	Residential RBCs	44	0.01	0.001
Trichlorofluoromethane	75-69-4	23000	Residential RBCs	4600	0.01	0.001
1,1-Dichloroethene	75-35-4	0.031	CH2M HILL	0.016	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2300000	Residential RBCs	460000	0.01	0.001
Acetone	67-64-1	70000	Residential RBCs	14000	0.01	0.001
Carbon Disulfide	75-15-0	0.00085	CH2M HILL	0.00043	0.01	0.001
Methyl Acetate	79-20-9	78000	Residential RBCs	16000	0.01	0.001
Methylene Chloride	75-09-2	0.37	CH2M HILL	0.074	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	0.4	CH2M HILL	0.08	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	160	Residential RBCs	32	0.01	0.001
1,1-Dichloroethane	75-34-3	0.027	CH2M HILL	0.014	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	0.4	CH2M HILL	0.08	0.01	0.001
2-Butanone	78-93-3	470000	Residential RBCs	94000	0.01	0.001

QAPP Worksheet #15-1—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Chloroform	67-66-3	0.022	CH2M HILL	0.011	0.01	0.001
1,1,1-Trichloroethane	71-55-6	0.03	CH2M HILL	0.015	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	0.047	CH2M HILL	0.024	0.01	0.001
Benzene	71-43-2	0.16	CH2M HILL	0.032	0.01	0.001
1,2-Dichloroethane	107-06-2	0.25	CH2M HILL	0.05	0.01	0.001
Trichloroethene	79-01-6	0.22	CH2M HILL	0.044	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	9.4	Residential RBCs	1.9	0.01	0.001
Bromodichloromethane	75-27-4	10	Residential RBCs	2.0	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	0.000051	CH2M HILL	0.000026	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	200	CH2M HILL	40	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	0.000051	CH2M HILL	0.000026	0.01	0.001
1,1,2-Trichloroethane	79-00-5	1.2	CH2M HILL	0.24	0.01	0.001
Tetrachloroethene	127-18-4	0.41	CH2M HILL	0.082	0.01	0.001
2-Hexanone	591-78-6	312	Prov. RfD	62.4	0.01	0.001
Dibromochloromethane	124-48-1	7.6	Residential RBCs	1.5	0.01	0.001
1,2-Dibromoethane	106-93-4	32	Residential RBCs	6.4	0.01	0.001

QAPP Worksheet #15-1—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Chlorobenzene	108-90-7	40	CH2M HILL	8.0	0.01	0.001
Ethylbenzene	100-41-4	1.1	CH2M HILL	0.22	0.01	0.001
Xylenes, total	1330-20-7	0.16	CH2M HILL	0.032	0.01	0.001
Styrene	100-42-5	300	CH2M HILL	60	0.01	0.001
Bromoform	75-25-2	0.65	CH2M HILL	0.13	0.01	0.001
Isopropylbenzene	98-82-8	0.086	CH2M HILL	0.017	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	1.4	CH2M HILL	0.28	0.01	0.001
1,3-Dichlorobenzene	541-73-1	1.7	CH2M HILL	0.34	0.01	0.001
1,4-Dichlorobenzene	106-46-7	20	CH2M HILL	4.0	0.01	0.001
1,2-Dichlorobenzene	95-50-1	0.34	CH2M HILL	0.068	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	0.2	Residential RBCs	0.04	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	20	CH2M HILL	4.0	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Prov. RfD is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	16000	Residential RBCs	3200	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.09	Residential RBCs	0.045	0.01	0.001
Bromomethane	74-83-9	110	Residential RBCs	22	0.01	0.001
Chloroethane	75-00-3	220	Residential RBCs	44	0.01	0.001
Trichlorofluoromethane	75-69-4	23000	Residential RBCs	4600	0.01	0.001
1,1-Dichloroethene	75-35-4	3900	Residential RBCs	780	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2300000	Residential RBCs	460000	0.01	0.001
Acetone	67-64-1	70000	Residential RBCs	14000	0.01	0.001
Carbon Disulfide	75-15-0	7800	Residential RBCs	1560	0.01	0.001
Methyl Acetate	79-20-9	78000	Residential RBCs	15600	0.01	0.001
Methylene Chloride	75-09-2	85	Residential RBCs	17	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	1600	Residential RBCs	320	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	160	Residential RBCs	32	0.01	0.001
1,1-Dichloroethane	75-34-3	16000	Residential RBCs	3200	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	780	Residential RBCs	156	0.01	0.001
2-Butanone	78-93-3	470000	Residential RBCs	94000	0.01	0.001
Chloroform	67-66-3	780	Residential RBCs	156	0.01	0.001

QAPP Worksheet #15-2—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
1,1,1-Trichloroethane	71-55-6	160000	Residential RBCs	32000	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	4.9	Residential RBCs	0.98	0.01	0.001
Benzene	71-43-2	12	Residential RBCs	2.4	0.01	0.001
1,2-Dichloroethane	107-06-2	7	Residential RBCs	1.4	0.01	0.001
Trichloroethene	79-01-6	1.6	Residential RBCs	0.32	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	9.4	Residential RBCs	1.9	0.01	0.001
Bromodichloromethane	75-27-4	10	Residential RBCs	2	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	6.4	Residential RBCs[4]	1.28	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	6300	Residential RBCs	1260	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	6.4	Residential RBCs[4]	1.28	0.01	0.001
1,1,2-Trichloroethane	79-00-5	11	Residential RBCs	2.2	0.01	0.001
Tetrachloroethene	127-18-4	1.2	Residential RBCs	0.24	0.01	0.001
2-Hexanone	591-78-6	313	Prov. RfD	62.6	0.01	0.001
Dibromochloromethane	124-48-1	7.6	Residential RBCs	1.5	0.01	0.001
1,2-Dibromoethane	106-93-4	32	Residential RBCs	6.4	0.01	0.001
Chlorobenzene	108-90-7	1600	Residential RBCs	320	0.01	0.001
Ethylbenzene	100-41-4	7800	Residential RBCs	1560	0.01	0.001
Xylenes, total	1330-20-7	16000	Residential RBCs	3200	0.01	0.001

QAPP Worksheet #15-2—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Styrene	100-42-5	16000	Residential RBCs	3200	0.01	0.001
Bromoform	75-25-2	81	Residential RBCs	16.2	0.01	0.001
Isopropylbenzene	98-82-8	7800	Residential RBCs	1560	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	3.2	Residential RBCs	0.64	0.01	0.001
1,3-Dichlorobenzene	541-73-1	230	Residential RBCs	46	0.01	0.001
1,4-Dichlorobenzene	106-46-7	27	Residential RBCs	5.4	0.01	0.001
1,2-Dichlorobenzene	95-50-1	7000	Residential RBCs	1400	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	0.2	Residential RBCs	0.10	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	780	Residential RBCs	160	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "1,3-dichloropropene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Prov. RfD is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-3—Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Dichlorodifluoromethane	75-71-8	160000	Residential RBCs	32000	0.01	0.001
Chloromethane	74-87-3	NC	N/A	0.01	0.01	0.001
Vinyl Chloride	75-01-4	0.9	Residential RBCs	0.45	0.01	0.001
Bromomethane	74-83-9	1100	Residential RBCs	220	0.01	0.001
Chloroethane	75-00-3	2200	Residential RBCs	440	0.01	0.001
Trichlorofluoromethane	75-69-4	230000	Residential RBCs	46000	0.01	0.001
1,1-Dichloroethene	75-35-4	0.031	CH2M HILL	0.016	0.01	0.001
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	23000000	Residential RBCs	4600000	0.01	0.001
Acetone	67-64-1	700000	Residential RBCs	140000	0.01	0.001
Carbon Disulfide	75-15-0	0.00085	CH2M HILL	0.00043	0.01	0.001
Methyl Acetate	79-20-9	780000	Residential RBCs	160000	0.01	0.001
Methylene Chloride	75-09-2	0.37	CH2M HILL	0.074	0.01	0.001
trans-1,2-Dichloroethene	156-60-5	0.4	CH2M HILL	0.08	0.01	0.001
Methyl tert-Butyl Ether	1634-04-4	1600	Residential RBCs	320	0.01	0.001
1,1-Dichloroethane	75-34-3	0.027	CH2M HILL	0.014	0.01	0.001
cis-1,2-Dichloroethene	156-59-2	0.4	CH2M HILL	0.08	0.01	0.001
2-Butanone	78-93-3	4700000	Residential RBCs	940000	0.01	0.001
Chloroform	67-66-3	0.022	CH2M HILL	0.011	0.01	0.001

QAPP Worksheet #15-3—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
1,1,1-Trichloroethane	71-55-6	0.03	CH2M HILL	0.015	0.01	0.001
Cyclohexane	110-82-7	NC	N/A	0.01	0.01	0.001
Carbon Tetrachloride	56-23-5	0.047	CH2M HILL	0.024	0.01	0.001
Benzene	71-43-2	0.16	CH2M HILL	0.032	0.01	0.001
1,2-Dichloroethane	107-06-2	0.25	CH2M HILL	0.05	0.01	0.001
Trichloroethene	79-01-6	0.22	CH2M HILL	0.044	0.01	0.001
Methylcyclohexane	108-87-2	NC	N/A	0.01	0.01	0.001
1,2-Dichloropropane	78-87-5	94	Residential RBCs	19	0.01	0.001
Bromodichloromethane	75-27-4	100	Residential RBCs	20	0.01	0.001
cis-1,3-Dichloropropene	10061-01-5	0.000051	CH2M HILL	0.000026	0.01	0.001
4-Methyl-2-pentanone	108-10-1	NC	N/A	0.01	0.01	0.001
Toluene	108-88-3	0.05	CH2M HILL	0.025	0.01	0.001
trans-1,3-Dichloropropene	10061-02-6	0.000051	CH2M HILL	0.000026	0.01	0.001
1,1,2-Trichloroethane	79-00-5	1.2	CH2M HILL	0.24	0.01	0.001
Tetrachloroethene	127-18-4	0.41	CH2M HILL	0.21	0.01	0.001
2-Hexanone	591-78-6	3130	Prov. RfD	626	0.01	0.001
Dibromochloromethane	124-48-1	76	Residential RBCs	15	0.01	0.001
1,2-Dibromoethane	106-93-4	320	Residential RBCs	64	0.01	0.001
Chlorobenzene	108-90-7	0.41	CH2M HILL	0.21	0.01	0.001
Ethylbenzene	100-41-4	1.1	CH2M HILL	0.22	0.01	0.001
Xylenes, total	1330-20-7	0.16	CH2M HILL	0.032	0.01	0.001

QAPP Worksheet #15-3—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Volatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Styrene	100-42-5	0.559	CH2M HILL	0.11	0.01	0.001
Bromoform	75-25-2	0.65	CH2M HILL	0.13	0.01	0.001
Isopropylbenzene	98-82-8	0.086	CH2M HILL	0.043	0.01	0.001
1,1,2,2-Tetrachloroethane	79-34-5	1.4	CH2M HILL	0.28	0.01	0.001
1,3-Dichlorobenzene	541-73-1	1.7	CH2M HILL	0.34	0.01	0.001
1,4-Dichlorobenzene	106-46-7	0.35	CH2M HILL	0.070	0.01	0.001
1,2-Dichlorobenzene	95-50-1	0.34	CH2M HILL	0.068	0.01	0.001
1,2-Dibromo-3-chloropropane	96-12-8	2	Residential RBCs	0.40	0.01	0.001
1,2,4-Trichlorobenzene	120-82-1	9.2	CH2M HILL	1.8	0.01	0.001

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

"Prov. RfD" is a surrogate value calculated by CH2M HILL human health risk assessors.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-4—Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	7800	Residential RBCs	1560	0.330	0.165
Phenol	108-95-2	30	CH2M HILL	6.0	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	0.58	Residential RBCs	0.29	0.330	0.165
2-Chlorophenol	95-57-8	0.0312	CH2M HILL	0.016	0.330	0.165
2-Methylphenol	95-48-7	3900	Residential RBCs	780	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	7800	Residential RBCs	1600	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	0.091	Residential RBCs	0.046	0.330	0.165
Hexachloroethane	67-72-1	1	CH2M HILL	0.50	0.330	0.165
Nitrobenzene	98-95-3	39	Residential RBCs	7.8	0.330	0.165
Isophorone	78-59-1	670	Residential RBCs	130	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	0.58	Residential RBCs[4]	0.29	0.330	0.165
2,4-Dichlorophenol	120-83-2	0.117	CH2M HILL	0.059	0.330	0.165
Naphthalene	91-20-3	0.176	CH2M HILL	0.088	0.330	0.165
4-Chloroaniline	106-47-8	310	Residential RBCs	62	0.330	0.165
Hexachlorobutadiene	87-68-3	8.2	Residential RBCs	1.6	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Caprolactam	105-60-2	39000	Residential RBCs	7800	0.330	0.165
4-Chloro-3-methylphenol	59-50-7	3900	Residential RBCs[5]	780	0.330	0.165
2-Methylnaphthalene	91-57-6	310	Residential RBCs	62	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	10	CH2M HILL	2.0	0.330	0.165
2,4,6-Trichlorophenol	88-06-2	10	CH2M HILL	2.0	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	4	CH2M HILL	2.0	0.830	0.415
1,1'-Biphenyl	92-52-4	60	CH2M HILL	12.0	0.330	0.165
2-Chloronaphthalene	91-58-7	6300	Residential RBCs	1300	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	200	CH2M HILL	40	0.330	0.165
2,6-Dinitrotoluene	606-20-2	78	Residential RBCs	16	0.330	0.165
Acenaphthylene	208-96-8	2300	Residential RBCs[6]	460	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	20	CH2M HILL	4.0	0.330	0.165
2,4-Dinitrophenol	51-28-5	20	CH2M HILL	4.0	0.830	0.415
4-Nitrophenol	100-02-7	7	CH2M HILL	4.0	0.830	0.415
Dibenzofuran	132-64-9	0.42	CH2M HILL	0.21	0.330	0.165
2,4-Dinitrotoluene	121-14-2	160	CH2M HILL	32	0.330	0.165
Diethylphthalate	84-66-2	100	CH2M HILL	20	0.330	0.165
Fluorene	86-73-7	30	CH2M HILL	6.0	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415
4,6-Dinitro-2-methylphenol	534-52-1	3900	Residential RBCs[7]	780	0.830	0.415
N-Nitroso diphenylamine	86-30-6	20	CH2M HILL	4.0	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	1.3	CH2M HILL	0.65	0.330	0.165
Hexachlorobenzene	118-74-1	0.02	CH2M HILL	0.010	0.330	0.165
Atrazine	1912-24-9	0.00662	CH2M HILL	0.033	0.330	0.165
Pentachlorophenol	87-86-5	5	CH2M HILL	1.0	0.830	0.415
Phenanthrene	85-01-8	0.204	CH2M HILL	0.10	0.330	0.165
Anthracene	120-12-7	0.0572	CH2M HILL	0.029	0.330	0.165
Carbazole	86-74-8	1.8	CH2M HILL	0.90	0.330	0.165
Di-n-butylphthalate	84-74-2	200	CH2M HILL	40	0.330	0.165
Fluoranthene	206-44-0	0.423	CH2M HILL	0.21	0.330	0.165
Pyrene	129-00-0	0.195	CH2M HILL	0.039	0.330	0.165
Butylbenzylphthalate	85-68-7	11	CH2M HILL	2.2	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	0.127	CH2M HILL	0.063	0.330	0.165
Benzo(a)anthracene	56-55-3	0.108	CH2M HILL	0.054	0.330	0.165
Chrysene	218-01-9	0.166	CH2M HILL	0.083	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	10	CH2M HILL	2.0	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165

QAPP Worksheet #15-4—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzo(b)fluoranthene	205-99-2	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(k)fluoranthene	207-08-9	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(a)pyrene	50-32-8	0.15	CH2M HILL	0.075	0.330	0.165
Indeno(1,2,3-cd)-pyrene	193-39-5	0.2	CH2M HILL	0.10	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.022	Residential RBCs	0.011	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	0.17	CH2M HILL	0.085	0.330	0.165

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
[7] The surrogate analyte "2-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.
"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-5—Reference Limits and Evaluation Table

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	7800	Residential RBCs	1600	0.330	0.165
Phenol	108-95-2	23000	Residential RBCs	4600	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	0.58	Residential RBCs	0.29	0.330	0.165
2-Chlorophenol	95-57-8	390	Residential RBCs	78	0.330	0.165
2-Methylphenol	95-48-7	3900	Residential RBCs	780	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	7800	Residential RBCs	1600	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	130	Residential RBCs	26	0.330	0.165
Hexachloroethane	67-72-1	46	Residential RBCs	9.2	0.330	0.165
Nitrobenzene	98-95-3	39	Residential RBCs	7.8	0.330	0.165
Isophorone	78-59-1	670	Residential RBCs	130	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	0.58	Residential RBCs[4]	0.29	0.330	0.165
2,4-Dichlorophenol	120-83-2	230	Residential RBCs	46	0.330	0.165
Naphthalene	91-20-3	1600	Residential RBCs	320	0.330	0.165
4-Chloroaniline	106-47-8	310	Residential RBCs	62	0.330	0.165
Hexachlorobutadiene	87-68-3	8.2	Residential RBCs	1.6	0.330	0.165
Caprolactam	105-60-2	39000	Residential RBCs	7800	0.330	0.165

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
4-Chloro-3-methylphenol	59-50-7	3900	Residential RBCs[5]	780	0.330	0.165
2-Methylnaphthalene	91-57-6	310	Residential RBCs	62	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	470	Residential RBCs	94	0.330	0.165
2,4,6-Trichlorophenol	88-06-2	58	Residential RBCs	12	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	7800	Residential RBCs	1600	0.830	0.415
1,1'-Biphenyl	92-52-4	3900	Residential RBCs	780	0.330	0.165
2-Chloronaphthalene	91-58-7	6300	Residential RBCs	1300	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	NC	N/A	0.330	0.330	0.165
2,6-Dinitrotoluene	606-20-2	78	Residential RBCs	16	0.330	0.165
Acenaphthylene	208-96-8	2300	Residential RBCs[6]	460	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	4700	Residential RBCs	940	0.330	0.165
2,4-Dinitrophenol	51-28-5	160	Residential RBCs	32	0.830	0.415
4-Nitrophenol	100-02-7	NC	N/A	0.830	0.830	0.415
Dibenzofuran	132-64-9	78	Residential RBCs	16	0.330	0.165
2,4-Dinitrotoluene	121-14-2	160	Residential RBCs	32	0.330	0.165
Diethylphthalate	84-66-2	63000	Residential RBCs	13000	0.330	0.165
Fluorene	86-73-7	3100	Residential RBCs	620	0.330	0.165
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
4,6-Dinitro-2-methylphenol	534-52-1	3900	Residential RBCs[7]	780	0.830	0.415
N-Nitroso diphenylamine	86-30-6	130	Residential RBCs	26	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	NC	N/A	0.330	0.330	0.165
Hexachlorobenzene	118-74-1	0.4	Residential RBCs	0.20	0.330	0.165
Atrazine	1912-24-9	2.9	Residential RBCs	0.58	0.330	0.165
Pentachlorophenol	87-86-5	5.3	Residential RBCs	1.1	0.830	0.415
Phenanthrene	85-01-8	2300	Residential RBCs[6]	460	0.330	0.165
Anthracene	120-12-7	23000	Residential RBCs	4600	0.330	0.165
Carbazole	86-74-8	32	Residential RBCs	6.4	0.330	0.165
Di-n-butylphthalate	84-74-2	7800	Residential RBCs	1560	0.330	0.165
Fluoranthene	206-44-0	3100	Residential RBCs	620	0.330	0.165
Pyrene	129-00-0	2300	Residential RBCs	460	0.330	0.165
Butylbenzylphthalate	85-68-7	16000	Residential RBCs	3200	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	1.4	Residential RBCs	0.28	0.330	0.165
Benzo(a)anthracene	56-55-3	0.22	Residential RBCs	0.11	0.330	0.165
Chrysene	218-01-9	22	Residential RBCs	4.4	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	46	Residential RBCs	9.2	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165
Benzo(b)fluoranthene	205-99-2	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(k)fluoranthene	207-08-9	2.2	Residential RBCs	0.44	0.330	0.165
Benzo(a)pyrene	50-32-8	2.2	Residential RBCs	0.44	0.330	0.165

QAPP Worksheet #15-5—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Indeno(1,2,3-cd)-pyrene	193-39-5	0.22	Residential RBCs	0.11	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.022	Residential RBCs	0.011	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	2300	Residential RBCs[6]	460	0.330	0.165

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

[7] The surrogate analyte "2-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILLCH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-6—Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: TCL Semivolatiles

Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Benzaldehyde	100-52-7	78000	Residential RBCs	16000	0.330	0.165
Phenol	108-95-2	0.031	CH2M HILL	0.016	0.330	0.165
bis-(2-Chloroethyl) ether	111-44-4	5.8	Residential RBCs	1.2	0.330	0.165
2-Chlorophenol	95-57-8	0.0312	CH2M HILL	0.016	0.330	0.165
2-Methylphenol	95-48-7	39000	Residential RBCs	7800	0.330	0.165
2,2'-oxybis(1-Chloropropane)	108-60-1	9.1	Residential RBCs	1.8	0.330	0.165
Acetophenone	98-86-2	78000	Residential RBCs	16000	0.330	0.165
4-Methylphenol	106-44-5	390	Residential RBCs	78	0.330	0.165
N-Nitroso-di-n propylamine	621-64-7	1300	Residential RBCs	260	0.330	0.165
Hexachloroethane	67-72-1	1	CH2M HILL	0.5	0.330	0.165
Nitrobenzene	98-95-3	390	Residential RBCs	78	0.330	0.165
Isophorone	78-59-1	6700	Residential RBCs	1300	0.330	0.165
2-Nitrophenol	88-75-5	NC	N/A	0.330	0.330	0.165
2,4-Dimethylphenol	105-67-9	1600	Residential RBCs	320	0.330	0.165
bis(2-Chloroethoxy) methane	111-91-1	5.8	Residential RBCs[4]	1.16	0.330	0.165
2,4-Dichlorophenol	120-83-2	0.117	CH2M HILL	0.059	0.330	0.165
Naphthalene	91-20-3	0.176	CH2M HILL	0.088	0.330	0.165
4-Chloroaniline	106-47-8	3100	Residential RBCs	620	0.330	0.165
Hexachlorobutadiene	87-68-3	82	Residential RBCs	16	0.330	0.165
Caprolactam	105-60-2	390000	Residential RBCs	78000	0.330	0.165
4-Chloro-3-methylphenol	59-50-7	39000	Residential RBCs[5]	7800	0.330	0.165
2-Methylnaphthalene	91-57-6	3100	Residential RBCs	620	0.330	0.165
Hexachlorocyclopentadiene	77-47-4	4700	Residential RBCs	940	0.330	0.165

QAPP Worksheet #15-6—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
2,4,6-Trichlorophenol	88-06-2	0.213	CH2M HILL	0.11	0.330	0.165
2,4,5-Trichlorophenol	95-95-4	78000	Residential RBCs	16000	0.830	0.415
1,1'-Biphenyl	92-52-4	1.1	CH2M HILL	0.55	0.330	0.165
2-Chloronaphthalene	91-58-7	63000	Residential RBCs	13000	0.330	0.165
2-Nitroaniline	88-74-4	NC	N/A	0.830	0.830	0.415
Dimethylphthalate	131-11-3	NC	N/A	0.330	0.330	0.165
2,6-Dinitrotoluene	606-20-2	780	Residential RBCs	160	0.330	0.165
Acenaphthylene	208-96-8	23000	Residential RBCs[6]	4600	0.330	0.165
3-Nitroaniline	99-09-2	NC	N/A	0.830	0.830	0.415
Acenaphthene	83-32-9	0.62	CH2M HILL	0.31	0.330	0.165
2,4-Dinitrophenol	51-28-5	1600	Residential RBCs	320	0.830	0.415
4-Nitrophenol	100-02-7	NC	N/A	0.830	0.830	0.415
Dibenzofuran	132-64-9	0.42	CH2M HILL	0.21	0.330	0.165
2,4-Dinitrotoluene	121-14-2	1600	Residential RBCs	320	0.330	0.165
Diethylphthalate	84-66-2	0.6	CH2M HILL	0.30	0.330	0.165
Fluorene	86-73-7	0.0774	CH2M HILL	0.039	0.330	0.165
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	0.330	0.330	0.165
4-Nitroaniline	100-01-6	NC	N/A	0.830	0.830	0.415
4,6-Dinitro-2-methylphenol	534-52-1	39000	Residential RBCs[7]	7800	0.830	0.415
N-Nitroso diphenylamine	86-30-6	2.684	CH2M HILL	0.54	0.330	0.165
4-Bromophenyl-phenylether	101-55-3	1.3	CH2M HILL	0.65	0.330	0.165
Hexachlorobenzene	118-74-1	0.02	CH2M HILL	0.010	0.330	0.165
Atrazine	1912-24-9	0.00662	CH2M HILL	0.0033	0.330	0.165
Pentachlorophenol	87-86-5	0.504	CH2M HILL	0.25	0.830	0.415
Phenanthrene	85-01-8	0.204	CH2M HILL	0.10	0.330	0.165

QAPP Worksheet #15-6—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TCL Semivolatiles
Concentration Level: Low (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Anthracene	120-12-7	0.0572	CH2M HILL	0.29	0.330	0.165
Carbazole	86-74-8	1.8	CH2M HILL	0.36	0.330	0.165
Di-n-butylphthalate	84-74-2	11	CH2M HILL	2.2	0.330	0.165
Fluoranthene	206-44-0	0.423	CH2M HILL	0.21	0.330	0.165
Pyrene	129-00-0	0.195	CH2M HILL	0.098	0.330	0.165
Butylbenzylphthalate	85-68-7	11	CH2M HILL	2.2	0.330	0.165
3,3'-Dichlorobenzidine	91-94-1	0.127	CH2M HILL	0.064	0.330	0.165
Benzo(a)anthracene	56-55-3	0.108	CH2M HILL	0.054	0.330	0.165
Chrysene	218-01-9	0.166	CH2M HILL	0.083	0.330	0.165
bis(2-Ethylhexyl) phthalate	117-81-7	0.18	CH2M HILL	0.090	0.330	0.165
Di-n-octylphthalate	117-84-0	NC	N/A	0.330	0.330	0.165
Benzo(b)fluoranthene	205-99-2	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(k)fluoranthene	207-08-9	0.24	CH2M HILL	0.12	0.330	0.165
Benzo(a)pyrene	50-32-8	0.22	Residential RBCs	0.11	0.330	0.165
Indeno(1,2,3-cd)-pyrene	193-39-5	0.2	CH2M HILL	0.10	0.330	0.165
Dibenzo(a,h)-anthracene	53-70-3	0.22	Residential RBCs	0.11	0.330	0.165
Benzo(g,h,i)perylene	191-24-2	0.17	CH2M HILL	0.085	0.330	0.165

QAPP Worksheet #15-6
Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "2-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-7—Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.006	CH2M HILL	0.003	0.0017	0.00028
beta-BHC	319-85-7	0.005	CH2M HILL	0.001	0.0017	0.00030
delta-BHC	319-86-8	0.12	CH2M HILL	0.024	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.00237	CH2M HILL	0.0012	0.0017	0.00024
Heptachlor	76-44-8	0.068	CH2M HILL	0.014	0.0017	0.00035
Aldrin	309-00-2	0.002	CH2M HILL	0.001	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.00247	CH2M HILL	0.0012	0.0017	0.00034
Endosulfan I	959-98-8	0.01	CH2M HILL	0.002	0.0017	0.00030
Dieldrin	60-57-1	0.0019	CH2M HILL	0.00095	0.0033	0.00062
4,4'-DDE	72-55-9	0.00316	CH2M HILL	0.0016	0.0033	0.00070
Endrin	72-20-8	0.00222	CH2M HILL	0.0011	0.0033	0.00051
Endosulfan II	33213-65-9	0.01	CH2M HILL	0.0050	0.0033	0.00069
4,4'-DDD	72-54-8	0.00488	CH2M HILL	0.0024	0.0033	0.00064
Endosulfan sulfate	1031-07-8	0.01	CH2M HILL	0.0050	0.0033	0.00065
4,4'-DDT	50-29-3	0.00416	CH2M HILL	0.0021	0.0033	0.00065
Methoxychlor	72-43-5	0.019	CH2M HILL	0.0095	0.017	0.00340
Endrin ketone	53494-70-5	23	Residential RBCs[4]	4.6	0.0033	0.00078
Endrin aldehyde	7421-93-4	23	Residential RBCs[4]	4.6	0.0033	0.00047

QAPP Worksheet #15-7—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-Chlordane	5103-71-9	0.0324	CH2M HILL	0.0065	0.0017	0.00034
gamma-Chlordane	5103-74-2	0.0324	CH2M HILL	0.0065	0.0017	0.00034
Toxaphene	8001-35-2	0.028	CH2M HILL	0.014	0.17	0.036
Aroclor-1016	12674-11-2	5.5	Residential RBCs	1.1	0.033	0.0049
Aroclor-1221	11104-28-2	0.32	Residential RBCs	0.064	0.067	0.0068
Aroclor-1232	11141-16-5	0.32	Residential RBCs	0.064	0.033	0.0032
Aroclor-1242	53469-21-9	0.32	Residential RBCs	0.064	0.033	0.0027
Aroclor-1248	12672-29-6	0.32	Residential RBCs	0.064	0.033	0.0050
Aroclor-1254	11097-69-1	0.32	Residential RBCs	0.064	0.033	0.0069
Aroclor-1260	11096-82-5	0.32	Residential RBCs	0.064	0.033	0.0048

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-8—Reference Limits and Evaluation Table

Matrix: Subsurface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.1	Residential RBCs	0.020	0.0017	0.00028
beta-BHC	319-85-7	0.35	Residential RBCs	0.070	0.0017	0.00030
delta-BHC	319-86-8	0.35	Residential RBCs[4]	0.07	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.49	Residential RBCs	0.098	0.0017	0.00024
Heptachlor	76-44-8	0.14	Residential RBCs	0.028	0.0017	0.00035
Aldrin	309-00-2	0.038	Residential RBCs	0.0076	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.07	Residential RBCs	0.014	0.0017	0.00034
Endosulfan I	959-98-8	47	Residential RBCs	9.4	0.0017	0.00030
Dieldrin	60-57-1	0.04	Residential RBCs	0.0080	0.0033	0.00062
4,4'-DDE	72-55-9	1.9	Residential RBCs	0.38	0.0033	0.00070
Endrin	72-20-8	2.3	Residential RBCs	0.46	0.0033	0.00051
Endosulfan II	33213-65-9	470	Residential RBCs[5]	94	0.0033	0.00069
4,4'-DDD	72-54-8	2.7	Residential RBCs	0.54	0.0033	0.00064
Endosulfan sulfate	1031-07-8	47	Residential RBCs	9.4	0.0033	0.00065
4,4'-DDT	50-29-3	1.9	Residential RBCs	0.38	0.0033	0.00065
Methoxychlor	72-43-5	39	Residential RBCs	7.8	0.017	0.00340
Endrin ketone	53494-70-5	23	Residential RBCs[6]	4.6	0.0033	0.00078
Endrin aldehyde	7421-93-4	23	Residential RBCs[6]	4.6	0.0033	0.00047

QAPP Worksheet #15-8—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-Chlordane	5103-71-9	1.8	Residential RBCs[7]	0.36	0.0017	0.00034
gamma-Chlordane	5103-74-2	1.8	Residential RBCs[7]	0.36	0.0017	0.00034
Toxaphene	8001-35-2	0.58	Residential RBCs	0.29	0.17	0.036
Aroclor-1016	12674-11-2	5.5	Residential RBCs	1.1	0.033	0.0049
Aroclor-1221	11104-28-2	0.32	Residential RBCs	0.16	0.067	0.0068
Aroclor-1232	11141-16-5	0.32	Residential RBCs	0.064	0.033	0.0032
Aroclor-1242	53469-21-9	0.32	Residential RBCs	0.064	0.033	0.0027
Aroclor-1248	12672-29-6	0.32	Residential RBCs	0.064	0.033	0.0050
Aroclor-1254	11097-69-1	0.32	Residential RBCs	0.064	0.033	0.0069
Aroclor-1260	11096-82-5	0.32	Residential RBCs	0.064	0.033	0.0048

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Technical HCH" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Endsulfan" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Chlordane" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-9—Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
alpha-BHC	319-84-6	0.006	CH2M HILL	0.0030	0.0017	0.00028
beta-BHC	319-85-7	0.005	CH2M HILL	0.0025	0.0017	0.00030
delta-BHC	319-86-8	0.12	CH2M HILL	0.024	0.0017	0.00033
gamma-BHC (Lindane)	58-89-9	0.00237	CH2M HILL	0.0012	0.0017	0.00024
Heptachlor	76-44-8	0.068	CH2M HILL	0.014	0.0017	0.00035
Aldrin	309-00-2	0.002	CH2M HILL	0.0010	0.0017	0.00032
Heptachlor epoxide	1024-57-3	0.00247	CH2M HILL	0.0012	0.0017	0.00034
Endosulfan I	959-98-8	0.01	CH2M HILL	0.0020	0.0017	0.00030
Dieldrin	60-57-1	0.0019	CH2M HILL	0.00095	0.0033	0.00062
4,4'-DDE	72-55-9	0.00316	CH2M HILL	0.0016	0.0033	0.00070
Endrin	72-20-8	0.00222	CH2M HILL	0.0011	0.0033	0.00051
Endosulfan II	33213-65-9	0.01	CH2M HILL	0.0050	0.0033	0.00069
4,4'-DDD	72-54-8	0.00488	CH2M HILL	0.0024	0.0033	0.00064
Endosulfan sulfate	1031-07-8	0.01	CH2M HILL	0.0050	0.0033	0.00065
4,4'-DDT	50-29-3	0.00416	CH2M HILL	0.0021	0.0033	0.00065
Methoxychlor	72-43-5	0.019	CH2M HILL	0.0095	0.017	0.00340
Endrin ketone	53494-70-5	230	Residential RBCs[4]	46	0.0033	0.00078
Endrin aldehyde	7421-93-4	230	Residential RBCs[4]	46	0.0033	0.00047
alpha-Chlordane	5103-71-9	0.0324	CH2M HILL	0.0065	0.0017	.00034

QAPP Worksheet #15-9—Reference Limits and Evaluation Table (continued)

Matrix: Sediment

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
gamma-Chlordane	5103-74-2	0.0324	CH2M HILL	0.0065	0.0017	0.00034
Toxaphene	8001-35-2	0.028	CH2M HILL	0.014	0.17	0.036
Aroclor-1016	12674-11-2	55	Residential RBCs	11	0.033	0.0049
Aroclor-1221	11104-28-2	3.2	Residential RBCs	0.64	0.067	0.0068
Aroclor-1232	11141-16-5	3.2	Residential RBCs	0.64	0.033	0.0032
Aroclor-1242	53469-21-9	3.2	Residential RBCs	0.64	0.033	0.0027
Aroclor-1248	12672-29-6	3.2	Residential RBCs	0.64	0.033	0.0050
Aroclor-1254	11097-69-1	3.2	Residential RBCs	0.64	0.033	0.0069
Aroclor-1260	11096-82-5	3.2	Residential RBCs	0.64	0.033	0.0048

NC: No Criteria; These constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment. These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-10—Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: TAL Metals/ Cyanide

Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	IDLs (mg/kg)
Aluminum	7429-90-5	78000	Residential RBCs	16000	20	2.21
Antimony	7440-36-0	5	CH2M HILL	2.5	6	0.0562
Arsenic	7440-38-2	0.43	Residential RBCs	0.22	1	0.265
Barium	7440-39-3	330	CH2M HILL	66	20	0.0312
Beryllium	7440-41-7	10	CH2M HILL	2	0.5	0.0124
Cadmium	7440-43-9	32	CH2M HILL	6.4	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	0.4	CH2M HILL	0.2	1	0.0461
Cobalt	7440-48-4	13	CH2M HILL	2.6	5	0.0273
Copper	7440-50-8	70	CH2M HILL	14	2.5	0.133
Iron	7439-89-6	55000	Residential RBCs	11000	10	0.611
Lead	7439-92-1	120	CH2M HILL	24	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	220	CH2M HILL	44	1.5	0.196
Mercury	7439-97-6	0.1	CH2M HILL	0.020	0.1	0.00242
Nickel	7440-02-0	38	CH2M HILL	7.6	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	1	CH2M HILL	0.5	3.5	0.377

QAPP Worksheet #15-10—Reference Limits and Evaluation Table (continued)

Matrix: Surface Soil

Analytical Group: TAL Metals/ Cyanide

Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	IDLs (mg/kg)
Silver	7440-22-4	390	Residential RBCs	78	1	0.0624
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	1	CH2M HILL	0.5	2.5	0.0638
Vanadium	7440-62-2	2	CH2M HILL	1	5	0.0316
Zinc	7440-66-6	50	CH2M HILL	10	6	0.171
Cyanide	57-12-5	1600	Residential RBCs	320	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-11—Reference Limits and Evaluation Table

Matrix: Subsurface Soil
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Aluminum	7429-90-5	78000	Residential RBCs	16000	20	2.21
Antimony	7440-36-0	31	Residential RBCs	6.2	6	0.0562
Arsenic	7440-38-2	0.43	Residential RBCs	0.22	1	0.265
Barium	7440-39-3	16000	Residential RBCs	3200	20	0.0312
Beryllium	7440-41-7	160	Residential RBCs	32	0.5	0.0124
Cadmium	7440-43-9	39	Residential RBCs	7.8	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	120000	Residential RBCs	24000	1	0.0461
Cobalt	7440-48-4	NC	N/A	5.0	5	0.0273
Copper	7440-50-8	3100	Residential RBCs	620	2.5	0.133
Iron	7439-89-6	55000	Residential RBCs	11000	10	0.611
Lead	7439-92-1	400	Human Health	80	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	1600	Residential RBCs	320	1.5	0.196
Mercury	7439-97-6	78	Residential RBCs[4]	15.6	0.1	0.00242
Nickel	7440-02-0	1600	Residential RBCs	320	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	390	Residential RBCs	78	3.5	0.377

QAPP Worksheet #15-11—Reference Limits and Evaluation Table (continued)

Matrix: Subsurface Soil

Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES
(ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Silver	7440-22-4	390	Residential RBCs	78	1	0.0624
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	5.5	Residential RBCs	2.8	2.5	0.0638
Vanadium	7440-62-2	78	Residential RBCs	16	5	0.0316
Zinc	7440-66-6	23000	Residential RBCs	4600	6	0.171
Cyanide	57-12-5	1600	Residential RBCs	320	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Methylmercury" was used for this analyte and multiplied by a factor of 10. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-12—Reference Limits and Evaluation Table

Matrix: Sediment
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Aluminum	7429-90-5	25500	CH2M HILL	5100	20	2.21
Antimony	7440-36-0	64	CH2M HILL	12.8	6	0.0562
Arsenic	7440-38-2	4.3	Residential RBCs	2.15	1	0.265
Barium	7440-39-3	500	CH2M HILL	100	20	0.0312
Beryllium	7440-41-7	1600	Residential RBCs	320	0.5	0.0124
Cadmium	7440-43-9	0.99	CH2M HILL	0.495	0.5	0.00775
Calcium	7440-70-2	NC	N/A	500	500	2.96
Chromium	7440-47-3	43.4	CH2M HILL	8.68	1	0.0461
Cobalt	7440-48-4	50	CH2M HILL	10	5	0.0273
Copper	7440-50-8	31.6	CH2M HILL	6.32	2.5	0.133
Iron	7439-89-6	20000	CH2M HILL	4000	10	0.611
Lead	7439-92-1	35.8	CH2M HILL	7.16	1	0.122
Magnesium	7439-95-4	NC	N/A	500	500	1.08
Manganese	7439-96-5	460	CH2M HILL	92	1.5	0.196
Mercury	7439-97-6	0.18	CH2M HILL	0.09	0.1	0.00242
Nickel	7440-02-0	22.7	CH2M HILL	4.54	4	0.0131
Potassium	7440-09-7	NC	N/A	500	500	3.71
Selenium	7782-49-2	2	CH2M HILL	1	3.5	0.377
Silver	7440-22-4	4.5	CH2M HILL	2.25	1	0.0624

QAPP Worksheet #15-12—Reference Limits and Evaluation Table (continued)

Matrix: Sediment
Analytical Group: TAL Metals/ Cyanide
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					CRQLs (mg/kg)	MDLs (mg/kg)
Sodium	7440-23-5	NC	N/A	500	500	2.21
Thallium	7440-28-0	55	Residential RBCs	11	2.5	0.0638
Vanadium	7440-62-2	780	Residential RBCs	156	5	0.0316
Zinc	7440-66-6	121	CH2M HILL	24.2	6	0.171
Cyanide	57-12-5	16000	Residential RBCs	3200	2.5	0.22

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment . These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-13—Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	10	CH2M HILL	2	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.8	Residential RBCs	1.16	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	230	Residential RBCs	46	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.78	Residential RBCs	0.16	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	10	CH2M HILL	2	0.08	0.022
Nitrobenzene (NB)	98-95-3	3.9	Residential RBCs	0.78	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.9	Residential RBCs	0.78	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	160	Residential RBCs[4]	32	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	80	CH2M HILL	16	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	16	Residential RBCs	3.2	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	7.8	Residential RBCs	1.6	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	78	Residential RBCs	16	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	160	Residential RBCs	32	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	31	Residential RBCs	6.2	0.10	0.034
PETN	78-11-5	NC	N/A	0.2	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	0.78	Residential RBCs	0.39	5	1
Nitroguanidine	556-88-7	782	Human Health	156	0.12	0.011

QAPP Worksheet #15-13—Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.
"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.
"Human Health" are human health screening values developed by CH2M HILL
human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-14—Reference Limits and Evaluation Table

Matrix: Subsurface Soil
Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)
Concentration Level: Medium

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	390	Residential RBCs	78	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	5.8	Residential RBCs	1.2	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	230	Residential RBCs	46	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	0.78	Residential RBCs	0.16	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	31	Residential RBCs	6.2	0.08	0.022
Nitrobenzene (NB)	98-95-3	3.9	Residential RBCs	0.78	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	3.9	Residential RBCs	0.78	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	160	Residential RBCs[4]	32	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	160	Residential RBCs[4]	32	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	16	Residential RBCs	3.2	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	7.8	Residential RBCs	1.6	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	78	Residential RBCs	16	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	160	Residential RBCs	32	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	31	Residential RBCs	6.2	0.10	0.034
PETN	78-11-5	NC	N/A	0.20	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	0.78	Residential RBCs	0.39	5	1
Nitroguanidine	556-88-7	782	Human Health	156	0.12	0.011

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-15—Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	10	CH2M HILL	2.0	0.08	0.014
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	10	CH2M HILL	2.0	0.08	0.012
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	2300	Residential RBCs	460	0.04	0.0050
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	7.8	Residential RBCs	1.6	0.04	0.0052
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	10	CH2M HILL	2	0.08	0.022
Nitrobenzene (NB)	98-95-3	39	Residential RBCs	7.8	0.04	0.0048
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	10	CH2M HILL	2	0.04	0.0058
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	1600	Residential RBCs[4]	320	0.04	0.0079
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	1600	Residential RBCs[4]	320	0.04	0.0051
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	160	Residential RBCs	32	0.04	0.0073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	78	Residential RBCs	16	0.04	0.0025
2-Nitrotoluene (2-NT)	88-72-2	780	Residential RBCs	160	0.08	0.014
3-Nitrotoluene (3-NT)	99-08-1	1600	Residential RBCs	320	0.08	0.025
4-Nitrotoluene (4-NT)	99-99-0	310	Residential RBCs	62	0.10	0.034
PETN	78-11-5	NC	N/A	0.20	0.20	0.029
3,5-Dinitroaniline	618-87-1	NC	N/A	80	80	0.0095
Nitroglycerine	55-63-0	7.8	Residential RBCs	3.9	5	1
Nitroguanidine	556-88-7	7820	Human Health	1560	0.12	0.011

QAPP Worksheet #15-15—Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment soil results will be compared to Residential RBCs and CH2M HILL's in-house ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminoinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment. These values were the most current available as of January 2008. Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-16—Reference Limits and Evaluation Table

Matrix: Surface and Subsurface Soil

Analytical Group: Wet Chemistry

Concentration Level: Medium (various)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Total organic carbon (TOC)	TOC[4]	NC	N/A	400	400	45.5
pH	PH[4]	NC	N/A	N/A	N/A	N/A

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface soil results will be compared to Residential RBCs and CH2M HILL ecological criteria. Subsurface soil results will be compared to Residential RBCs only.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] Contractor-specific CAS number

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-17—Reference Limits and Evaluation Table

Matrix: Sediment

Analytical Group: Wet Chemistry

Concentration Level: Medium (various)

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (mg/kg)	Laboratory-Specific Limits	
					QLs (mg/kg)	MDLs (mg/kg)
Total organic carbon (TOC)	TOC[4]	NC	N/A	400	400	45.5
Grain Size	GRAIN SIZE[4]	NC	N/A	N/A	N/A	N/A
pH	PH[4]	NC	N/A	N/A	N/A	N/A

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Sediment results will be compared to Residential RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] Contractor-specific CAS number

"Residential RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Residential Soil and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater Sediment and Flora and Fauna in Soils. The value for Flora and Fauna in Soils was used if established. If not established, the Freshwater Sediment values were applied. These values were the most current available as of January 2008. Soil and Sediment values are based upon a TOC value of 1%. Varations from this assumption in the analytical data results may result in a change in Project Action Limits.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-18—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Dichlorodifluoromethane	75-71-8	350	Tap Water RBCs	70	10	1.0
Chloromethane	74-87-3	190	Tap Water RBCs	38	10	1.0
Vinyl Chloride	75-01-4	0.015	Tap Water RBCs	0.0075	10	1.0
Bromomethane	74-83-9	8.5	Tap Water RBCs	1.7	10	1.0
Chloroethane	75-00-3	3.6	Tap Water RBCs	0.72	10	1.0
Trichlorofluoromethane	75-69-4	1300	Tap Water RBCs	260	10	1.0
1,1-Dichloroethene	75-35-4	7	MCLs	1.4	10	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	59000	Tap Water RBCs	12000	10	1.0
Acetone	67-64-1	5500	Tap Water RBCs	1100	10	1.0
Carbon Disulfide	75-15-0	1000	Tap Water RBCs	200	10	1.0
Methyl Acetate	79-20-9	6100	Tap Water RBCs	1200	10	1.0
Methylene Chloride	75-09-2	4.1	Tap Water RBCs	2.05	10	1.0
trans-1,2-Dichloroethene	156-60-5	100	MCLs	20	10	1.0
Methyl tert-Butyl Ether	1634-04-4	2.6	Tap Water RBCs	0.52	10	1.0
1,1-Dichloroethane	75-34-3	900	Tap Water RBCs	180	10	1.0
cis-1,2-Dichloroethene	156-59-2	61	Tap Water RBCs	12	10	1.0
2-Butanone	78-93-3	7000	Tap Water RBCs	1400	10	1.0
Chloroform	67-66-3	0.15	Tap Water RBCs	0.075	10	1.0
1,1,1-Trichloroethane	71-55-6	200	MCLs	40	10	1.0

QAPP Worksheet #15-18—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Cyclohexane	110-82-7	12000	Tap Water RBCs	2400	10	1.0
Carbon Tetrachloride	56-23-5	0.16	Tap Water RBCs	0.08	10	1.0
Benzene	71-43-2	0.34	Tap Water RBCs	0.17	10	1.0
1,2-Dichloroethane	107-06-2	0.12	Tap Water RBCs	0.06	10	1.0
Trichloroethene	79-01-6	0.026	Tap Water RBCs	0.013	10	1.0
Methylcyclohexane	108-87-2	6300	Tap Water RBCs	1300	10	1.0
1,2-Dichloropropane	78-87-5	0.26	Tap Water RBCs	0.13	10	1.0
Bromodichloromethane	75-27-4	0.17	Tap Water RBCs	0.085	10	1.0
cis-1,3-Dichloropropene	10061-01-5	0.44	Tap Water RBCs[4]	0.22	10	1.0
4-Methyl-2-pentanone	108-10-1	6300	Tap Water RBCs	1300	10	1.0
Toluene	108-88-3	1000	MCLs	200	10	1.0
trans-1,3-Dichloropropene	10061-02-6	0.44	Tap Water RBCs[4]	0.22	10	1.0
1,1,2-Trichloroethane	79-00-5	0.19	Tap Water RBCs	0.095	10	1.0
Tetrachloroethene	127-18-4	0.1	Tap Water RBCs	0.05	10	1.0
2-Hexanone	591-78-6	1.04	Human Health	0.52	10	1.0
Dibromochloromethane	124-48-1	0.13	Tap Water RBCs	0.065	10	1.0
1,2-Dibromoethane	106-93-4	0.0053	Tap Water RBCs	0.0027	10	1.0
Chlorobenzene	108-90-7	90	Tap Water RBCs	18	10	1.0
Ethylbenzene	100-41-4	700	MCLs	140	10	1.0

QAPP Worksheet #15-18—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Xylenes, total	1330-20-7	210	Tap Water RBCs	42	10	1.0
Styrene	100-42-5	100	MCLs	20	10	1.0
Bromoform	75-25-2	8.5	Tap Water RBCs	1.7	10	1.0
Isopropylbenzene	98-82-8	660	Tap Water RBCs	130	10	1.0
1,1,2,2-Tetrachloroethane	79-34-5	0.053	Tap Water RBCs	0.027	10	1.0
1,3-Dichlorobenzene	541-73-1	18	Tap Water RBCs	3.6	10	1.0
1,4-Dichlorobenzene	106-46-7	0.28	Tap Water RBCs	0.14	10	1.0
1,2-Dichlorobenzene	95-50-1	270	Tap Water RBCs	54	10	1.0
1,2-Dibromo-3-chloropropane	96-12-8	0.0002	Tap Water RBCs, MCLs	0.00010	10	1.0
1,2,4-Trichlorobenzene	120-82-1	61	Tap Water RBCs	12.2	10	1.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "1,3-Dichloropropene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-19—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Dichlorodifluoromethane	75-71-8	3500	Tap Water RBCs	700	10	1.0
Chloromethane	74-87-3	1900	Tap Water RBCs	380	10	1.0
Vinyl Chloride	75-01-4	0.15	Tap Water RBCs	0.075	10	1.0
Bromomethane	74-83-9	85	Tap Water RBCs	17	10	1.0
Chloroethane	75-00-3	36	Tap Water RBCs	7.2	10	1.0
Trichlorofluoromethane	75-69-4	13000	Tap Water RBCs	2600	10	1.0
1,1-Dichloroethene	75-35-4	25	CH2M HILL	5.0	10	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	590000	Tap Water RBCs	120000	10	1.0
Acetone	67-64-1	1500	CH2M HILL	300	10	1.0
Carbon Disulfide	75-15-0	0.92	CH2M HILL	0.46	10	1.0
Methyl Acetate	79-20-9	61000	Tap Water RBCs	12000	10	1.0
Methylene Chloride	75-09-2	41	Tap Water RBCs	8.2	10	1.0
trans-1,2-Dichloroethene	156-60-5	590	CH2M HILL	120	10	1.0
Methyl tert-Butyl Ether	1634-04-4	26	Tap Water RBCs	5.2	10	1.0
1,1-Dichloroethane	75-34-3	47	CH2M HILL	9.4	10	1.0
cis-1,2-Dichloroethene	156-59-2	590	CH2M HILL	120	10	1.0
2-Butanone	78-93-3	14000	CH2M HILL	2800	10	1.0
Chloroform	67-66-3	1.5	Tap Water RBCs	0.75	10	1.0
1,1,1-Trichloroethane	71-55-6	11	CH2M HILL	2.2	10	1.0

QAPP Worksheet #15-19—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Cyclohexane	110-82-7	120000	Tap Water RBCs	24000	10	1.0
Carbon Tetrachloride	56-23-5	1.6	Tap Water RBCs	0.80	10	1.0
Benzene	71-43-2	3.4	Tap Water RBCs	0.68	10	1.0
1,2-Dichloroethane	107-06-2	1.2	Tap Water RBCs	0.60	10	1.0
Trichloroethene	79-01-6	0.26	Tap Water RBCs	0.13	10	1.0
Methylcyclohexane	108-87-2	63000	Tap Water RBCs	13000	10	1.0
1,2-Dichloropropane	78-87-5	2.6	Tap Water RBCs	0.52	10	1.0
Bromodichloromethane	75-27-4	1.7	Tap Water RBCs	0.85	10	1.0
cis-1,3-Dichloropropene	10061-01-5	24.4	CH2M HILL	4.9	10	1.0
4-Methyl-2-pentanone	108-10-1	170	CH2M HILL	34	10	1.0
Toluene	108-88-3	9.8	CH2M HILL	2.0	10	1.0
trans-1,3-Dichloropropene	10061-02-6	24.4	CH2M HILL	4.9	10	1.0
1,1,2-Trichloroethane	79-00-5	1.9	Tap Water RBCs	0.95	10	1.0
Tetrachloroethene	127-18-4	1	Tap Water RBCs	0.20	10	1.0
2-Hexanone	591-78-6	99	CH2M HILL	20	10	1.0
Dibromochloromethane	124-48-1	1.3	Tap Water RBCs	0.65	10	1.0
1,2-Dibromoethane	106-93-4	0.053	Tap Water RBCs	0.027	10	1.0
Chlorobenzene	108-90-7	64	CH2M HILL	13	10	1.0
Ethylbenzene	100-41-4	90	CH2M HILL	18	10	1.0

QAPP Worksheet #15-19—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Volatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Xylenes, total	1330-20-7	13	CH2M HILL	2.6	10	1.0
Styrene	100-42-5	72	CH2M HILL	14	10	1.0
Bromoform	75-25-2	85	Tap Water RBCs	17	10	1.0
Isopropylbenzene	98-82-8	2.6	CH2M HILL	0.52	10	1.0
1,1,2,2-Tetrachloroethane	79-34-5	0.53	Tap Water RBCs	0.27	10	1.0
1,3-Dichlorobenzene	541-73-1	71	CH2M HILL	14	10	1.0
1,4-Dichlorobenzene	106-46-7	2.8	Tap Water RBCs	0.56	10	1.0
1,2-Dichlorobenzene	95-50-1	14	CH2M HILL	2.8	10	1.0
1,2-Dibromo-3-chloropropane	96-12-8	0.002	Tap Water RBCs	0.0010	10	1.0
1,2,4-Trichlorobenzene	120-82-1	110	CH2M HILL	22	10	1.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-20—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzaldehyde	100-52-7	3700	Tap Water RBCs	740	10	5
Phenol	108-95-2	11000	Tap Water RBCs	2200	10	5
bis-(2-Chloroethyl) ether	111-44-4	0.0096	Tap Water RBCs	0.0048	10	5
2-Chlorophenol	95-57-8	30	Tap Water RBCs	6.0	10	5
2-Methylphenol	95-48-7	1800	Tap Water RBCs	360	10	5
2,2'-oxybis(1-Chloropropane)	108-60-1	0.26	Tap Water RBCs	0.13	10	5
Acetophenone	98-86-2	610	Tap Water RBCs	120	10	5
4-Methylphenol	106-44-5	180	Tap Water RBCs	36	10	5
N-Nitroso-di-n propylamine	621-64-7	0.0096	Tap Water RBCs	0.0048	10	5
Hexachloroethane	67-72-1	4.8	Tap Water RBCs	2.4	10	5
Nitrobenzene	98-95-3	3.5	Tap Water RBCs	1.8	10	5
Isophorone	78-59-1	70	Tap Water RBCs	14	10	5
2-Nitrophenol	88-75-5	NC	N/A	10.0	10	5
2,4-Dimethylphenol	105-67-9	730	Tap Water RBCs	150	10	5
bis(2-Chloroethoxy) methane	111-91-1	0.0096	Tap Water RBCs[4]	0.0048	10	5
2,4-Dichlorophenol	120-83-2	110	Tap Water RBCs	22	10	5
Naphthalene	91-20-3	6.5	Tap Water RBCs	3.2	10	5
4-Chloroaniline	106-47-8	150	Tap Water RBCs	30	10	5
Hexachlorobutadiene	87-68-3	0.086	Tap Water RBCs	0.043	10	5
Caprolactam	105-60-2	18000	Tap Water RBCs	3600	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
4-Chloro-3-methylphenol	59-50-7	1800	Tap Water RBCs[5]	360	10	5
2-Methylnaphthalene	91-57-6	24	Tap Water RBCs	12	10	5
Hexachlorocyclopentadiene	77-47-4	50	MCLs	10	10	5
2,4,6-Trichlorophenol	88-06-2	6.1	Tap Water RBCs	3.0	10	5
2,4,5-Trichlorophenol	95-95-4	3700	Tap Water RBCs	740	25	12.5
1,1'-Biphenyl	92-52-4	300	Tap Water RBCs	60	10	5
2-Chloronaphthalene	91-58-7	490	Tap Water RBCs	98	10	5
2-Nitroaniline	88-74-4	NC	N/A	25.0	25	12.5
Dimethylphthalate	131-11-3	NC	N/A	10.0	10	5
2,6-Dinitrotoluene	606-20-2	37	Tap Water RBCs	7.4	10	5
Acenaphthylene	208-96-8	180	Tap Water RBCs[6]	36	10	5
3-Nitroaniline	99-09-2	NC	N/A	25	25	12.5
Acenaphthene	83-32-9	370	Tap Water RBCs	74	10	5
2,4-Dinitrophenol	51-28-5	73	Tap Water RBCs	37	25	12.5
4-Nitrophenol	100-02-7	NC	N/A	25	25	12.5
Dibenzofuran	132-64-9	37	Tap Water RBCs	7.4	10	5
2,4-Dinitrotoluene	121-14-2	73	Tap Water RBCs	15	10	5
Diethylphthalate	84-66-2	29000	Tap Water RBCs	5800	10	5
Fluorene	86-73-7	240	Tap Water RBCs	48	10	5
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	10.0	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
4-Nitroaniline	100-01-6	NC	N/A	25	25	12.5
4,6-Dinitro-2-methylphenol	534-52-1	73	Tap Water RBCs	37	25	12.5
N-Nitroso diphenylamine	86-30-6	14	Tap Water RBCs	7.0	10	5
4-Bromophenyl-phenylether	101-55-3	NC	N/A	10.0	10	5
Hexachlorobenzene	118-74-1	0.042	Tap Water RBCs	0.021	10	5
Atrazine	1912-24-9	0.3	Tap Water RBCs	0.15	10	5
Pentachlorophenol	87-86-5	1	MCLs	0.50	25	12.5
Phenanthrene	85-01-8	180	Tap Water RBCs[6]	36	10	5
Anthracene	120-12-7	1800	Tap Water RBCs	360	10	5
Carbazole	86-74-8	3.3	Tap Water RBCs	1.7	10	5
Di-n-butylphthalate	84-74-2	3700	Tap Water RBCs	740	10	5
Fluoranthene	206-44-0	1500	Tap Water RBCs	300	10	5
Pyrene	129-00-0	180	Tap Water RBCs	36	10	5
Butylbenzylphthalate	85-68-7	7300	Tap Water RBCs	1500	10	5
3,3'-Dichlorobenzidine	91-94-1	0.15	Tap Water RBCs	0.075	10	5
Benzo(a)anthracene	56-55-3	0.03	Tap Water RBCs	0.015	10	5
Chrysene	218-01-9	30	Tap Water RBCs	6.0	10	5
bis(2-Ethylhexyl) phthalate	117-81-7	4.8	Tap Water RBCs	5.0	10	5
Di-n-octylphthalate	117-84-0	NC	N/A	10.0	10	5
Benzo(b)fluoranthene	205-99-2	0.03	Tap Water RBCs	0.015	10	5
Benzo(k)fluoranthene	207-08-9	0.3	Tap Water RBCs	0.15	10	5

QAPP Worksheet #15-20—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzo(a)pyrene	50-32-8	0.003	Tap Water RBCs	0.0015	10	5
Indeno(1,2,3-cd)-pyrene	193-39-5	0.03	Tap Water RBCs	0.015	10	5
Dibenzo(a,h)-anthracene	53-70-3	0.003	Tap Water RBCs	0.0015	10	5
Benzo(g,h,i)perylene	191-24-2	180	Tap Water RBCs[4]	36	10	5

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "3-Methylphenol" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-21—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
Benzaldehyde	100-52-7	37000	Tap Water RBCs	7400	10	5.00
Phenol	108-95-2	110	CH2M HILL	22	10	5.00
bis-(2-Chloroethyl) ether	111-44-4	0.096	Tap Water RBCs	0.048	10	5.00
2-Chlorophenol	95-57-8	24	CH2M HILL	12	10	5.00
2-Methylphenol	95-48-7	13	CH2M HILL	6.5	10	5.00
2,2'-oxybis(1-Chloropropane)	108-60-1	2.6	Tap Water RBCs	1.3	10	5.00
Acetophenone	98-86-2	6100	Tap Water RBCs	1200	10	5.00
4-Methylphenol	106-44-5	543	CH2M HILL	109	10	5.00
N-Nitroso-di-n propylamine	621-64-7	0.096	Tap Water RBCs	0.048	10	5.00
Hexachloroethane	67-72-1	12	CH2M HILL	6.0	10	5.00
Nitrobenzene	98-95-3	35	Tap Water RBCs	7.0	10	5.00
Isophorone	78-59-1	700	Tap Water RBCs	140	10	5.00
2-Nitrophenol	88-75-5	1920	CH2M HILL	380	10	5.00
2,4-Dimethylphenol	105-67-9	21.2	CH2M HILL	11	10	5.00
bis(2-Chloroethoxy) methane	111-91-1	0.096	Tap Water RBCs[4]	0.048	10	5.00
2,4-Dichlorophenol	120-83-2	11	CH2M HILL	5.5	10	5.00
Naphthalene	91-20-3	12	CH2M HILL	6.0	10	5.00
4-Chloroaniline	106-47-8	232	CH2M HILL	46	10	5.00
Hexachlorobutadiene	87-68-3	1.3	CH2M HILL	0.65	10	5.00
Caprolactam	105-60-2	180000	Tap Water RBCs	36000	10	5.00
4-Chloro-3-methylphenol	59-50-7	0.3	CH2M HILL	0.15	10	5.00
2-Methylnaphthalene	91-57-6	4.7	CH2M HILL	2.3	10	5.00
Hexachlorocyclopentadiene	77-47-4	0.07	CH2M HILL	0.035	10	5.00
2,4,6-Trichlorophenol	88-06-2	4.9	CH2M HILL	2.5	10	5.00
2,4,5-Trichlorophenol	95-95-4	63	CH2M HILL	32	25	12.50
1,1'-Biphenyl	92-52-4	14	CH2M HILL	7.0	10	5.00
2-Chloronaphthalene	91-58-7	4900	Tap Water RBCs	980	10	5.00

QAPP Worksheet #15-21—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
2-Nitroaniline	88-74-4	NC	N/A	25.0	25	12.50
Dimethylphthalate	131-11-3	330	CH2M HILL	66	10	5.00
2,6-Dinitrotoluene	606-20-2	370	Tap Water RBCs	74	10	5.00
Acenaphthylene	208-96-8	23000	Tap Water RBCs[5]	4600	10	5.00
3-Nitroaniline	99-09-2	NC	N/A	25	25	12.50
Acenaphthene	83-32-9	23	CH2M HILL	12	10	5.00
2,4-Dinitrophenol	51-28-5	6.2	CH2M HILL	3.1	25	12.50
4-Nitrophenol	100-02-7	300	CH2M HILL	60	25	12.50
Dibenzofuran	132-64-9	3.7	CH2M HILL	1.9	10	5.00
2,4-Dinitrotoluene	121-14-2	730	Tap Water RBCs	150	10	5.00
Diethylphthalate	84-66-2	210	CH2M HILL	42	10	5.00
Fluorene	86-73-7	3.9	CH2M HILL	2.0	10	5.00
4-Chlorophenyl-phenyl ether	7005-72-3	NC	N/A	10.0	10	5.00
4-Nitroaniline	100-01-6	NC	N/A	25	25	12.50
4,6-Dinitro-2-methylphenol	534-52-1	2.3	CH2M HILL	1.2	25	12.50
N-Nitroso diphenylamine	86-30-6	140	Tap Water RBCs	28	10	5.00
4-Bromophenyl-phenylether	101-55-3	1.5	CH2M HILL	0.75	10	5.00
Hexachlorobenzene	118-74-1	0.42	Tap Water RBCs	0.21	10	5.00
Atrazine	1912-24-9	1.8	CH2M HILL	0.90	10	5.00
Pentachlorophenol	87-86-5	15	CH2M HILL	7.5	25	12.50
Phenanthrene	85-01-8	6.3	CH2M HILL	3.2	10	5.00
Anthracene	120-12-7	0.73	CH2M HILL	0.37	10	5.00
Carbazole	86-74-8	33	Tap Water RBCs	6.6	10	5.00
Di-n-butylphthalate	84-74-2	35	CH2M HILL	7.0	10	5.00
Fluoranthene	206-44-0	8.1	CH2M HILL	4.1	10	5.00
Pyrene	129-00-0	0.025	CH2M HILL	0.013	10	5.00
Butylbenzylphthalate	85-68-7	19	CH2M HILL	9.5	10	5.00

QAPP Worksheet #15-21—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Semivolatiles

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
3,3'-Dichlorobenzidine	91-94-1	1.5	Tap Water RBCs	0.75	10	5.00
Benzo(a)anthracene	56-55-3	0.027	CH2M HILL	0.014	10	5.00
Chrysene	218-01-9	30	Tap Water RBCs	6.0	10	5.00
bis(2-Ethylhexyl) phthalate	117-81-7	16	CH2M HILL	8.0	10	5.00
Di-n-octylphthalate	117-84-0	22	CH2M HILL	11	10	5.00
Benzo(b)fluoranthene	205-99-2	0.3	Tap Water RBCs	0.15	10	5.00
Benzo(k)fluoranthene	207-08-9	3	Tap Water RBCs	1.5	10	5.00
Benzo(a)pyrene	50-32-8	0.014	CH2M HILL	0.0070	10	5.00
Indeno(1,2,3-cd)-pyrene	193-39-5	0.3	Tap Water RBCs	0.15	10	5.00
Dibenzo(a,h)-anthracene	53-70-3	0.03	Tap Water RBCs	0.015	10	5.00
Benzo(g,h,i)perylene	191-24-2	23000	Tap Water RBCs[4]	4600	10	5.00

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "bis(2-Chloroethyl)ether" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Pyrene" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-22—Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: TCL Pesticides/ Aroclors
Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
alpha-BHC	319-84-6	0.011	Tap Water RBCs	0.0055	0.05	0.0042
beta-BHC	319-85-7	0.037	Tap Water RBCs	0.019	0.05	0.0039
delta-BHC	319-86-8	0.037	Tap Water RBCs[4]	0.019	0.05	0.0040
gamma-BHC (Lindane)	58-89-9	0.052	Tap Water RBCs	0.010	0.05	0.0049
Heptachlor	76-44-8	0.015	Tap Water RBCs	0.0075	0.05	0.0043
Aldrin	309-00-2	0.0039	Tap Water RBCs	0.0020	0.05	0.0037
Heptachlor epoxide	1024-57-3	0.0074	Tap Water RBCs	0.0037	0.05	0.0038
Endosulfan I	959-98-8	220	Tap Water RBCs	44	0.05	0.0043
Dieldrin	60-57-1	0.0042	Tap Water RBCs	0.0021	0.1	0.0082
4,4'-DDE	72-55-9	0.2	Tap Water RBCs	0.04	0.1	0.0079
Endrin	72-20-8	2	MCLs	0.40	0.1	0.0092
Endosulfan II	33213-65-9	220	Tap Water RBCs	44	0.1	0.0075
4,4'-DDD	72-54-8	0.28	Tap Water RBCs	0.056	0.1	0.0098
Endosulfan sulfate	1031-07-8	220	Tap Water RBCs[5]	44	0.1	0.0074
4,4'-DDT	50-29-3	0.2	Tap Water RBCs	0.040	0.1	0.0056
Methoxychlor	72-43-5	40	MCLs	8.0	0.5	0.032
Endrin ketone	53494-70-5	11	Tap Water RBCs[6]	2.2	0.1	0.0056
Endrin aldehyde	7421-93-4	11	Tap Water RBCs[6]	2.2	0.1	0.012
alpha-Chlordane	5103-71-9	0.19	Tap Water RBCs[7]	0.038	0.05	0.0039

QAPP Worksheet #15-22—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater
Analytical Group: TCL Pesticides/ Aroclors
Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
gamma-Chlordane	5103-74-2	0.19	Tap Water RBCs[7]	0.038	0.05	0.0035
Toxaphene	8001-35-2	0.061	Tap Water RBCs	0.031	5	0.65
Aroclor-1016	12674-11-2	0.5	MCLs	0.25	1	0.084
Aroclor-1221	11104-28-2	0.033	Tap Water RBCs	0.017	2	0.10
Aroclor-1232	11141-16-5	0.033	Tap Water RBCs	0.017	1	0.14
Aroclor-1242	53469-21-9	0.033	Tap Water RBCs	0.017	1	0.14
Aroclor-1248	12672-29-6	0.033	Tap Water RBCs	0.017	1	0.16
Aroclor-1254	11097-69-1	0.033	Tap Water RBCs	0.017	1	0.13
Aroclor-1260	11096-82-5	0.033	Tap Water RBCs	0.017	1	0.088

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Technical HCH" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[5] The surrogate analyte "Endosulfan" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[6] The surrogate analyte "Endrin" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

[7] The surrogate analyte "Chlordane" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-23—Reference Limits and Evaluation Table

Matrix: Surface Water

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
alpha-BHC	319-84-6	0.11	Tap Water RBCs	0.022	0.05	0.0042
beta-BHC	319-85-7	0.37	Tap Water RBCs	0.074	0.05	0.0039
delta-BHC	319-86-8	2.2	CH2M HILL	0.44	0.05	0.0040
gamma-BHC (Lindane)	58-89-9	0.08	CH2M HILL	0.016	0.05	0.0049
Heptachlor	76-44-8	0.0069	CH2M HILL	0.0035	0.05	0.0043
Aldrin	309-00-2	0.039	Tap Water RBCs	0.020	0.05	0.0037
Heptachlor epoxide	1024-57-3	0.0069	CH2M HILL	0.0035	0.05	0.0038
Endosulfan I	959-98-8	0.056	CH2M HILL	0.011	0.05	0.0043
Dieldrin	60-57-1	0.042	Tap Water RBCs	0.021	0.1	0.0082
4,4'-DDE	72-55-9	10.5	CH2M HILL	2.1	0.1	0.0079
Endrin	72-20-8	0.036	CH2M HILL	0.018	0.1	0.0092
Endosulfan II	33213-65-9	0.056	CH2M HILL	0.028	0.1	0.0075
4,4'-DDD	72-54-8	0.011	CH2M HILL	0.0055	0.1	0.0098
Endosulfan sulfate	1031-07-8	0.056	CH2M HILL	0.028	0.1	0.0074
4,4'-DDT	50-29-3	0.013	CH2M HILL	0.0065	0.1	0.0056
Methoxychlor	72-43-5	0.03	CH2M HILL	0.015	0.5	0.032
Endrin ketone	53494-70-5	0.036	CH2M HILL	0.018	0.1	0.0056
Endrin aldehyde	7421-93-4	0.036	CH2M HILL	0.018	0.1	0.012
alpha-Chlordane	5103-71-9	0.17	CH2M HILL	0.034	0.05	0.0039

QAPP Worksheet #15-23—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water

Analytical Group: TCL Pesticides/ Aroclors

Concentration Level: Medium (OLM04.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	MDLs (µg/L)
gamma-Chlordane	5103-74-2	0.17	CH2M HILL	0.034	0.05	0.0035
Toxaphene	8001-35-2	0.011	CH2M HILL	0.0055	5	0.65
Aroclor-1016	12674-11-2	0.28	CH2M HILL	0.14	1	0.084
Aroclor-1221	11104-28-2	0.28	CH2M HILL	0.14	2	0.10
Aroclor-1232	11141-16-5	0.33	Tap Water RBCs	0.17	1	0.14
Aroclor-1242	53469-21-9	0.053	CH2M HILL	0.027	1	0.14
Aroclor-1248	12672-29-6	0.081	CH2M HILL	0.041	1	0.16
Aroclor-1254	11097-69-1	0.033	CH2M HILL	0.017	1	0.13
Aroclor-1260	11096-82-5	0.33	Tap Water RBCs	0.017	1	0.088

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-24—Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Aluminum	7429-90-5	37000	Tap Water RBCs	7400	200	2.21
Antimony	7440-36-0	6	MCLs	3	60.0	0.0562
Arsenic	7440-38-2	0.045	Tap Water RBCs	0.0225	10.0	0.265
Barium	7440-39-3	2000	MCLs	400	200.0	0.0312
Beryllium	7440-41-7	4	MCLs	2	5.0	0.0124
Cadmium	7440-43-9	5	MCLs	1	5.0	0.00775
Calcium	7440-70-2	NC	N/A	5000	5000	2.96
Chromium	7440-47-3	100	MCLs	20	10	0.0461
Cobalt	7440-48-4	150	Tap Water RBCs[4]	50	50	0.0273
Copper	7440-50-8	1300	MCLs	260	25	0.133
Iron	7439-89-6	26000	Tap Water RBCs	5200	100	0.611
Lead	7439-92-1	15	MCLs	3	10.0	0.122
Magnesium	7439-95-4	NC	N/A	5000	5000	1.08
Manganese	7439-96-5	730	Tap Water RBCs	146	15.0	0.196
Mercury	7439-97-6	2	MCLs	0.4	0.20	0.0309
Nickel	7440-02-0	730	Tap Water RBCs	146	40	0.0131
Potassium	7440-09-7	NC	N/A	5000	5000	3.71
Selenium	7782-49-2	50	MCLs	10	35	0.377
Silver	7440-22-4	180	Tap Water RBCs	36	10	0.624

QAPP Worksheet #15-24—Reference Limits and Evaluation Table (continued)

Matrix: Groundwater
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Sodium	7440-23-5	NC	N/A	5000	5000	2.21
Thallium	7440-28-0	2	MCLs	1	25	0.0638
Vanadium	7440-62-2	37	Tap Water RBCs	7.4	50	0.0316
Zinc	7440-66-6	11000	Tap Water RBCs	2200	60	0.171
Cyanide	57-12-5	200	MCLs	40	10	4.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable
[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.
[2] Groundwater results will be compared to Tap Water RBCs and MCLs.
[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.
[3] This value was taken from a previous publication of the Tap Water RBCs, from April 2005. This action was recommended by a CH2M HILL human health risk assessor.
"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.
"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-25—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Aluminum	7429-90-5	87	CH2M HILL	44	200	2.21
Antimony	7440-36-0	30	CH2M HILL	6.0	60.0	0.0562
Arsenic	7440-38-2	0.45	Tap Water RBCs	0.23	10.0	0.265
Barium	7440-39-3	4	CH2M HILL	2.0	200.0	0.0312
Beryllium	7440-41-7	0.66	CH2M HILL	0.33	5.0	0.0124
Cadmium	7440-43-9	0.27	CH2M HILL	0.14	5.0	0.00775
Calcium	7440-70-2	NC	N/A	5000	5000	2.96
Chromium	7440-47-3	11.4	CH2M HILL	2.3	10	0.0461
Cobalt	7440-48-4	23	CH2M HILL	4.6	50	0.0273
Copper	7440-50-8	9.33	CH2M HILL	4.7	25	0.133
Iron	7439-89-6	1000	CH2M HILL	200	100	0.611
Lead	7439-92-1	3.18	CH2M HILL	1.6	10.0	0.122
Magnesium	7439-95-4	NC	N/A	5000	5000	1.08
Manganese	7439-96-5	120	CH2M HILL	24	15.0	0.196
Mercury	7439-97-6	0.91	CH2M HILL	0.46	0.20	0.0309
Nickel	7440-02-0	52.2	CH2M HILL	10	40	0.0131
Potassium	7440-09-7	NC	N/A	5000	5000	3.71
Selenium	7782-49-2	5	CH2M HILL	2.5	35	0.377
Silver	7440-22-4	0.36	CH2M HILL	0.18	10	0.624

QAPP Worksheet #15-25—Reference Limits and Evaluation Table (continued)

Matrix: Surface Water
Analytical Group: TAL Metals/ Cyanide, TAL Dissolved Metals
Concentration Level: ICP-AES (ILM05.3)

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					CRQLs (µg/L)	IDLs (µg/L)
Sodium	7440-23-5	NC	N/A	5000	5000	2.21
Thallium	7440-28-0	12	CH2M HILL	2.4	25	0.0638
Vanadium	7440-62-2	20	CH2M HILL	4.0	50	0.0316
Zinc	7440-66-6	120	CH2M HILL	24	60	0.171
Cyanide	57-12-5	5.2	CH2M HILL	2.6	10	4.0

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-26—Reference Limits and Evaluation Table

Matrix: Groundwater

Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)

Concentration Level: Medium

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					QLs (µg/L)	MDLs (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	1800	Tap Water RBCs	360	0.40	0.13
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	0.61	Tap Water RBCs	0.31	0.40	0.068
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	1100	Tap Water RBCs	220	0.20	0.035
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	3.7	Tap Water RBCs	1.9	0.20	0.022
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	150	Tap Water RBCs	30	0.55	0.180
Nitrobenzene (NB)	98-95-3	3.5	Tap Water RBCs	0.7	0.20	0.038
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	2.2	Tap Water RBCs	0.44	0.20	0.024
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	73	Tap Water RBCs[4]	14.6	0.20	0.028
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	73	Tap Water RBCs[4]	14.6	0.20	0.023
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	73	Tap Water RBCs	15	0.22	0.073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	37	Tap Water RBCs	7.4	0.40	0.028
2-Nitrotoluene (2-NT)	88-72-2	61	Tap Water RBCs	12	0.40	0.075
3-Nitrotoluene (3-NT)	99-08-1	120	Tap Water RBCs	24	0.40	0.088
4-Nitrotoluene (4-NT)	99-99-0	4.2	Tap Water RBCs	0.84	0.40	0.12
PETN	78-11-5	NC	N/A	1.0	1.0	0.35
3,5-Dinitroaniline	618-87-1	NC	N/A	0.40	0.40	0.095
Nitroglycerine	55-63-0	3.7	Tap Water RBCs	1.85	1000	200
Nitroguanidine	556-88-7	365	Human Health	73	10	2.70

QAPP Worksheet #15-26—Reference Limits and Evaluation Table (continued)

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Groundwater results will be compared to Tap Water RBCs and MCLs.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

[4] The surrogate analyte "Aminodinitrotoluenes" was used for this analyte. This is because there was no established criteria for the original analyte. This surrogate was approved by a CH2M HILL human health risk assessor.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"MCLs" are from the U.S. Environmental Protection Agency's Maximum Contaminant Levels (MCLs) for drinking water contaminants. These values were current as of January 2008.

"Human Health" are human health screening values developed by CH2M HILL human health risk assessors and were current as of January 2008.

Shading represents laboratory-specific QLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-27—Reference Limits and Evaluation Table

Matrix: Surface Water
Analytical Group: Explosives (Nitroaromatics/Nitroamines, PETN, 3,5-Dinitroaniline, Nitroglycerine, and Nitroguanidine)
Concentration Level: Medium

Analyte	CAS Number	Project Action Limits[1] (µg/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (µg/L)	Laboratory-Specific Limits	
					QLs (µg/L)	MDLs (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	330	CH2M HILL	66	0.40	0.13
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1	Tap Water RBCs	0.31	0.40	0.068
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	11	CH2M HILL	2.2	0.20	0.035
1,3-Dinitrobenzene (1,3-DNB)	99-65-0	17	CH2M HILL	3.4	0.20	0.022
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	479-45-8	1500	Tap Water RBCs	30	0.55	0.180
Nitrobenzene (NB)	98-95-3	35	Tap Water RBCs	0.7	0.20	0.038
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	55	Tap Water RBCs	0.44	0.20	0.024
4-Amino-2,6-dinitrotoluene (4-Am-DNT)	1946-51-0	730	Tap Water RBCs[4]	146	0.20	0.028
2-Amino-4,6-dinitrotoluene (2-Am-DNT)	35572-78-2	1480	CH2M HILL	300	0.20	0.023
2,4-Dinitrotoluene (2,4-DNT)	121-14-2	37	CH2M HILL	7.4	0.22	0.073
2,6-Dinitrotoluene (2,6-DNT)	606-20-2	81	CH2M HILL	16	0.40	0.028
2-Nitrotoluene (2-NT)	88-72-2	610	Tap Water RBCs	12	0.40	0.075
3-Nitrotoluene (3-NT)	99-08-1	120	Tap Water RBCs	24	0.40	0.088
4-Nitrotoluene (4-NT)	99-99-0	42	Tap Water RBCs	0.84	0.40	0.12
PETN	78-11-5	85000	CH2M HILL	17000.0	1.0	0.35
3,5-Dinitroaniline	618-87-1	59	CH2M HILL	12.00	0.40	0.095
Nitroglycerine	55-63-0	37	Tap Water RBCs	7.4	1000	200
Nitroguanidine	556-88-7	3650	Human Health	730	10	2.70

NC: No Criteria; these constituents will be analyzed in order to determine their presence or absence at the AOC being investigated. Should these constituents be detected, the Team will reconvene and determine the appropriate path forward. N/A: Not applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Surface Water results will be compared to Tap Water RBCs and CH2M HILL ecological criteria.

[3] Project Quantitation Limit Goals were determined on a case by case basis by dividing the Project Action Limit by a factor of 2 or 5. The rationale behind this was to establish the lowest possible Project Quantitation Limit Goal while assuring that this goal was above laboratory-specific QLs.

"Tap Water RBCs" are from Risk-Based Concentration Table, October 2007, U.S. EPA Region III, Jennifer Hubbard for Tap Water and are subject to change when RBCs are updated.

"CH2M HILL" are ecological screening values developed by CH2M HILL ecological risk assessors specifically for Naval Weapons Station Yorktown and Cheatham Annex. These values were based upon Region III Biological Technical Assistance Group (BTAG) values for Freshwater.

Shading represents laboratory-specific CRQLs that are greater than project action limits. Detections of such analytes will serve to verify their presence in media at the associated AOC.

QAPP Worksheet #15-28—Reference Limits and Evaluation Table

Matrix: Liquid IDW

Analytical Group: TCLP-VOCs (Volatile results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
1,1-Dichloroethene	75-35-4	700	40 CFR 261.4	140	100	4.2
1,2-Dichloroethane	107-06-2	500	40 CFR 261.4	100	100	7.1
2-Butanone	78-93-3	200000	40 CFR 261.4	40000	100	24
Benzene	71-43-2	500	40 CFR 261.4	100	100	3.2
Carbon tetrachloride	56-23-5	500	40 CFR 261.4	100	100	7.4
Chlorobenzene	108-90-7	100000	40 CFR 261.4	20000	100	4.9
Chloroform	67-66-3	6000	40 CFR 261.4	1200	100	5.2
Tetrachloroethene	127-18-4	700	40 CFR 261.4	140	100	3.8
Trichloroethene	79-01-6	500	40 CFR 261.4	100	100	4.4
Vinyl chloride	75-01-4	200	40 CFR 261.4	40	100	9.5

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-29—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-SVOCs (Semivolatile results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
2-Methylphenol	95-48-7	200000	40 CFR 261.4	40000	150	48
4-Methylphenol	106-44-5	200000	40 CFR 261.4	40000	150	44
1,4-Dichlorobenzene	106-46-7	7500	40 CFR 261.4	1500	50	6.5
2,4-Dinitrotoluene	121-14-2	130	40 CFR 261.4	65	50	12
Hexachlorobenzene	118-74-1	130	40 CFR 261.4	65	50	9
Hexachlorobutadiene	87-68-3	500	40 CFR 261.4	100	50	9.5
Hexachloroethane	67-72-1	3000	40 CFR 261.4	600	50	9.5
Nitrobenzene	98-95-3	2000	40 CFR 261.4	400	50	6.5
Pentachlorophenol	87-86-5	100000	40 CFR 261.4	20000	100	22
Pyridine	110-86-1	5000	40 CFR 261.4	1000	50	8.5
2,4,5-Trichlorophenol	95-95-4	400000	40 CFR 261.4	80000	52	17
2,4,6-Trichlorophenol	88-06-2	2000	40 CFR 261.4	400	50	15

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-30—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Pesticides (Pesticide results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
gamma-BHC (Lindane)	58-89-9	400	40 CFR 261.4	80	0.25	0.010
Heptachlor	76-44-8	8	40 CFR 261.4	1.6	0.25	0.010
Heptachlor epoxide	1024-57-3	8	40 CFR 261.4	0.17	0.25	0.015
Endrin	72-20-8	20	40 CFR 261.4	4	0.25	0.012
Methoxychlor	72-43-5	10000	40 CFR 261.4	2000	0.25	0.016
Toxaphene	8001-35-2	500	40 CFR 261.4	100	5.0	0.28
Chlordane (technical)	12789-03-6	30	40 CFR 261.4	6	5.0	0.26

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-31—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Herbicides (Herbicide results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
2,4,5-TP (Silvex)	93-72-1	1000	40 CFR 261.4	200	5.0	0.32
2,4-D	94-75-7	10000	40 CFR 261.4	2000	5.0	0.55

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-32—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: TCLP-Metals (Metal results from the leaching procedure)

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (ug/L)	Laboratory-specific	
					QLs (ug/L)	MDLs (ug/L)
Arsenic	7440-38-2	5000	40 CFR 261.4	1000	200	42
Barium	7440-39-3	100000	40 CFR 261.4	20000	1000	32
Cadmium	7440-43-9	1000	40 CFR 261.4	200	60	2.1
Chromium	7440-47-3	5000	40 CFR 261.4	1000	50	6.3
Lead	7439-92-1	5000	40 CFR 261.4	1000	100	12
Selenium	7782-49-2	1000	40 CFR 261.4	200	200	1.7
Silver	7440-22-4	5000	40 CFR 261.4	1000	50	4.7
Mercury	7439-97-6	200	40 CFR 261.4	40	2.0	0.19

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-34—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: Corrosivity

Analyte	CAS Number	Project Action Limit[1] (s.u.)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (s.u.)	Laboratory-specific	
					QLs (s.u.)	MDLs (s.u.)
pH	PH	2<pH<12.5	40 CFR 261.4	0<pH<14	0<pH<14	N/A

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #15-35—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: Ignitability

Analyte	CAS Number	Project Action Limit[1] (degrees F)	Project Action Limit Reference[2]	Project Quantitation Limit Goal[3] (degrees F)	Laboratory-specific	
					QLs (F)[2]	MDLs (F)
Ignitablitity	FLASHPOINT	140	40 CFR 261.4	140	70 - 140 - 200	N/A

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Aqueous IDW results will be compared to 40 CFR 261.4.

[3] Project Quantitation Limit Goal was determined based on the Project Action Limit.

QAPP Worksheet #15-36—Reference Limits and Evaluation Table

Matrix: Liquid IDW
Analytical Group: Reactivity

Analyte	CAS Number	Project Action Limit[1] (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal[2] (mg/L)	Laboratory-specific	
					QLs	MDLs
Reactivity to Sulfide	REACT-S	NC	N/A	10	10	N/A
Reactivity to Cyanide	REACT-CN	NC	N/A	0.025	0.025	N/A

NC = No Criteria; N/A = Not Applicable

[1] Project Action Limits are based upon the most conservative value found for that particular constituite in applicable regulatory criteria.

[2] Project Quantitation Limit Goal was determined based on the Laboratory's achievable Quantitation Limit.

QAPP Worksheet #16—Project Schedule/Timeline Table

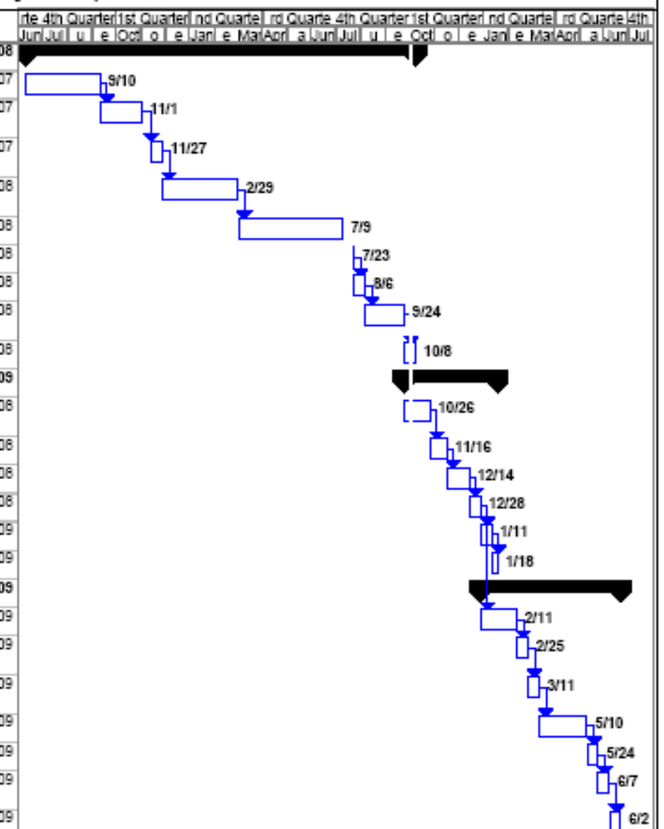
(UFP-QAPP Manual Section 2.8.2)

List all project activities as well as the QA assessments that will beperformed during the course of the project. Include the anticipated start and completion dates.

☐ Worksheet Not Applicable (State Reason)

Table 4-1
CAX AOCs 1, 6, 7, and 8 Site Investigations - Project Schedule

ID	CAX AOCs Site Investigation - CTO-174	Duration	Start	Finish
1	**Work Plan**	**486 days**	**Mon 6/11/07**	**Wed 10/8/08**
2	Preparation of Preliminary Work Plan	92 days	Mon 6/11/07	Mon 9/10/07
3	Preliminary Work Plan review by NAVFAC	52 days	Tue 9/11/07	Thu 11/1/07
4	Respond to NAVFAC Comments and Produce Draft Work Plan	14 days	Wed 11/14/07	Tue 11/27/07
5	Comment Resolution and QAPP revisons	94 days	Wed 11/28/07	Fri 2/29/08
6	Regulatory Review of Draft Work Plan	129 days	Mon 3/3/08	Wed 7/9/08
7	Comment Resolution	1 day	Wed 7/23/08	Wed 7/23/08
8	RTCs on Draft Work Plan	14 days	Thu 7/24/08	Wed 8/6/08
9	Regulatory Review of Draft Final Work Plan, QAPP and RTCs	49 days	Thu 8/7/08	Wed 9/24/08
10	Final Work Plan Production	14 days	Thu 9/25/08	Wed 10/8/08
11	**Field Investigation**	**117 days**	**Wed 9/24/08**	**Sun 1/18/09**
12	Field Work - Subcontractor procurement and field preparation	33 days	Wed 9/24/08	Sun 10/26/08
13	Field Work - test pits, media sampling	21 days	Mon 10/27/08	Sun 11/16/08
14	Laboratory Analyses	28 days	Mon 11/17/08	Sun 12/14/08
15	Analytical Data QC	14 days	Mon 12/15/08	Sun 12/28/08
16	Analytical Data Validation	14 days	Mon 12/29/08	Sun 1/11/09
17	Loading of Analytical Data into Endat	7 days	Mon 1/12/09	Sun 1/18/09
18	**SI Report**	**175 days**	**Mon 12/29/08**	**Sun 6/21/09**
19	Preparation of Preliminary SI Report	45 days	Mon 12/29/08	Wed 2/11/09
20	Preliminary SI Report review by NAVFAC	14 days	Thu 2/12/09	Wed 2/25/09
21	Respond to NAVFAC Comments and Product Draft SI Report	14 days	Thu 2/26/09	Wed 3/11/09
22	Regulatory Review of Draft SI Report	60 days	Thu 3/12/09	Sun 5/10/09
23	RTCs on Draft SI Report	14 days	Mon 5/11/09	Sun 5/24/09
24	Regulatory Review of Draft Final SI Report and RTCs	14 days	Mon 5/25/09	Sun 6/7/09
25	Final SI Report Production	14 days	Mon 6/8/09	Sun 6/21/09



Task | Milestone | External Tasks
Split | Summary | External Milestone
Progress | Project Summary | Deadline

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QAPP Worksheet #17—Sampling Design and Rationale
(UFP-QAPP Section 3.1.1)

Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

☐ Worksheet Not Applicable (State Reason)

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): The proposed sampling locations were chosen consistent with historical records in order to bias the sampling to areas where releases most likely occurred.
Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]: The number of samples to be taken was based on prior history of the AOCs, site topography, and known transport routes and were agreed to by the project team. For the sampling design and rationale, See Section 3.2.2 of the SI Work Plan. For details of the QA/QC sampling, see Section 3.2.1 of the SI Work Plan. The sampling design and rationale was developed using the *Guidance for Performing Site Inspections Under CERCLA* (Interim Final, U.S. Environmental Protection Agency, EPA/540-R-92-021, PB92-963375, September 1992) as a reference.

QAPP Worksheet #18— Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations or ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all required information, using additional worksheets if necessary.

☐ Worksheet Not Applicable (State Reason)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
N/A	Aqueous IDW	N/A	TCLP VOCs	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP SVOCs	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Pesticides	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Herbicides	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	TCLP Metals	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Reactivity to Cyanide and Sulfide	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Corrosivity	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
N/A	Aqueous IDW	N/A	Ignitability	Medium	1	HSE-411	See Section 3.2.1 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TAL Dissolved Metal	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	TCL Pesticides/ Aroclors	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 1	Groundwater	Dependent on potential concentration*	Explosives	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	7	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Volatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Explosives	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Nitroglycerin	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Nitroguanadine	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Surface Soil	0-6” bgs	Total Organic Carbon, pH	Medium	19/ 19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TAL Metals/ Cyanide	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	TCL Pesticides/ Aroclors	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Explosives	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 1	Subsurface Soil	6-24” bgs	TCL Volatiles	Medium	19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 1	Subsurface Soil	6-24” bgs	Total Organic Carbon, pH	Medium	19/ 19	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TAL Metals/Cyanide	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TAL Dissolved Metals	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Explosives	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	10	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TAL Metals/Cyanide	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TAL Dissolved Metals	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	TCL Semivolatiles	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Explosives	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Nitroglycerin	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Nitroguanadine	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Water	Directly below water surface	Hardness	Medium	2	SW Sampling	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	TAL Metals/Cyanide	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Total Organic Carbon	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 6	Surface Soil	0-6” bgs	pH	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Explosives	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Nitroglycerin	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Surface Soil	0-6” bgs	Nitroguanadine	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	TAL Metals/Cyanide	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Total Organic Carbon	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	pH	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Explosives	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	18	Soils	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	TAL Metals/ Cyanide	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	TCL Semivolatiles	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Total Organic Carbon	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	pH	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Grain Size	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Explosives	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Nitroglycerin	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 6	Sediment	Top 4”	Nitroguanadine	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 6	Sediment	Top 4”	Acid Volatile Sulfate/Simultaneously Extracted Metals (AVS/SEM)	Medium	4	Sediment	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TAL Dissolved Metal	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	TCL Pesticides/Aroclors	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Explosives	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Volatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Explosives	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Nitroglycerin	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	Nitroguanadine	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 7	Surface Soil	0-6” bgs	Total Organic Carbon	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Surface Soil	0-6” bgs	pH	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	TCL Volatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	TAL Metals/ Cyanide	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	TCL Pesticides/ Aroclors	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	Explosives	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	Total Organic Carbon	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 7	Subsurface Soil	6-24” bgs	pH	Medium	7	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Volatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TAL Metals/ Cyanide	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TAL Dissolved Metals	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Semivolatiles	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	TCL Pesticides/ Aroclors	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	Explosives	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Groundwater	Dependent on potential concentration*	Nitroglycerin	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 8	Groundwater	Dependent on potential concentration*	Nitroguanadine	Medium	4	DPGW	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Volatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TAL Metals/ Cyanide	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Semivolatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	TCL Pesticides/ Aroclors	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Explosives	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Nitroglycerin	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Nitroguanadine	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	Total Organic Carbon	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Surface Soil	0-6” bgs	pH	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Volatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TAL Metals/ Cyanide	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Semivolatiles	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	TCL Pesticides/ Aroclors	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Explosives	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Nitroglycerin	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Nitroguanadine	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan
AOC 8	Subsurface Soil	6-24” bgs	Total Organic Carbon	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan

QAPP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
AOC 8	Subsurface Soil	6-24" bgs	pH	Medium	9	Soils	See Section 3.2.2 of the SI Work Plan

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21).

* In the source areas, the sample collection depth will be determined based on the depth of the observed potential contamination. In upgradient and downgradient areas, the sample depth interval will be approximately 0 to 2 ft below the water table.

QAPP Worksheet #19—Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

For each matrix, analytical group, and concentration level, list the analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding time.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
Aqueous IDW	TCLP Volatiles	Medium	SW-846 1311, 8260B	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to analyze
Aqueous IDW	TCLP Semivolatiles	Medium	SW-846 1311, 8270C	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	Corrosivity	Medium	SW-846 7.2.2-1a	100ml	125ml HDPE	cool to 4±2 degrees C	24 hours to analyze
Aqueous IDW	Ignitability	Medium	SW-846 1010	100ml	125ml HDPE	cool to 4±2 degrees C	28 days to analyze
Aqueous IDW	TCLP Herbicides	Medium	SW-846 1311, 8151A	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	TCLP Metals	Medium	SW-846 1311, 6010B, 7470A	1L	1 L HDPE	cool to 4±2 degrees C	6 months
Aqueous IDW	TCLP Pesticides	Medium	SW-846 1311, 8081A	1L	1 L amber glass with Teflon-lined cap	cool to 4±2 degrees C	7 days of sample filtration to extract/40 days analysis
Aqueous IDW	Reactivity to cyanide	Medium	SW-846 7.3, 9014	100 mL	250 mL plastic	cool to 4±2 degrees C, NaOH to pH > 12	14 days
Aqueous IDW	Reactivity to sulfide	Medium	SW-846 7.3, 9034	100 mL	250 mL plastic	cool to 4±2 degrees C, NaOH to pH >2, ZnAce	7 days
GW	TCL VOCs	Medium	CLP OLM04.3	(3) 40 mL	(3) 40 mL VOA Vial	cool to 4±2 degrees C, 1:1 HCL, pH <2	10 Days VTSR

QAPP Worksheet #19—Analytical SOP Requirements Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
GW	TAL Metals, TAL Diss. Metals	Medium	CLP ILM05.3	500 mL	Plastic	cool to 4±2 degrees C HNO3, pH <2	6 Months/28 Days (Hg)
GW	Cyanide	Medium	CLP ILM05.3	250 mL	Plastic	cool to 4±2 degrees C, NaOH	14 Days
GW	TCL SVOCs	Medium	CLP OLM04.3	(2)1000 mL	Glass	cool to 4±2 degrees C	5 Days VSTR/40 Days
GW	TCL Pesticides/ PCBs	Medium	CLP OLM04.3	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	5-days of VTSR / 40 -days analysis
GW	Explosives	Medium	SW846 8330	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
GW	Nitroglycerin	Medium	SW846 8332	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
GW	Nitroguanadine	Medium	SW846 8330M	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	TAL Metals, TAL Diss. Metals	Medium	CLP ILM05.3	500 mL	Plastic	cool to 4±2 degrees C HNO3, pH <2	6 Months/28 Days (Hg)
SW	Cyanide	Medium	CLP ILM05.3	250 mL	Plastic	cool to 4±2 degrees C, NaOH	14 Days
SW	Explosives	Medium	SW846 8330	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Nitroglycerin	Medium	SW846 8332	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Nitroguanadine	Medium	SW846 8330M	1- L	1-L Amber Glass with Telflon-lined lid	cool to 4±2 degrees C	7-days ext/ 40-days analysis
SW	Hardness	Medium	SM 2340B	500 mL	Plastic	HNO3, pH <2, cool to 4±2 degrees C, dark	6 months/ 28 days
SS/SB	TCL VOCs	Medium	CLP OLM04.3	2 oz.	Soil jar with Teflon-lined cap	cool to 4±2 degrees C	10 VSTR Days
SS/SB	TAL Metals	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	6 Months/28 Days (Hg)
SS/SB	Cyanide		CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SS/SB	Total Organic Carbon	Medium	Lloyd Kahn	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SS/SB	pH	Medium	SW846 9045C	2 oz.	Soil jar	cool to 4±2 degrees C	7 Days
SS/SB	TCL SVOCs	Medium	CLP OLM04.3	4 oz.	Soil jar	cool to 4±2 degrees C	10 Days VSTR/40 Days

QAPP Worksheet #19—Analytical SOP Requirements Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference1	Sample Volume	Containers (Number, Size, and Type)	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)
SS/SB	TCL Pesticides/ PCBs	Medium	CLP OLM04.3	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	10-days of VTSR / 40 -days analysis
SS/SB	Explosives	Medium	SW846 8330	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SS/SB	Nitroglycerin	Medium	SW846 8332	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SS/SB	Nitroguanadine	Medium	SW846 8330M	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	TAL Metals	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	6 Months
SD	Cyanide	Medium	CLP ILM05.3	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SD	AVS/SEM	Medium	EPA 821-R-91-100	2 oz.	Soil jar	cool to 4±2 degrees C, dark	14 Days
SD	Total Organic Carbon	Medium	Lloyd Kahn	2 oz.	Soil jar	cool to 4±2 degrees C	14 Days
SD	pH	Medium	SW846 9045C	2 oz.	Soil jar	cool to 4±2 degrees C	7 Days
SD	Grain Size	Medium	ASTM D422	500 g	1 16oz jar or zip-lock bag	None	None
SD	Explosives	Medium	SW846 8330	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	Nitroglycerin	Medium	SW846 8332	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis
SD	Nitroguanadine	Medium	SW846 8330M	250 GM	8-oz Glass with Teflon-lined lid	cool to 4±2 degrees C	14-days ext/ 40-days analysis

[1] See Analytical SOP References table (Worksheet #23).

QAPP Worksheet #20— Field Quality Control Sample Summary Table
(UFP-QAPP Manual Section 3.1.1)

Summarize by matrix, analytical group, and concentration level the number of field QC samples that will be collected and sent to the laboratory.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Aqueous IDW	TCLP-VOCs	Medium	H7, M5	1	0	0	0	0	0	1
Aqueous IDW	TCLP-SVOCs	Medium	H7, P5	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Pesticides	Medium	H7, Q6	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Herbicides	Medium	H7, Q10	1	0	0	0	0	0	1
Aqueous IDW	TCLP-Metals	Medium	H7, H10, H12	1	0	0	0	0	0	1
Aqueous IDW	Reactivity to Cyanide	Medium	J13, J43	1	0	0	0	0	0	1
Aqueous IDW	Reactivity to Sulfide	Medium	J13, J11	1	0	0	0	0	0	1
Aqueous IDW	Corrosivity	Medium	J12	1	0	0	0	0	0	1
Aqueous IDW	Ignitability	Medium	N1	1	0	0	0	0	0	1
Groundwater	VOA	Medium	SOP-7, SOP-9	12	2	2	1	3	3	23
Groundwater	TAL Metals/Cyanide	Medium	SOP-4, SOP-11, SOP-17, SOP-19	22	3	4	1	4	0	33
Groundwater	TAL Dissolved Metals	Medium	SOP-4, SOP-11, SOP-17, SOP-19	22	3	4	1	4	0	33
Groundwater	TCL Semivolatiles	Medium	SOP-6, SOP-8	12	2	2	1	3	0	20

QAPP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Groundwater	TCL Pesticides/ Aroclor	Medium	Q20	12	2	2	1	3	0	20
Groundwater	Explosives	Medium	S1	22	3	4	1	4	0	33
Groundwater	Nitroglycerin	Medium	S7	22	3	4	1	4	0	33
Groundwater	Nitroguanadine	Medium	S4	22	3	4	1	4	0	33
Surface Water	TAL Metals/Cyanide	Medium	SOP-4, SOP-11, SOP-17, SOP-19	2	1	2	1	1	0	7
Surface Water	TAL Dissolved Metals	Medium	SOP-4, SOP-11, SOP-17, SOP-19	2	1	2	1	1	0	7
Surface Water	Explosives	Medium	S1	2	1	2	1	1	0	7
Surface Water	Nitroglycerin	Medium	S7	2	1	2	1	1	0	7
Surface Water	Nitroguanadine	Medium	S4	2	1	2	1	1	0	7
Surface Water	Hardness	Medium	SOP-8	2	1	2	0	0	0	5
Soil	TCL Volatiles	Medium	SOP-7, SOP-10	62	7	10	1	4	4	88
Soil	TAL Metals/Cyanide	Medium	SOP-4, SOP-12, SOP-18, SOP-19	88	9	12	1	5	0	115
Soil	Total Organic Carbon	Medium	SOP-2	88	9	10	0	0	0	107
Soil	pH	Medium	SOP-3	88	9	0	0	0	0	107
Soil	TCL Semivolatiles	Medium	SOP-5, SOP-8	62	7	8	1	4	0	82
Soil	TCL Pesticides/ Aroclor	Medium	Q20	52	6	8	1	4	0	71
Soil	Explosives	Medium	S1	88	9	12	1	5	0	115
Soil	Nitroglycerin	Medium	S7	88	9	12	1	5	0	115

QAPP Worksheet #20—Field Quality Control Sample Summary Table (continued)

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSDs (total)	No. of Field Blanks	No. of Equip. Blanks	No. of Trip Blanks	Total No. of Samples to Lab
Soil	Nitroguanadine	Medium	S4	88	9	12	1	5	0	115
Sediment	TAL Metals/Cyanide	Medium	SOP-4, SOP-12, SOP-18, SOP-19	4	1	2	1	1	0	9
Sediment	Total Organic Carbon	Medium	SOP-2	4	1	2	0	0	0	7
Sediment	pH	Medium	SOP-3	4	1	0	0	0	0	5
Sediment	Grain Size	Medium	SOP-16	4	0	0	0	0	0	4
Sediment	AVS/SEM	Medium	SOP-20	4	1	2	1	1	0	9
Sediment	Explosives	Medium	S1	4	1	2	1	1	0	9
Sediment	Nitroglycerin	Medium	S7	4	1	2	1	1	0	9
Sediment	Nitroguanadine	Medium	S4	4	1	2	1	1	0	9

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #21—Project Sampling SOP References Table
(UFP-QAPP Manual Section 3.1.2)

List all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
BlankPrep	Equipment Blank and Field Blank Preparation, reviewed 1/08	CH2M HILL	Sample bottles, gloves, blank liquid, preservatives	☐	
COC	Chain-of-Custody, reviewed and updated 1/08	CH2M HILL	Chain-of-Custody	☐	
Decon	Decontamination of Personnel and Equipment, QCd and revised 1/08	CH2M HILL	DI water, distilled water, potable water, Liquinox, plastic pails or tubs, 55 gallon drum, gloves, decon pad	☐	
DeconRig	Decontamination of Drilling Rigs and Equipment, QCed and revised 1/08	CH2M HILL	Portable steam cleaner, potable water, Liquinox, buckets, brushes, distilled water, methanol, ASTM Type-II water, aluminum foil	☐	
DPGW	Direct Push Groundwater Sample Collection, reviewed 1/08	CH2M HILL	Hydraulic percussion hammer, direct push sampling rods, polyethylene tubing	☐	
DPSoil	Direct-Push Soil Sample Collection, reviewed and revised 1/08	CH2M HILL	Truck-mounted hydraulic percussion hammer, sampling rods, sampling tubes and acetate liners, pre-cleaned sample containers and stainless-steel sampling implements	☐	
Homog	Homogenization of Soil and Sediment Samples, reviewed 1/08	CH2M HILL	Sample containers, stainless steel spoons or spatulas, stainless steel pans	☐	
HoribaU22	Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature using the Horiba® U-22 with Flow-through Cell, QC review 1/08	CH2M HILL	Horiba® U-22 Water Quality Checker with flow-through cells, distilled water in squirt bottle, Horiba® U-22 Auto-Calibration Standard Solution.	☐	
HSE-408	Waste Management: Analysis and Characterization	CH2M HILL	N/A	N	Contains drum labeling information

QAPP Worksheet #21—Project Sampling SOP References Table (continued)

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
HSE-411	Waste Management: Non-Hazardous Waste	CH2M HILL	N/A	N	
HSE-413	Waste Management Planning	CH2M HILL	N/A	N	
HSE-414	Waste Management: Subcontractor Qualifications	CH2M HILL	N/A	N	
Log Books	Preparing Field Log Books, reviewed and revised 1/08	CH2M HILL	Log book, indelible pen	☐	
LowFlow	Low-Flow Groundwater Sampling from Monitoring Wells, reviewed 1/08	CH2M HILL	Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe, Horiba® U-22 Water Quality Checker with flow-through cells, water-level indicator, in-line disposable 0.45 µm filters, adjustable-rate positive displacement pump, submersible pump, or peristaltic pump, generator, disposable polyethylene tubing, plastic sheeting, calibrated bucket or other container and watch with second indicator to determine flow rate	☐	
Sediment	Sediment Sampling, QCed and revised 5/20/03	CH2M HILL	Sample collection device (hand corer, scoop, dredge, grab sampler, etc), stainless steel spoon or spatula, measuring tape, log book, personal protection equipment, materials for classifying soils, sample jars	☐	
Soils	Soil Sampling, reviewed and revised 1/08	CH2M HILL	Stainless steel trowel, shovel, scoopula, coring device, hand auger, etc; stainless steel split-spoon samplers, thin-walled sampling tubes, drilling rig or soil-coring rig, stainless steel pan or bowl, sample bottles	☐	
Surface Water	Surface Water Sampling, QCed and revised 5/20/03	CH2M HILL	Open tube sampler, dip sampler, weighted bottle sampler, hand pump, Kemmerer or Van Dorn sampler, depth-integrating sampler, sample containers, meters for specific conductance, temperature, pH, and dissolved oxygen.	☐	
Trench	Trenching for Landfill Delineation, reviewed and revised 1/08	CH2M HILL	Backhoe, shovels, barricades, plastic sheeting, decon pad	Yes	Procedures are correct, but will not take place at a technical "landfill"
Utility Location_General	Locating and Clearing Underground Utilities, revised 1/15/08	CH2M HILL	Magnetic Field Methods, Optical Methods, Ground Penetrating Radar, Electromagnetic Induction	☐	
WaterLevels	Water-Level Measurements, reviewed 1/08	CH2M HILL	Electronic water-level meter with 100 foot tape, interface probe	☐	
VOCAq	VOC Sampling- Water, reviewed and revised 1/08	CH2M HILL	Sample vials, gloves, pH meter, HCl	☐	

QAPP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.1.2.4)

Identify all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provide the SOP reference number for each type of equipment. In addition, document the frequency of activity, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Horiba U-22 pH probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	pH reads 4.0 +/- 3%	Clean probe with Deionized water and calibrate again. Do not use instrument if not able to calibrate properly	Field Team Lead	HoribaU22
Horiba U-22 Specific conductance probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	Conductivity reads 4.49 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22
Horiba U-22 Turbidity probe	Calibrate using Auto-Calibration Standard Solution				Calibrate daily, before use	Turbidity reads 0 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table (continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Horiba U-22 Dissolved oxygen and Temperature Probes			During calibration of other probes, check these readings against the day's atmospheric pressure and ambient temperature		Test daily, before use	Consistent with the current atmospheric pressure and ambient temperature	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22
Horiba U-22		Check mechanical and electronic parts, verify system continuity, check battery, and clean probes. Calibration check.	Visual inspection		Perform Maintenance daily before use, at the end of the day, and when unstable readings occur.	Stable readings after 3 minutes. pH reads 4.0 +/- 3% conductivity reads 4.49 +/- 3% turbidity reads 0 +/- 3%	Clean probe with deionized water and calibrate again. Do not use instrument if not able to calibrate properly.	Field Team Lead	HoribaU22

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #23—Analytical References SOP Table
(UFP-QAPP Manual Section 3.2.1)

List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP reference in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP.

☐ Worksheet Not Applicable (State Reason)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-1 (CA-751)	Preparation and Analysis Of Samples For Cyanide Using Midi-Distillation Followed By Flow Injection Analysis	05/06	4	Definitive	Wet Chemistry	Konelab	Katahdin Analytical Services	N
SOP-2 (CA-741)	Determination of Total Organic Carbon in Solids Using the EPA Region II Lloyd Kahn Method	01/07	1	Definitive	Wet Chemistry	TOC Analyzer	Katahdin Analytical Services	N
SOP-3 (CA-709)	pH Concentration Measurements In Soil Matrices - SW 846 Method 9045	03/07	6	Definitive	Wet Chemistry	pH Meter	Katahdin Analytical Services	N
SOP-4 (CA-630)	Analysis of Aqueous and Solid Samples by ICP in Accordance With USEPA CLP Statement Of Work, Document Number ILM05.3	07/25/06	0	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-5 (CA-533)	Preparation of Sediment/Soil Samples For CLP Extractable Semivolatile Analysis: USEPA Contract Laboratory Program, Document Numbers OLM03.1 & OLM04.2	04/06	3	Definitive	Extractions	TEKMAR ARCON ENCON	Katahdin Analytical Services	N
SOP-6 (CA-509)	Preparation of Aqueous Samples For CLP Extractable Semivolatile Analysis: USEPA Contract Laboratory Program, Document Numbers OLM03.1 & OLM04.2	04/06	1	Definitive	Extractions	TEKMAR ARCON ENCON	Katahdin Analytical Services	N
SOP-7 (CA-320)	Purge and Trap Extraction of Volatiles for GC Analysis - Method 5030	06/18/04	3	Definitive	VOA	GC/MS	Katahdin Analytical Services	N
SOP-8 (CA-219)	Analysis of Semivolatile Organic Compounds By Capillary Column GC/MS: USEPA Contract Laboratory Program, Document Number OLM04.2	04/06	1	Definitive	SVOA	GC/MS	Katahdin Analytical Services	N
SOP-9 (CA-218)	Analysis of VOA's By Purge and Trap GC/MS: USEPA Contract Laboratory Program, Document Number OLM04.2 and OLM04.3	06/07	4	Definitive	VOA	GC/MS	Katahdin Analytical Services	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
SOP-10 (CA-214)	Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples Using Sw846 Method 5035	04/06	4	Definitive	VOA	GC/MS	Katahdin Analytical Services	N
SOP-11 (CA-622)	Acid Digestion of Aqueous Samples For ICP Metals Analysis In Accordance With USEPA CLP Statement of Work, Document Number ILM04.0	03/07	2	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-12 (CA-623)	Acid Digestion of Soil/Sediment Samples For ICP and GFAA Metals Analysis In Accordance With USEPA CLP Statement of Work, Document Number ILM04.0	08/29/02	7	Definitive	Metals	ICP/ICPMS	Katahdin Analytical Services	N
SOP-13 (SD-902)	Sample Receipt and Internal Control	02/07	7	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
SOP-14 (SD-903)	Sample Disposal	02/05	2	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
SOP-15 (SD-900)	Subcontracting Analyses	04/06	3	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
LM-SL-D422	Particle Size Analysis of Soils D422-63	07/29/05	5	Definitive	Geotechnical	None	STL	N
Q20	CLP OLM04.3	06/07	2	Definitive	TCL Pesticides/ PCBs	GC-ECD	GPL Laboratories, LLLP	N
S1	SW846 8330	05/07	24	Definitive	Explosives	HPLC	GPL Laboratories, LLLP	N
S7	SW846 8332	10/06	7	Definitive	Nitroglycerin	HPLC	GPL Laboratories, LLLP	N
S4	SW846 8330M	06/07	1	Definitive	Nitroguanadine	HPLC	GPL Laboratories, LLLP	N
F.1	Sample Chain-of-Custody Procedures	11/00	9				GPL Laboratories, LLLP	
F.2	Sample Receipt, Inspection, Preservation, and Storage Condition Requirements	09/06	18				GPL Laboratories, LLLP	
F.3	Sample Logging and Record Keeping	02/03	6				GPL Laboratories, LLLP	

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
F2	Sample Receipt, Inspection, Preservation, and Storage Condition Requirements, September 07, Rev. 18	09/07	18	Definitive	Sample Management	N/a	GPL Laboratories, LLLP	N
H7	Toxicity Characterization Leaching Procedure (TCLP) , October 06, Rev. 9	10/06	9	Definitive	TCPL Organics/Inorganics	N/A	GPL Laboratories, LLLP	N
M5	SW-846 8260B	08/07	18	Definitive	TCLP Volatiles	GC/MS	GPL Laboratories, LLLP	N
P5	SW-846 8270C	08/07	15	Definitive	TCLP Semivolatiles	GC/MS	GPL Laboratories, LLLP	N
Q6	SW-846 8081A	08/07	12	Definitive	TCLP Pesticides	GC/ECD	GPL Laboratories, LLLP	N
Q10	SW-846 8151A	12/05	7	Definitive	TCLP Herbicides	GC/ECD	GPL Laboratories, LLLP	N
H10	SW-846 6010B	11/07	18	Definitive	TCLP Metals	ICP	GPL Laboratories, LLLP	N
H12	SW-846 7470A	09/07	22	Definitive	TCLP Metals	Mercury Analyzer	GPL Laboratories, LLLP	N
N1	SW-846 1010	02/07	8	Definitive	Ignitability	Flashpoint Analyzer	GPL Laboratories, LLLP	N
J12	SW-846 7.2.2-1a	08/04	5	Definitive	Corrosivity (pH)	pH meter	GPL Laboratories, LLLP	N
J13	SW-846 7.3	10/06	5	Definitive	Reactivity	N/A	GPL Laboratories, LLLP	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number	Title	Revision Date	Revision No.	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
J11	SW-846 9034	02/07	7	Definitive	Sulfide	N/A	GPL Laboratories, LLLP	N
J43	SW-846 9014	10/06	5	Definitive	Cyanide	UV/Vis	GPL Laboratories, LLLP	N

QAPP Worksheet #24—Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS - VOA	Initial Calibration	IC – instrument receipt, instrument change (new trap, column, etc.), when CCC does not meet criteria or when manual tune performed.	IC – RSD for each CCC < 30%, minimum mean RF for each SPCC as noted in 7.3.5.4 of method 8260B. If RSD for an analyte is > 15% apply linear (r2 > 0.99) or quadratic method for quantitation	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - VOA	Calibration Check	CV – at beginning of each 12 hour shift immediately after BFB tune.	CV - %D for each CCC < 20%, minimum RF for each SPCC as noted in 7.3.5.4 of method 8260B.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - VOA	BFB Tune	Every 12 hours	Criteria listed in section 7.3 current rev. of SOP CA-202	Retune and/or clean source	Analyst, Supervisor	SOP-7, SOP-9, SOP-10
GC/MS - SVOA	Initial Calibration	IC – Instrument receipt, instrument change (new column, source cleaning, etc.), when CCC is out of criteria or when manual tune performed	IC – minimum RF of ≥ 0.050 for each SPCC, % RSD of ≤ 30% for each CCC. If RSD for an analyte is > 15% apply linear or quadratic method for quantitation	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-8
GC/MS - SVOA	Calibration Check	CV – at the beginning of each 12 hour shift immediately after DFTPP tune.	CV – minimum RF of each SPCC ≥ 0.050, % RSD ≤ 20% for each CCC.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data.	Analyst, Supervisor	SOP-8
GC/MS - SVOA	DFTPP Tune	Every 12 hours	Criteria listed in section 7.4 current rev. of SOP CA-204	Retune and/or clean source	Analyst, Supervisor	SOP-8
Mercury analyzer	Initial calibration	IC-instrument receipt, major instrument change, at the start of each day	Correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
Mercury analyzer	continuing calibration	CCV-at beginning and end of each run sequence and every 10 samples	80-120% of True Value	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Konelab	Initial calibration	Initial Calibration- prior to sample analysis.	Correlation coefficient ≥ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-1
Konelab	continuing calibration	CCV (undistilled)-at beginning and end of each run sequence and every 10 samples	± 15% of True Value	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Supervisor	SOP-1
TOC analyzer	Initial calibration	Initial Calibration- initially, when the daily CCV does not pass, but, no longer than every 3 months.	Correlation coefficient ≥ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-2
TOC analyzer	continuing calibration	CCV-every 10 samples and at the end of the run	80-120% of true value for 415.1 75-125% of true value for Lloyd Kahn	If the CCV fails high, report samples that are <PQL. Recalibrate and/or reanalyze samples back to last acceptable CCV recovery.	Analyst, Supervisor	SOP-2
ICP	Initial calibration	At the beginning of each day or if QC is out of criteria.	One point calibration per manufacturer's guidelines; analytes run at their calibration levels must fall within 95-105% of True Values	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP	continuing calibration	At the beginning and end of each run sequence and every 10 samples	90-110% of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP/MS	Initial Calibration	Daily prior to sample analysis.	0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
ICP/MS	Continuing Calibration Verification CCV)	At beginning of run, after every 10 samples, and at end of run.	Recovery within ± 10% of true value.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	SOP-4, SOP-11, SOP-12
pH Meter	Initial Calibration	Once per day	± 0.05 pH units for every buffer	If calibration is not achieved, check meter, buffer solutions, and probe; replace if necessary; repeat calibration	Analyst, Supervisor	SOP-3
GC-ECD	Calibration procedure according to the method	Initial calibration prior to sample analysis	acceptance criteria from the method	correct problem and rerun	Rekha Patel	Q20

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for each analyte ≤ 20%	correct problem and rerun	Samy Shawky	S1
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for analyte ≤ 20%	correct problem and rerun	Samy Shawky	S4
HPLC	Minimum 5 point initial calibration	Initial calibration prior to sample analysis	RSD for analyte ≤ 20%	correct problem and rerun	Samy Shawky	S4
GCMS Semivolatiles	Minimum five point calibration for all analytes	Daily, Prior to sample analysis or instrument change, when instrument does not meet method criteria	30% RSD for CCC's and Min RF for SPCCs, 15% for Avg RF, 0.995 corr for linear, 0.99 corr for Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Hall Moore	P5
GCMS Volatiles	Minimum five point calibration for all analytes	Daily, Prior to sample analysis or instrument change, when instrument does not meet method criteria	30% RSD for CCC's and Min RF for SPCCs, 15% for Avg RF, 0.995 corr for linear, 0.99 corr for Quadratic	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Nathan Krueger	M5
GC-ECD Pesticides	5 point calibration plus ICV	CCV every 10 samples	%RSD <20% for initial curve, %difference from ICAL <15% for CCV	correct problem and rerun	Rekha Patel	Q6
GC-ECD Herbicides	5 point calibration plus ICV	CCV every 10 samples	%RSD <20% for initial curve, %difference from ICAL <15% for CCV	correct problem and rerun	Rekha Patel	Q10

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
pH Meter	Calibrate meter at pH 10 and 4, check 7 4 and 10 alternately as appropriate to pH of samples	Before analysis and check every 3 hrs or 10 samples	±0.10 pH units for every check	Recalibrate as necessary	James Anderson	J.12
ICP	One point calibration per manufacturers guidelines	At the beginning of each day or if QC is outside criteria	90-110% of true value	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.10
UV/Vis Spectrophoto-meter	Minimum five point calibration	At the beginning of each day or if QC is outside criteria	Correlation coefficient >0.995 ICV/CCV 85-115% recovery	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	James Anderson	J.43
Titration	ICV/ CCV	CCV every 10 samples	ICV/CCV 70-130% recovery	Check calibration standards, Reanalyze affected samples	James Anderson	J.11
Hg Analyzer/FIMS	Minimum five point calibration	At the beginning of each day or if QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.12

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Flashpoint Tester	Flashpoint of p-xylene	At the beginning and end of each set of 20 samples or less	Flash at 27 degrees C, ± 2.2 degrees C	Check standard	Namory Keita	N.1

QAPP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Identify all analytical instruments that require maintenance, testing, or inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

☐ Worksheet Not Applicable (State Reason)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GC/MS (VOA)	Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	Prior to initial calibration and/or as necessary.	Refer to SOP 9, Section 7.5	Refer to SOP 9, Section 7.5	Analyst, Department Manager	SOP-9
GC/MS (SVOA)	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria, change septa as needed, change liner as needed, cut column as needed. Other maintenance specified in lab Equipment Maintenance SOP	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	Prior to initial calibration and/or as necessary	Refer to SOP-8, Section 8.0	Refer to SOP-8, Section 8.0	Analyst, Department Manager	SOP-8
ICP	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Torch, nebulizer chamber, pump, pump tubing	Prior to initial calibration and as necessary	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
CVAA	Replace peristaltic pump tubing, replace mercury lamp, replace drying tube, clean optical cell and/or clean liquid/gas separator as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Tubing, sample probe, optical cell	Prior to initial calibration and as necessary	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
ICP/MS	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Torch, nebulizer, spray chamber, pump tubing	Prior to initial calibration and as necessary	Refer to SOP-4, Section 8.0	Refer to SOP-4, Section 8.0	Analyst, Department Manager	SOP-4
Konelab Autoanalyzer	Check and clean segments weekly, clean reagent tubes monthly. Change lamp, change diluent and wash tubes, change mixing paddles and syringes, change dispensing needle, all as needed	QC standards	Segments, reagent tubes, diluent reservoir, dispersing needle, cuvette waste container	Prior to initial calibration and as necessary	Refer to SOP-1, Section 8.0	Refer to SOP-1, Section 8.0	Analyst, Department Manager	SOP-1

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
TOC Combustion Analyzer	Check level of dilution water, drain vessel water, humidifier water, autosampler rinse water and phosphoric acid vessel and fill as needed. Replace oxygen cylinder.	QC standards	Tubing, sample boat, syringe, humidifier, rinse reservoir, phosphoric acid vessel, oxygen pressure	Prior to initial calibration and as necessary	Refer to SOP-2, Section 8.0	Refer to SOP-2, Section 8.0	Analyst, Department Manager	SOP-2
pH meter	Clean probe	QC standards	probe	As necessary	Refer to SOP-3, Section 8.0	Refer to SOP-3, Section 8.0	Analyst, Department Manager	SOP-3
Sieves	Cleaning	None	Visual	Per Sample	Visual	Re-clean	Analyst	LM-SL-D42 2
GC-ECD	change septum and liner, trim abnalytical column	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Rekha Patel	Q20
Spectrophotometric	Clear cuvettes and lense as necessary. Outside calibration annually.	QC Standards	Cuvettes, cuvette holder, lenses	As necessary	Refer to SOP-20, Section 8.0	Refer to SOP-20, Section 8.0	Analyst, Department Manager	SOP-20
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S1
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S4
HPLC	change pre-column filter, wash system with MeOH, replace pump seals	Calibration	per SOP	As necessary	Acceptable Chromatography	repeat	Samy Shawky	S7
GCMS	Check gas supply daily, Bake or change trap as necessary, Manual tune if BFB/DFTPP not within criteria, Cut column, change septum as needed	VOA/ SVOA Analysis	Ion source, seal septum, liner	Prior to sample analysis or, when instrument does not meet method criteria	30% RSD CCCs, min RF SPCCs, 15% Avg RSD, 0.995 linear, 0.99 corr. Quadratic init cal; 20% diff CCV for CCCs, min RF SPCCs	Recalibrate and or perform necessary instrument maintenance, Check calibration standards, Reanalyze affected samples	Nathan Krueger/H all Moore	M5, P5
GC/ECD	change septum and liner, trim analytical column	Calibration	CCV analysis	Daily	Acceptable chromatograph y and %Difference	repeat	Rekha Patel	Q6, Q10

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (continued)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
pH meter	Change buffer solutions or pH probe	Calibration	Calibration Check	Before analysis begins, check every 3 hrs	pH within +/- 0.10 of buffer value	Recalibrate as necessary	James Anderson	J.12
UV/Vis Spectrophotometer	check wavelength, prepare fresh coloring reagents	Calibration	Calibration Check	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or Check calibration standards, prepare fresh color reagents	James Anderson	J.43
Hg Analyzer	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	Hg Analysis	Change tubing, change filter, clean windows, check gas flow, Check reagents and standards	At the beginning of each day or when QC is outside criteria	Correlation coefficient >0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Rita Amin	H.12
Flashpoint Tester	Change propane tank, calibrate thermometer	Flashpoint	Tank, thermometer	Before use	Flash at 27 degrees C, + 2.2 degrees C	Check standard	Namory Keita	N.1

QAPP Worksheet #26—Sample Handling System

(UFP-QAPP Manual Appendix A)

Use this worksheet to identify components of the project-specific sample handling system. Record personnel, and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

☐ Worksheet Not Applicable (State Reason)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in Attachment 1 of this QAPP.
Sample Packaging (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in Attachment 1 of this QAPP.
Coordination of Shipment (Personnel/Organization): FTL David Livingston/CH2M HILL.
Type of Shipment/Carrier: Overnight/Fed Ex
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Custody and Storage (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Preparation (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
Sample Determinative Analysis (Personnel/Organization): Lab SOPs in Attachment 1 of this QAPP.
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): See Worksheet 19.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): See Worksheet 19.
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Lab SOPs in Attachment 1 of this QAPP.
Number of Days from Analysis: After submission, the laboratory will keep samples 90 days and the sample extracts for a minimum of 60 days.

QAPP Worksheet #27—Sample Custody Requirements

(UFP-QAPP Manual Section 3.3.3)

Describe the procedures that will be used to maintain sample custody and integrity. Include examples of chain-of-custody forms, traffic reports, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms. Attach or reference applicable SOPs.

☐ Worksheet Not Applicable (State Reason)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Samples will be collected by field team members under the supervision of the field team leader. As samples are collected, they will be places into containers and labeled, as outlined below. Labels will be taped to the jar to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples below 4 degrees Celsius until they are received by the laboratory. The chain of custody will be placed into the cooler as well. Coolers will be shipped to the laboratories via Fed Ex overnight, with the air bill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples to CH2M HILL.
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Laboratory custody procedures can be found in the following SOPs, which are referenced in Worksheet 23 and can be found in Attachment 1 of this QAPP: **GPL:** GPL SOP #F.1/#F.2/#F.3 **Katahdin:** SD-900, SD-902, SD-903
Sample Identification Procedures: Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, and sampler's initials. The field logbook will identify the sample ID with the location and time collected and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample log-in forms to the EIS to check that sample IDs and parameters are correct.
Chain-of-custody Procedures: Chain of custodies will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID. Date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain of custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the LIMS database for each sample.

QAPP Worksheet #27a—Example Sample Labels

QEC
P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME	
SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____ GRAB _____ COMPOSITE
ANALYSIS REQUESTED	

QEC
P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME	
SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____ GRAB _____ COMPOSITE
ANALYSIS REQUESTED	

QEC
P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME	
SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____ GRAB _____ COMPOSITE
ANALYSIS REQUESTED	

QEC
P.O. Box 1160
Beaver, WV 25813
800-255-3950 • 304-255-3900
Quality Environmental Containers

PROJECT NAME	
SAMPLE ID	SAMPLE DATE
SAMPLED BY	SAMPLE TIME
PRESERVATIVE	_____ GRAB _____ COMPOSITE
ANALYSIS REQUESTED	

QAPP Worksheet #27b—Example Custody Seals

QAPP Worksheet #27c—GPL Chain-of-Custody

GPL LABORATORIES
7210A Corporate Ct.
Frederick, MD 21703
301-694-5310

CHAIN OF CUSTODY

PAGE: 1 OF 1

GPL Project Manager:	Client Name:	Phone:	
Project Name:	Address:	Cell:	
Purchase Order:	City, State	Zip Code	

Comments: H=Hold Analysis Request X=Analyze

Preservatives and Containers

Sample Information

Methods for Analysis

RUSH

No.	Client Name, address and phone #	Date Sampled	Time Sampled	Matrix	Sampler's Initials																		QC (MS/MSD)	TOTAL BOTTLES
1							X	X	X	X	X	X	X	X	X	X		X						4
2																.								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								

Sample Matrix: WG= Groundwater; SO= Soil; WS= Surface Water; AA= Ambient Air; WQ= Water Quality

Total number of samples 4

Relinquished By:	Date:	Time:	For Lab Use	COOLER RECEIPT CONDITION
Received By:	Date:	Time:	GPL WORK ORDER #:_____	
Relinquished By:	Date:	Time:		
Received By:	Date:	Time:		
Relinquished By:	Date:	Time:		

QAPP Worksheet #27d—Katahdin Chain-of-Custody

Katahdin ANALYTICAL SERVICES

600 Technology Way
P.O. Box 540
Scarborough, ME 04070
Tel: (207) 874-2400
Fax: (207) 775-4029

Chain of Custody

Client:	Contract:	Phone #: ( )	Fax #: ( )
Address:	City:	State:	Zip Code:
Purchase Order #:	Proj. Name/No.:		Katahdin Quote #:
Bill (if different than above):		Address:	
Sampler (Print/Sign):			Copies To:

LAB USE ONLY	Work Order #: Katahdin Project Number		
Remarks:			
Shipping Info:	FEDEX	UPS	CLIENT
Airbill No:			
Temp C	Temp Blank	Intact	Not Intact

*	Sample Description	Date/Time Collected	Matrix	No. of Containers	Analysis and Container Type Preservatives									
					Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N	Filt. Y / N

COMMENTS:

Relinquished By:	Date/Time	Received By:	Relinquished By:	Date/Time	Received By:
Relinquished By:	Date/Time	Received By:	Relinquished By:	Date/Time	Received By:

QAPP Worksheet #27e—Example Form I Result Pages

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water)_____ Lab Sample ID: _____

Sample wt/vol: _____(g/mL)_____ Lab File ID: _____

Level: (low/med)_____ Date Received: _____

% Moisture: not dec._____ Date Analyzed: _____

GC Column: _____ ID: _____ (mm) Dilution Factor: _____

Soil Extract Volume: _____(µL) Soil Aliquot Volume: _____(µL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (µg/L or µg/Kg)_____	Q
75-71-8	Dichlorodifluoromethane		
74-87-3	Chloromethane		
75-01-4	Vinyl Chloride		
74-83-9	Bromomethane		
75-00-3	Chloroethane		
75-69-4	Trichlorofluoromethane		
75-35-4	1,1-Dichloroethene		
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane		
67-64-1	Acetone		
75-15-0	Carbon Disulfide		
79-20-9	Methyl Acetate		
75-09-2	Methylene Chloride		
156-60-5	trans-1,2-Dichloroethene		
1634-04-4	Methyl tert-Butyl Ether		
75-34-3	1,1-Dichloroethane		
156-59-2	cis-1,2-Dichloroethene		
78-93-3	2-Butanone		
67-66-3	Chloroform		
71-55-6	1,1,1-Trichloroethane		
110-82-7	Cyclohexane		
56-23-5	Carbon Tetrachloride		
71-43-2	Benzene		
107-06-2	1,2-Dichloroethane		

FORM I VOA-1 OLM04.2

1B
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

Lab Name: _____ Contract: _____

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix: (soil/water)_____ Lab Sample ID: _____

Sample wt/vol: _____(g/mL)_____ Lab File ID: _____

Level: (low/med)_____ Date Received: _____

% Moisture: not dec._____ Date Analyzed: _____

GC Column: _____ ID: _____ (mm) Dilution Factor: _____

Soil Extract Volume: _____(µL) Soil Aliquot Volume: _____(µL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (µg/L or µg/Kg)_____	Q
79-01-6	Trichloroethene		
108-87-2	Methylcyclohexane		
78-87-5	1,2-Dichloropropane		
75-27-4	Bromodichloromethane		
10061-01-5	cis-1,3-Dichloropropene		
108-10-1	4-Methyl-2-pentanone		
108-88-3	Toluene		
10061-02-6	trans-1,3-Dichloropropene		
79-00-5	1,1,2-Trichloroethane		
127-18-4	Tetrachloroethene		
591-78-6	2-Hexanone		
124-48-1	Dibromochloromethane		
106-93-4	1,2-Dibromoethane		
108-90-7	Chlorobenzene		
100-41-4	Ethylbenzene		
1330-20-7	Xylene (total)		
100-42-5	Styrene		
75-25-2	Bromoform		
98-82-8	Isopropylbenzene		
79-34-5	1,1,2,2-Tetrachloroethane		
541-73-1	1,3-Dichlorobenzene		
106-46-7	1,4-Dichlorobenzene		
95-50-1	1,2-Dichlorobenzene		
96-12-8	1,2-Dibromo-3-chloropropane		
120-82-1	1,2,4-Trichlorobenzene		

FORM I VOA-2 OLM04.2

QAPP Worksheet #28-1—QC Samples Table

(UFP-QAPP Manual Section 3.4)

Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

☐ Worksheet Not Applicable (State Reason)

Matrix	Soil
Analytical Group	TCL Volatiles
Concentration Level	Medium Soil (OLM04.3)
Sampling SOP[1]	Soils
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-7, SOP-9, SOP-10
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	80

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per prep batch	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.
MS	One MS per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
MSD	One MSD per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
LCS	One LCS per every 20 samples.	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
SMC spike	Every sample, control, standard, and method blank	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
SMC = System Monitoring Compounds
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-2—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	TCL Semivolatiles
Concentration Level	Medium Soil (OLM04.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/ SOP Reference	EPA CLP OLM04.3/ SOP-8
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	120

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per 20 samples or whenever samples are extracted by the same procedure.	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters.
MS	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
MSD	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
LCS	Every 20 samples of a similar matrix or concentration or every batch of samples extracted.	QC acceptance criteria, section 8.3 of KAS SOP CA-219.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of KAS SOP CA-219.
Surrogate spike	Every sample, control, standard, and method blank	QC acceptance criteria, section 8.2 of KAS SOP CA-219.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-219.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-3—QC Samples Table

Matrix	Soil
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Soil (OLM04.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	EPA CLP OLM04.3/ #Q20
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	80

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every extraction batch	must meet acceptance criteria for surrogates; all target analytes<CRQL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes<CRQL
Instrument Blank	every 12 hours	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL	reanalysis	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL
Field duplicate	one per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet spike recovery and RPD criteria in OLM04.3	document matrix interference	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision/accuracy	must meet spike recovery and RPD criteria in OLM04.3

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
CRQL= Contract Required Quantitation Limit
RPD= Relative Percent Difference

QAPP Worksheet #28-4—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	TAL Total Metals
Concentration Level	Soil (ILM05.3)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-12, SOP-18, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katadin Analytical Services
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Blank (ICB)	Immediately after the ICV	≤ CRQL	Correct problem, recalibrate and reanalyze ICV and ICB	Analyst/Supervisor, QA Manager	Accuracy/bias, Contamination	≤ CRQL
CRQL Standard for ICP (CRI)	At the beginning of a sample run, after every 20 samples and at the end of the run	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.	1. Reanalyze immediately for failing elements only. 2. Terminate analysis, correct problem, recalibrate and reanalyze all analytical samples analyzed since last good CRI.	Analyst/Supervisor, QA Manager	Sensitivity	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.
Preparation Blank (PBS)	One per digestion batch	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.	1. If blank value > CRQL report sample results if < CRQL or > 10 x the blank value; otherwise redigest. 2. If blank value is less than negative CRQL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst/Supervisor, QA Manager	Accuracy/bias-	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.
Serial Dilution (DL)	Once per matrix type or SDG, whichever is more frequent	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.
Laboratory Control Sample (CSS)	One per digestion batch.	Recovery within reference limits supplied by SRM vendor.	Redigest and reanalyze all associated samples for affected analyte (except Ag and Sb)	Analyst/Supervisor, QA Manager	Accuracy/Bias	Recovery within reference limits supplied by SRM vendor.
Sample Duplicate (D)	Once per matrix type or SDG, whichever is more frequent	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.	Flag results for affected analytes for all associated samples with “*”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.
Spike Sample (S)	Once per matrix type or SDG, whichever is more frequent	Recovery ± 25 % of true value if sample < 4x spike value	Flag results for affected analytes for all associated samples with ”N”, Perform post-digestion spike for all failing elements, except Ag, at 2x the indigenous level or 2x the CRQL, whichever is greater.	Analyst/Supervisor, QA Manager	Accuracy/bias	Recovery ± 25 % of true value if sample < 4x spike value

CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-4—QC Samples Table (continued)

Matrix	Soil/Sediment
Analytical Group	Cyanide
Concentration Level	Soil (ILM05.3)
Sampling SOP[1]	Soils/ Sediment
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-12, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch	No analyte > CRQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with "B". Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Instrument Blank	After each ICV and CCV,	No analyte > CRQL	Investigate source of contamination. Report sample results < CRQL	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Laboratory Duplicate	One per twenty samples.	RPD < 20 % for samples greater than 5x the CRQL.	Investigate problem and reanalyze sample in duplicate	Analyst, Supervisor, QA Manager	Precision	If RPD is still > 20, report original result.
Matrix Spike (MS)	One per distillation batch.	Recovery ± 25 % if sample < 4x spike concentration.	Flag results for affected samples	Analyst, Supervisor, QA Manager	Accuracy/Bias	Recovery ± 25 % if sample < 4x spike concentration.
Laboratory Control Sample(LCS)	One per prep batch	85-115 %	If the LCS fails high, report samples that are < CRQL. Reprep and reanalyze all other samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	85-115 %
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.

CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-5—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives
Concentration Level	Medium (SW-846 8330)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8330/#S1
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogate; the target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogate; the target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-6—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8332/#S7
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogates ; all target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogates ; all target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD - Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-7—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	SW-846 8330M/#S4
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	135

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 35%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 35%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD - Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-9—QC Samples Table

Matrix	Soil/Sediment
Analytical Group	Wet Chemistry (TOC, pH, Grain Size)
Concentration Level	Medium (various)
Sampling SOP[1]	Soils, SedSamp
Analytical Method/SOP Reference	Lloyd Kahn/ SOP-2; SW-846 9045C/ SOP-3; ASTM D422/ SOP-16
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	55/ 55/ 3

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Total Organic Carbon (Lloyd Kahn method)						
Method Blank	One per 20 samples	No analyte > PQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with "B". Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > PQL
Instrument Blank	After each ICV and CCV,	No analyte >PQL	Samples analyzed before or after an unacceptable blank will be reanalyzed.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > PQL
Laboratory Quadruplicate	One sample quadruplicate per 20 samples.	RSD < 30%	If lab QC in criteria and matrix interference suspected, flag data. Else, reanalyze.	Analyst, Supervisor, QA Manager	Precision	RSD < 30%
Matrix Spike (MS)	One per 10 samples	75-125 % recovery	If LCS in criteria and matrix interference suspected, flag data. Else, reanalyze.	Analyst, Supervisor, QA Manager	Accuracy/Bias	75-125 % recovery
Laboratory Control Sample(LCS)	One per 20 samples	80-120%	Investigate source of problem. f the LCS fails high, report samples that are < PQL. Reprep a blank the remaining samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	80-120%
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.
pH (SW-846 9045C)						
Laboratory Control Sample(LCS)	One per 20 samples	90-110% recovery	Correct problem, recalibrate	Analyst, Supervisor, QA Manager	Accuracy/Bias	90-110% recovery
Sample duplicate	One sample duplicate per every 10 field samples.	RPD < 20	1) Investigate problem and reanalyze sample in duplicate (2) If RPD is still unacceptable, report original result with notation or narration.	Analyst, Supervisor, QA Manager	Precision	RPD < 20
Grain Size (ASTM D422)						
As requested	None	None	Not Applicable	None	None	None

ICV= Initial Calibration Verification
CCV= Continuing Calibration Verification
PQL = Project Quantitation Limit
RPD = Relative Percent Difference

QAPP Worksheet #28-10—QC Samples Table

Matrix	Groundwater
Analytical Group	TCL Volatiles
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-7, SOP-9
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	11

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per prep batch	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for acetone and 2-butanone and up to 2.5 times for methylene chloride.
MS	One MS per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
MSD	One MSD per every 20 samples	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.2 of KAS SOP CA-218.
LCS	One LCS per every 20 samples.	QC acceptance criteria, section 8.2 of KAS SOP CA-218.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of this SOP.
SMC spike	Every sample, control, standard, and method blank	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, Table 6 in method; Relative Retention Time must be within ±0.06 RRT units of its Relative Retention Time in the continuing calibration.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
SMC = System Monitoring Compounds
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-11—QC Samples Table

Matrix	Groundwater , Surface Water
Analytical Group	TCL Semivolatiles
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP OLM04.3/ SOP-8
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	23

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per 20 samples or whenever samples are extracted by the same procedure.	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters..	(1) Investigate source of contamination (2) Reprep and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analytes detected > CRQL; up to 5 times CRQL for phthalate esters..
MS	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
MSD	One for each group of 20 samples of a similar matrix or concentration.	QC acceptance criteria, section 8.4 of KAS SOP CA-219.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable, reprep the samples and QC.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Precision	QC acceptance criteria, section 8.4 of KAS SOP CA-219.
LCS	Every 20 samples of a similar matrix or concentration or every batch of samples extracted.	QC acceptance criteria, section 8.3 of KAS SOP CA-219.	LCS and LCSD samples are not required but are extracted and analyzed. The target analytes and recoveries are the same as for Matrix spike and Matrix spike duplicate samples. Since they are not required, the results are only advisory and no corrective action is taken.	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.3 of KAS SOP CA-219.
Surrogate spike	Every sample, control, standard, and method blank	QC acceptance criteria, section 8.2 of KAS SOP CA-219.	(1) File Katahdin CAR (2) Check chromatogram for interference; if found, flag data (3) If not found, check instrument performance; if problem is found, correct and reanalyze(4) If still out, re-extract and analyze sample (5) If reanalysis is out, flag data	Analyst, Supervisor, QA Manager	Accuracy/Bias	QC acceptance criteria, section 8.2 of KAS SOP CA-219.
Internal Standards	Every sample, control, standard, and method blank	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS	Inspect Mass spectrometer or GC for malfunctions: mandatory reanalysis of samples analyzed while system was malfunctioning. If reanalysis confirms matrix interference, report sample and narrate.	Analyst, Supervisor, QA Manager	Accuracy/Bias	Retention time ± 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS

MS = Matrix Spike
MSD = Matrix Spike Duplicate
LCS = Laboratory Control Sample
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-12—QC Samples Table

Matrix	Groundwater
Analytical Group	TCL Pesticides/ Aroclors
Concentration Level	Water (OLM04.3)
Sampling SOP[1]	DPGW
Analytical Method/SOP Reference	EPA CLP OLM04.3/#Q20
Field Team Leader	Carol Peterson
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	11

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every extraction batch	must meet acceptance criteria for surrogates; all target analytes<CRQL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes<CRQL
Instrument Blank	every 12 hours	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL	reanalysis	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	contamination/bias	must meet acceptance criteria for surrogates; all target analytes< 0.5XCRQL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet spike recovery and RPD criteria in OLM04.3	document matrix interference	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Rekha Patel, Hossam Said	precision/accuracy	must meet spike recovery and RPD criteria in OLM04.3

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
CRQL= Contract Required Quantitation Limit
RPD= Relative Percent Difference

QAPP Worksheet #28-13—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	TAL Metals TAL Filtered Metals
Concentration Level	Water (ILM05.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-11, SOP-17, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	21/ 21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Blank (ICB)	Immediately after the ICV	≤ CRQL	Correct problem, recalibrate and reanalyze ICV and ICB	Analyst/Supervisor, QA Manager	Accuracy/bias, Contamination	≤ CRQL
CRQL Standard for ICP (CRI)	At the beginning of a sample run, after every 20 samples and at the end of the run	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.	1. Reanalyze immediately for failing elements only. 2. Terminate analysis, correct problem, recalibrate and reanalyze all analytical samples analyzed since last good CRI.	Analyst/Supervisor, QA Manager	Sensitivity	Recovery within 70% - 130 % of true value. For Sb, Pb & Tl recovery within 50% - 150% of true value.
Preparation Blank (PBW)	One per digestion batch	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.	1. If blank value > CRQL report sample results if < CRQL or > 10 x the blank value; otherwise redigest. 2. If blank value is less than negative CRQL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.	Analyst/Supervisor, QA Manager	Accuracy/bias-	Absolute value < CRQL. sample results if > 10x the absolute value of the blank result, otherwise redigest.
Serial Dilution (DL)	Once per matrix type or SDG, whichever is more frequent	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	If original sample result is at least 50x ISDL, 5-fold dilution must agree within ± 10% of the original result.
Laboratory Control Sample (LCSW)	One per digestion batch.	Recovery within ± 20% of true value.	Redigest and reanalyze all associated samples for affected analyte (except Ag and Sb)	Analyst/Supervisor, QA Manager	Accuracy/Bias	Recovery within reference limits supplied by SRM vendor.
Sample Duplicate (D)	Once per matrix type or SDG, whichever is more frequent	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.	Flag results for affected analytes for all associated samples with “*”.	Analyst/Supervisor, QA Manager	Accuracy/Bias, Precision	RPD ± 20%, if sample and duplicate ≥ 5x CRQL; ± CRQL if sample or duplicate < 5x CRQL.
Spike Sample (S)	Once per matrix type or SDG, whichever is more frequent	Recovery ± 25 % of true value if sample < 4x spike value	Flag results for affected analytes for all associated samples with ”N”, Perform post-digestion spike for all failing elements, except Ag, at 2x the indigenous level or 2x the CRQL, whichever is greater.	Analyst/Supervisor, QA Manager	Accuracy/bias	Recovery ± 25 % of true value if sample < 4x spike value

ICV = Initial Calibration Verification
CRQL = Contract Required Quantitation Limit

QAPP Worksheet #28-13—QC Samples Table (continued)

Matrix	Groundwater / Surface Water
Analytical Group	Cyanide
Concentration Level	Water (ILM05.3)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	EPA CLP ILM05.3/ SOP-4, SOP-11, SOP-19
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	Katahdin Analytical Services
No. of Sample Locations	21/ 21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch	No analyte > CRQL	Investigate source of contamination. Report all sample results > 10 x the blank result and flag results with "B". Reprep and analyze method blank and all other samples processed with the contaminated blank.	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Instrument Blank	After each ICV and CCV,	No analyte > CRQL	Investigate source of contamination. Report sample results < CRQL	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	No analyte > CRQL
Laboratory Duplicate	One per twenty samples.	RPD < 20 % for samples greater than 5x the CRQL.	Investigate problem and reanalyze sample in duplicate	Analyst, Supervisor, QA Manager	Precision	If RPD is still > 20, report original result.
Matrix Spike (MS)	One per distillation batch.	Recovery ± 25 % if sample < 4x spike concentration.	Flag results for affected samples	Analyst, Supervisor, QA Manager	Accuracy/Bias	Recovery ± 25 % if sample < 4x spike concentration.
Laboratory Control Sample(LCS)	One per prep batch	85-115%	If the LCS fails high, report samples that are < CRQL. Reprep and reanalyze all other samples.	Analyst, Supervisor, QA Manager	Accuracy/Bias	85-115%
Low-level Calibration Sample	With each initial calibration	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.	Reanalyze sample	Analyst, Supervisor, QA Manager	Accuracy/Bias	Low-level calibration standard in the initial calibration is spiked at or below the QL. Initial calibration acceptance criteria is a correlation coefficient of > 0.995.

ICV = Initial Calibration Verification
CRQL = Contract Required Quantitation Limit
CCV= Continuing Calibration Verification

QAPP Worksheet #28-14—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives
Concentration Level	Medium (SW-846 8330)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8330/#S1
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	must meet acceptance criteria for surrogate; the target analytes<1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	must meet acceptance criteria for surrogate; the target analytes<1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-15—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroglycerin)
Concentration Level	Medium (SW-846 8332)
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8332/#S7
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-16—QC Samples Table

Matrix	Groundwater / Surface Water
Analytical Group	Explosives (Nitroguanadine)
Concentration Level	Medium
Sampling SOP[1]	DPGW, SWSamp
Analytical Method/SOP Reference	SW-846 8330M/#S4
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	21

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action[2]	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	one every batch of 20 samples or less	target analyte <1/2 RL	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	contamination/bias	target analyte <1/2 RL
Field duplicate	One per 10 field samples	should meet RPD criteria of 25%	Document	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision	should meet RPD criteria of 25%
MS/MSD	one set every 20 samples	must meet laboratory spike recovery and RPD criteria	document matrix interference or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	precision/accuracy	must meet laboratory spike recovery and RPD criteria
LCS	one every batch of 20 samples or less	must meet laboratory spike QC criteria	reanalysis or re-extraction	D.J.Broca,Veena Telhan, Nayana Patel, Issac Erusiafe, Samy Shawky, James Anderson	accuracy	must meet laboratory spike QC criteria

[1]Reference number from QAPP Worksheet #21.
[2]LQAO = Laboratory Quality Assurance Officer
MS/MSD = Matrix Spike/ Matrix Spike Duplicate
LCS = Laboratory Control Sample
RPD= Relative Percent Difference
RL= Reporting Limit

QAPP Worksheet #28-17—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-VOCs
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8260B/ H7, M5
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%	Re-clean and re-analyze	Nathan Kreuger	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%
Surrogates	Each sample	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%	Check instrument performance, re-analyze and qualify data	Nathan Kreuger	Accuracy/ Bias	Surrogates must be within: 1,2-Dichloroethane-d4: 70-120% 4-bromofluorobenzene: 75-120% 1,2-Dichlorobenzene-d4: 64-132% Toluene-d8: 85-120%
LCS	1 per batch or 1 per 20 samples	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%	Check instrument performance, re-analyze	Nathan Kreuger	Accuracy/ Bias	Benzene: 80-120% Carbon tetrachloride: 65-140% Chlorobenzene: 80-120% Chloroform: 65-135% 1,2-Dichloroethane: 70-130% 1,1-Dichloroethene: 70-130% 2-Butanone: 30-150% Tetrachloroethene: 45-150% Trichloroethene: 70-125% Vinyl Chloride:50-145%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Nathan Kreuger	Accuracy/ Bias	Same acceptance criteria as LCS
Internal Standards	Each sample	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration	Check instrument performance, re-analyze and qualify data	Nathan Kreuger	Precision/ Accuracy/ Bias	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Nathan Kreuger	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-18—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-SVOCs
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8270C/ H7, P5
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Re-clean and re-analyze	Hall Moore	Bias/ Contamination	No target analytes > Quantitation Limit Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%
Surrogates	Each sample	Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%	Check instrument performance, re-analyze and qualify data	Hall Moore	Accuracy/ Bias	Surrogates within: 2-Fluorobiphenyl: 46 -108% Terphenyl-d14: 29-133% 2,4,6-Tribromophenol: 35-157% 2-Fluorophenol: 28-116% Nitrobenzene-d5: 38-122%
LCS	1 per batch or 1 per 20 samples	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene: 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%	Check instrument performance, re-analyze	Hall Moore	Accuracy/ Bias	2-methylphenol: 17-153% 3&4-methylphenol: 21-143% 1,4-Dichlorobenzene: 24-144% 2,4-Dinitrotoluene: 33-153% Hexachlorobenzene: 24-110% Hexachlorobutadiene: 25-137% Hexachloroethane: 23-147% Nitrobenzene: 23-147% Pentachlorophenol: 19-110% Pyridine: 23-121% 2,4,5-Trichlorphenol: 28-144% 2,4,6-Trichlorophenol: 31-147%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Hall Moore	Accuracy/ Bias	Same acceptance criteria as LCS
Internal Standards	Each sample	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration	Check instrument performance, re-analyze and qualify data	Hall Moore	Precision/ Accuracy/ Bias	Area counts –50% to +100% of Initial Calibration IS or Continuing Calibration IS area counts; Retention times +/- 30 secs of Continuing Calibration
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Hall Moore	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-19—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Pesticides
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8081A/ H7, Q6
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Re-clean and re-analyze	Rekha Patel	Bias/ Contamination	No target analytes > Quantitation Limit surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%
Surrogates	Each sample	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%	Check instrument performance, re-analyze and qualify data	Rekha Patel	Accuracy/ Bias	surrogates within: Decachlorobiphenyl: 16-166% TCMX: 6-154%
LCS	1 per batch or 1 per 20 samples	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Endrin: 43-134% Heptachlor: 45-128% Heptachlor epoxide: 53-134% Gamma-BHC: 73-125% Methoxychlor: 73-142%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Same acceptance criteria as LCS
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Rekha Patel	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-20—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Herbicides
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 8151A/ H7, Q10
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	Every 12 hours	No target analytes > Quantitation Limit surrogate values within lab statistical QC limits: DCAA: 61-136%	Re-clean and re-analyze	Rekha Patel	Bias/ Contamination	No target analytes > Quantitation Limit surrogate values within lab statistical QC limits: DCAA: 61-136%
Surrogates	Each sample	surrogate values within lab statistical QC limits: DCAA: 61-136%	Check instrument performance, re-analyze and qualify data	Rekha Patel	Accuracy/ Bias	surrogate values within lab statistical QC limits: DCAA: 61-136%
LCS	1 per batch or 1 per 20 samples	2,4-D: 61-136% 2,4,5-TP: 61-136%	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	2,4-D: 61-136% 2,4,5-TP: 61-136%
LCSD	1 per batch or 1 per 20 samples if no MSD	Same acceptance criteria as LCS	Check instrument performance, re-analyze	Rekha Patel	Accuracy/ Bias	Same acceptance criteria as LCS
MS/MSD	Every 20 samples	Same acceptance criteria as LCS	Check instrument performance, qualify data	Rekha Patel	Precision/ Accuracy/ Bias	Same acceptance criteria as LCS

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-21—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	TCLP-Metals
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1311, 6010B, 7470A/ H7, H10, H12
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per batch or 1 per 20 samples	No target analytes > ½ Quantitation Limit	Re-digest and re-analyze	Rita Amin	Bias/ Contamination	No target analytes > ½ Quantitation Limit
LCS	1 per batch or 1 per 20 samples	%Recovery 80% - 120%	Re-digest and re-analyze	Rita Amin	Accuracy/ Bias/ Contamination	%Recovery 80% - 120%
Duplicate Sample	1 per 20 samples	RPD ≤20%	Qualify data	Rita Amin	Precision	RPD ≤20%
Matrix Spike	1 per 20 samples	%Recovery 80% - 120%	Perform post-digestion spike analysis, qualify data	Rita Amin	Accuracy/ Bias	%Recovery 80% - 120%
Post-digestion Spike	For compounds outside of QC limits in Matrix Spike	%Recovery 75% - 125%	Qualify data	Rita Amin	Accuracy/ Bias	%Recovery 75% - 125%
ICP Serial Dilution	per analytical run	% Difference < 10%	Qualify data	Rita Amin	Accuracy/ Bias	% Difference < 10%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-22—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 7.3, 9014, 9034/ J11, J13, J43
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	1 per batch or 1 per 20 samples	CN %Recovery 1.7% - 2.9% S %Recovery 23.7% - 30.3%	Recalibrate/ reanalyze	James Anderson	Accuracy/ Bias	CN %Recovery 1.7% - 2.9% S %Recovery 23.7% - 30.3%
Duplicate Sample	1 per 20 samples	RPD ≤15%	Qualify data	James Anderson	Precision	RPD ≤15%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-23—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	Reactivity to Cyanide and Sulfide
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 7.2.2-1a/ J12
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS (pH 7.0 buffer)	Every 10 samples	± 0.10 pH units	Recalibrate/ reanalyze	James Anderson	Accuracy/ Precision	± 0.10 pH units
Duplicate Sample	1 per 20 samples	RPD ≤20%	Qualify data	James Anderson	Precision	RPD ≤20%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #28-24—QC Samples Table

Matrix	Aqueous IDW
Analytical Group	Ignitability
Concentration Level	Medium
Sampling SOP[1]	HSE-411
Analytical Method/SOP Reference	SW-846 1010/ N1
Field Team Leader	Carol Peterson/ David Livingston
Field Sampling Organization	CH2M HILL
Analytical Organization	GPL Laboratories, LLLP
No. of Sample Locations	1

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	One per batch of 20 or fewer samples	%Recovery 80% - 120%	Reanalyze	Namory Keita	Accuracy	%Recovery 80% - 120%
Duplicate Sample	One set per 20 field samples, for every sample that flashes, or extinguishes flame <140 degrees	RPD ≤20%	Repeat, qualify data	Namory Keita	Precision	RPD ≤20%

[1]Reference number from QAPP Worksheet #21.

QAPP Worksheet #29—Project Documents and Records Table
(UFP-QAPP Manual Section 3.5.1)

Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

☐ Worksheet Not Applicable (State Reason)

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field Notebooks • Chain-of-Custody Records • Air Bills • Custody Seals • Corrective Action Forms • Electronic Data Deliverables • Identification of QC Samples • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes and drilling logs	• No onsite analysis will take place other than collecting water quality parameters. These readings will be recorded in field logbooks as they are collected	• Sample Receipt, Chain-of-Custody, and Tracking Records • Standard Traceability Logs • Equipment Calibration Logs • Sample Prep Logs • Run Logs • Equipment Maintenance, Testing, and Inspection Logs • Corrective Action Forms • Reported Field Sample Results • Reported Result for Standards, QC Checks, and QC Samples • Instrument printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples • If manual integration was performed, will include chromatagrams before and after each manual integration and reasons for the integration. • Data Package Completeness Checklists • Sample disposal records • Extraction/Clean-up Records • Raw Data (stored on disk)	• Fixed Laboratory Audit Checklists • Data Validation Reports • Corrective Action Forms • Laboratory QA Plan • MDL Study Information	

QAPP Worksheet #30—Analytical Services Table

(UFP-QAPP Manual Section 3.5.2.3)

Complete this worksheet for each matrix, analytical group, and concentration level. Identify all laboratories or organizations that will provide analytical services for the project, including on-site screening, on-site definitive, and off-site laboratory analytical work. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organizations cannot be used.

☐ Worksheet Not Applicable (State Reason)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
GW	TCL VOCs	Medium	TBD	SOP-2, SOP-7	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
GW	TAL Total Metals/Cyanide, TAL Dissolved Metals	Medium	TBD	SOP-4, SOP-1, SOP-11, SOP-17, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
GW	TCL SVOCs	Medium	TBD	SOP-8, SOP-6	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SW	TAL Total Metals/Cyanide, TAL Dissolved Metals	Medium	TBD	SOP-4, SOP-1, SOP-11, SOP-17, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SW	Hardness	Medium	TBD	SOP-8	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
SS/SB	TCL VOCs	Medium	TBD	SOP-9, SOP-10	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
SS/SB	TAL Total Metals/Cyanide	Medium	TBD	SOP-4, SOP-1, SOP-12, SOP-18, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	Total Organic Carbon	Medium	TBD	SOP-2	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	pH	Medium	TBD	SOP-3	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SS/SB	TCL SVOCs	Medium	TBD	SOP-8, SOP-5	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	AVS/SEM	Medium	TBD	SOP-20	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	TAL Total Metals/Cyanide	Medium	TBD	SOP-4, SOP-1, SOP-12, SOP-18, SOP-19	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	
SD	Total Organic Carbon	Medium	TBD	SOP-2	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
						(207)874-2400	
SD	pH	Medium	TBD	SOP-3	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, Maine 04074 (207)874-2400	TBD
SD	Grain Size	Medium	TBD	SOP-16	28 calendar days	Ron Pentkowski Test America Labs Burlington, Vermont 30 Community Drive, Suite 11 South Burlington, VT 05403 (802) 923-1027	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Aqueous IDW	TCLP-VOCs	Medium	TBD	H7, M5	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
Aqueous IDW	TCLP-SVOCs	Medium	TBD	H7, P5	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Pesticides	Medium	TBD	H7, Q6	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Herbicides	Medium	TBD	H7, Q10	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	TCLP-Metals	Medium	TBD	H7, H10, H12	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Reactivity- Sulfide	Medium	TBD	J13, J11	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Reactivity- Cyanide	Medium	TBD	J13, J43	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
Aqueous IDW	Corrosivity	Medium	TBD	J12	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Aqueous IDW	Ignitability	Medium	TBD	N1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
GW	TCL Pesticides/PCBs	Medium	TBD	#Q20	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
GW	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SW	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

QAPP Worksheet #30
Analytical Services Table (continued)

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
SO	TCL Pesticides/PCBs	Medium	TBD	#Q20	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	TBD
SO	Explosives	Medium	TBD	#S1	28 calendar days (48 hours for Form I's from AOC 6, full package within 28 calendar days)	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SO	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SO	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Explosives	Medium	TBD	#S1	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Nitroglycerin	Medium	TBD	#S7	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	
SD	Nitroguanadine	Medium	TBD	#S4	28 calendar days	Yemane Yohannes GPL Laboratories, LLLP 7210A Corporate Court Frederick ,MD 21703 Tel: 301-694-5310	

[1] A backup laboratory has not been identified for this project. If a situation arises where the primary laboratories cannot perform the work, a backup will be identified at that time.

QAPP Worksheet #31—Planned Project Assessments Table
(UFP-QAPP Manual Section 4.1.1)

Identify the type, frequency, and responsible parties of planned assessment activities that will be preformed for the project.

☐ Worksheet Not Applicable (State Reason)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Offsite Laboratory Technical Systems Audit	Yearly, expires August 16, 2009	External	U.S. Navy	Project QA Officer- Pati Moreno/ NFESC, Port Hueneme, CA	Yemane Yohannes, GPL QA Officer	Yemane Yohannes, GPL QA Officer	Program Chemist- Anita Dodson- CH2M HILL
Offsite Laboratory Technical Systems Audit	Yearly, expires September 30, 2008	External	U.S. Navy	Project QA Officer- Pati Moreno/ NFESC, Port Hueneme, CA	Leslie Dimond, Katahdin QA Officer	Leslie Dimond, Katahdin QA Officer	Program Chemist- Anita Dodson- CH2M HILL

QAPP Worksheet #31a—GPL Laboratories NFESC Letter

Elsa Tai

From: Moreno, Pati (NFESC) [pati.moreno@navy.mil]
Sent: Friday, October 05, 2007 1:24 PM
To: tai@gplab.com
Cc: Neil, Kenda L. (NFESC)
Subject: Navy Assessment - GPL Laboratories

Ms. Tai,

This email addresses the status of GPL Laboratories, LLLP of Frederick Maryland in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

NAVSEA 04XQ conducted a laboratory assessment of GPL Laboratories, LLLP of Frederick Maryland as a support service to the Naval Facilities Engineering Service Center (NFESC). The general conclusion of the assessment is that the laboratory has successfully completed the evaluation for the parameters summarized in NAVSEA 04XQ letter Ser 04XQ (LABS)/274 dated October 5, 2007; these results are applicable to the Navy ER QA Program administered by NFESC. Based on the outcome of the assessment, a re-evaluation of your laboratory under the Navy ER QA Program will be due not later than August 16, 2009.

The outcome of this assessment does not guarantee the delivery of any analytical samples, and is facility specific (i.e. is not applicable to an affiliated or subcontract laboratory). The Navy reserves the right to conduct additional laboratory assessments. The outcome of the assessment may result in the addition or removal of parameters listed in the original scope of review, or reclassification from successful to unsuccessful.

Contact Ms. Kenda Neil (kenda.neil@navy.mil / 805 982-6060) if there are parameters not presented on the table in the aforementioned NAVSEA letter that the laboratory expects to run on a routine basis in support of Navy environmental restoration projects. In these circumstances the laboratory's capability to run the tests will be assessed and the table will be modified accordingly. Any other questions concerning the information provided should be directed to me.

Sincerely,
Pati Moreno
NFESC ER QA Program Coordinator
PH: (805) 982-1659 Fax: (805) 982-4304
Email: pati.moreno@navy.mil

1

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVE SE
WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

5090
Ser 04XQ (LABS)/274
October 5, 2007

Ms. Elsa Tai
GPL Laboratories
7210A Corporate Court
Frederick, Maryland 21703-8386

Subj: COMPLETION LETTER REPORT, GPL LABORATORIES – FREDERICK, MARYLAND

NAVSEA Laboratory Quality and Accreditation Office (LQAO) has concluded the assessment of GPL Laboratories, located in Frederick, Maryland.

The assessment was intended as a general review of analytical capability to support remediation projects and the laboratory's ability to meet quality assurance requirements presented in the DoD Quality Systems Manual for Environmental Laboratories (Version 3, dated Jan 2006). The specific methods reviewed under the assessment are summarized in the attached table. This letter presents the outcome of our assessment documented in the following reports:

LQAO ltr 5090 Ser 04XQ(LABS)/ 214 of 16 Aug 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 235 of 5 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 260 of 27 Sep 07
LQAO ltr 5090 Ser 04XQ(LABS)/ 273 of 4 Oct 07

- **Desk Assessment:** A review of laboratory supplied documentation was conducted. Documentation included the laboratory's quality assurance (QA) manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, and historical PT information. The documentation was reflective of a laboratory that was in a position to meet Navy requirements; however findings that required resolution were identified.

- **Proficiency Testing (PT) Samples:** GPL Laboratories participates in a number of external certification and PT programs, and provided results for the past two years. Recurring failures were not identified in any specific analyte group, and the laboratory appears to be processing PT samples regularly (i.e. two times a year for each method/matrix).

5090
Ser 04XQ (LABS)/274
October 5, 2007

- **On-site Assessment:** Existing on-site assessment documentation is available and was applied to this assessment. The State of Florida Environmental Laboratory Accreditation Program (FL ELAP) conducted an on-site assessment of the laboratory on June 19 - 21, 2007. FL ELAP is a National Environmental Laboratory Accreditation Conference (NELAC) recognized accreditation body. The State of Florida accepted the corrective actions and accredited the laboratory effective July 1, 2007, expiring June 30, 2008. The Florida assessment report and the laboratory Corrective Action Report (CAR) were reviewed. The nature of the findings did not raise a level of concern that would require a Navy follow-up on-site assessment.

- **Corrective Actions:** The laboratory successfully remedied all of the Navy findings associated with the desk assessment.

The laboratory has provided documentation that demonstrates their capability to support environmental restoration projects (for the tests reviewed under this assessment, and summarized in the following table), and conformance the DoD Quality Systems Manual. However, due to the number of repeat finding from the Navy's 2005 desk assessment, an on-site assessment will be conducted in order to evaluate the laboratory's implementation the DoD QSM. If you have questions concerning your standing in the Navy ER QA Program, please contact Pati Moreno at (805) 982-1659.

Sincerely,

by direction

E. B. HARTZOG, JR.
Director, Laboratory Quality
and Accreditation Office

Copy To: NFESC (P. Moreno, Code 413)

GPL Laboratories - Methods Reviewed
(including parameters and matrices)

METHOD	PARAMETER	MATRIX
8260B/8021	Volatile Organics	Water/ Solids
6010B/7000A/6020	TAL Metals: Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/ Solids
8270D	Semivolatile Organics	Water/ Solids
8081A	Organochlorine Pesticides	Water/ Solids
8082	Polychlorinated Biphenyls	Water/ Solids/Oil
8015B	Diesel Range Organics	Water/ Solids
7196A	Hexavalent Chromium	Water/ Solids
9056	Anions: Chloride, Fluoride, Sulfate, Nitrate, and Nitrite	Water/Solids
9012/9014	Cyanide	Water/ Solids
9066	Total Phenolics	Water/ Solids
9020	Total Organic Halides	Water/ Solids
8330	Explosives by HPLC	Water/ Solids
9071	Oil and Grease	Water/ Solids
8310	Polyaromatics Hydrocarbons (PAHs)	Water/ Solids
8151A	Chlorinated Herbicides	Water/ Solids
RSK-175	Methane, Ethane, and Ethene	Water/ Solids
8011	1,2-Dibromoehtane, 1,2-Dibromo-3-chloropropane, and 1,2,3-Trichloropropane by GC	Water/ Solids
8315A	Carbonyl Compounds by HPLC	Water/ Solids

QAPP Worksheet #31b—Katahdin Analytical Services NFESC Letter

08/23/07 THU 15:41 FAX 002

DEPARTMENT OF THE NAVY

NAVAL FACILITIES ENGINEERING SERVICE CENTER
1100 23RD AVE
PORT HUENEME CA 93043-4370

IN REPLY REFER TO:

NFESC 413
August 23, 2007

Ms. Leslie Dimond
Quality Assurance Officer
Katahdin Analytical Services
340 Country Road No. 5
Westbrook, ME 04098

Dear Ms. Dimond,

This correspondence addresses the status of Katahdin Analytical Services of Westbrook, Maine in the Navy Environmental Restoration (ER) Quality Assurance (QA) Program as administered by the Naval Facilities Engineering Service Center (NFESC).

Your laboratory is accepted to perform sample analysis for the methods listed in Table 1. The period of acceptance expires September 30, 2008. This acceptance does not guarantee the delivery of any analytical samples. Acceptance is facility specific and can not be transferred to an affiliated or subcontract laboratory.

The Navy's assessment included a review of the laboratory's QA manual, selected standard operating procedures (SOPs) and SOP master list, list of major analytical instrumentation, performance test (PT) results and onsite assessment documentation[1].

The Navy reserves the right to conduct additional laboratory assessments or to suspend or revoke acceptance status for any or all of the listed parameters if deemed necessary.

Table 1

METHOD	PARAMETER	MATRIX
300 Series/9056	Anions: Bromide, Chloride, Fluoride, Nitrate, Nitrite, Orthophosphate, Phosphorus, Sulfate, Sulfide, Sulfite	Water/Solid
8260B	Volatile Organic Compounds	Water/Solid
8270C	Semivolatile Organic Compounds	Water/Solid
8081A	Organochlorine Pesticides	Water/Solid
8330	Explosives	Water/Solid
8082	Polychlorinated Biphenyls (PCBs)	Water/Solid

[1] The State of Florida conducted the onsite on August 28-30, 2006 to assess laboratory conformance with National Environmental Laboratory Accreditation Conference (NELAC) requirements. A supplementary Navy onsite was conducted May 8, 2007.

NFESC 413
August 23, 2007

6010B/7000A	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
6020	TAL Metals: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc	Water/Solid
7196	Chromium VI	Water/Solid
1664	Total Petroleum Hydrocarbons (TPH)	Water/Solid
8011	1,2 Dibromoehtane and 1,2 Dibromo-3-Chloropropane by Microestraction and Gas Chromatograph	Water/Solid
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics (GRO) Diesel Range Organics (DRO)	Water/Solid
9012	Cyanide	Water/Solid

Acceptance for use for parameters not identified on the table will be determined by Navy project personnel.

The laboratory should notify NFESC if there are parameters not presented on Table 1 that the laboratory expects to run on a routine basis in support of Navy installation restoration projects. In these circumstances the laboratory's capability to run the tests will be reviewed and the table will be modified accordingly.

Questions concerning the information provided should be directed to the NFESC IR QA Program coordinator, Ms. Patricia Moreno at (805) 982-1659, or via email at pati.moreno@navy.mil.

Sincerely,

Robert J. Kratzke
Supervisor, Consultation/Information
Management Branch

QAPP Worksheet #31c—Corrective Action Form

(UFP-QAPP Manual Section 4.1.1)

Person initiating corrective action _____ Date _____

Description of problem and when identified: _____

_____

Cause of problem, if known or suspected: _____

_____

_____

Sequence of Corrective Action (CA): (including date implemented, action planned and personnel/data affected) _____

_____

_____

_____

_____

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date: _____

Follow-up date: _____

Final CA approved by: _____ Date: _____

Information copies to:

_____

_____

QAPP Worksheet #32—Assessment Findings and Corrective Action Responses
(UFP-QAPP Manual Section 4.1.2)

For each type of assessment describe procedures for handling QAPP and project deviations encountered during the planned project assessments.

☐ Worksheet Not Applicable (State Reason)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Performance Audit Checklist[1]	Written Audit Report	Project Manager, CH2M HILL	Within one week of audit	Memorandum	FTL, CH2M HILL	Within one week of receipt of Corrective Action Form
Laboratory Performance and Systems Audits	Written Audit Report	Laboratory QA Manager: GPL- Yemane Yohannes Katahdin- Leslie Dimond	Within 2 months of audit	Memorandum	NFESC Auditor, TBD	Within two months of receipt of initial notification.

Notes:

[1]CH2M HILL has an internal performance audit that is performed on a project-by-project basis. If an audit is selected to be performed by the Project Manager, the Field Performance Audit Checklist will be utilized. Additional checks include review of the field notebook and chain-of-custody forms concurrent with the field investigation, during the SI report development, and through a post-field investigation meeting.

QAPP Worksheet #32-1—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ Date: _____

Project Location: _____ Signature: _____

Team Members:

Yes __ No __ 1) Is the approved CAX AOCs SI work plan being followed?
Comments _____

_____

Yes __ No __ 2) Was a briefing held for project participants?
Comments _____

_____

Yes __ No __ 3) Were additional instructions given to project participants?
Comments _____

_____

Sample Collection

Yes __ No __ 1) Is there a written list of sampling locations and descriptions?
Comments _____

_____

Yes __ No __ 2) Are samples collected as stated in the SOPs?
Comments _____

_____

Yes __ No __ 3) Are samples collected in the type of containers specified in the CAX AOCs SI work plan?
Comments _____

_____

Yes __ No __ 4) Are samples preserved as specified in the CAX AOCs SI work plan?
Comments _____

_____

Yes __ No __ 5) Are the number, frequency, and type of samples collected as specified in the CAX AOCs SI work plan?
Comments _____

_____

QAPP Worksheet #32-1—Field Performance Audit Checklist (continued)

Yes __ No __ 6) Are quality assurance checks performed as specified in the CAX AOCs SI work plan?
Comments _____

_____

Yes __ No __ 7) Are photographs taken and documented?
Comments _____

_____

Document Control

Yes __ No __ 1) Have any accountable documents been lost?
Comments _____

_____

Yes __ No __ 2) Have any accountable documents been voided?
Comments _____

_____

Yes __ No __ 3) Have any accountable documents been disposed of?
Comments _____

Yes __ No __ 4) Are the samples identified with sample tags?
Comments _____

_____

Yes __ No __ 5) Are blank and duplicate samples properly identified?
Comments _____

_____

Yes __ No __ 6) Are samples listed on a chain-of-custody record?
Comments _____

_____

Yes __ No __ 7) Is chain-of-custody documented and maintained?
Comments _____

QAPP Worksheet #33—QA Management Reports Table
(UFP-QAPP Manual Section 4.2)

Identify the frequency and type of planned QA Management Reports, the projected delivery date, the personnel responsible for report preparation, and the report recipients.

☐ Worksheet Not Applicable (State Reason)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Site Investigation Report	Post- Field Event	TBD	Laura Lampshire, Project Manager, CH2M HILL	Stakeholders, see Worksheet 4

QAPP Worksheet #34—Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Describe the processes that will be followed to verify project data. Verification inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the persons responsible. *Internal or external* is in relation to the data generator.

☐ Worksheet Not Applicable (State Reason)

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody and shipping forms	CoC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the CoC will be initialed by the reviewer, a copy of the CoC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See CoC SOP (on CD) for further details.	Internal	Carol Peterson, David Livingston, Chelsea Bennet CH2M HILL
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and Master Plans (Baker, 2005d).	Internal	Laura Lampshire CH2M HILL
Laboratory Data	Upon their arrival at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	External	GPL and Katahdin employees
Field Investigation Interpretive Data	Immediately following receipt of the analytical data from the laboratory and prior to submittal to the data validator, a population to population comparison will be conducted comparing site results and the results from the background sample set. The background population to population comparison for will be used to determine the likelihood of a release relative to background. The data will also be compared to unadjusted residential risk-based concentration (RBC) and Biological Technical Assistance Group (BTAG) flora and fauna screening values.	Internal	Laura Lampshire, Roni Warren, Bill Kappleman CH2M HILL

QAPP Worksheet #35—Validation (Steps IIa and IIb) Process Table
(UFP-QAPP Manual Section 5.2.2)

Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps IIa and IIb of validation.

☐ Worksheet Not Applicable (State Reason)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Review field logbooks, laboratory case narratives, data deliverables for compliance to methods.	**David Livingston, Megan Hilton** *CH2M HILL* **Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIa	QC Results	Establish that all QC samples were run and compliant with method-required limits.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIa/ IIb	Field QC Samples	Field QC provides information on the precision of the field sample collection and laboratory procedures. The field QC will also provide useful information on matrix interferences and biases, which can be used to determine the levels of uncertainty during a risk assessment.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services* **Bill Kappleman, Roni Warren** *CH2M HILL*
IIb	QC Results	Verify that QC samples were run and compliant with limits established in the UFP-QAPP.	**Anita Dodson** *CH2M HILL* **Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*
IIb	Project Quantification Limits	Ensure all sample results met the project quantification and action limits specified in the QAPP.	**Laura Lampshire, Megan Hilton** *CH2M HILL*
IIb	Raw data	10% review of raw data to confirm laboratory calculations.	**Laura Maschhoff, Jackie Cleveland** *DataQual Environmental Services* **Nancy Weaver** *Environmental Data Services*

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2)

Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

☐ Worksheet Not Applicable (State Reason)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	GW	TCL Volatiles, TCL Semivolatiles,	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Laura Maschhoff DataQual Environmental Services
IIa	GW	TCL Pesticides and PCBs	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Nancy Weaver Environmental Data Services
IIa	GW, SW	Total Metals, Dissolved Metals	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Jackie Cleveland DataQual Environmental Services
IIa	SW, Soil, Sediment	TOC, pH, hardness, AVS/SEM	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Jackie Cleveland DataQual Environmental Services
IIa	GW, SW	Explosives, Nitroglycerin, Nitroguanadine,	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Nancy Weaver Environmental Data Services
IIa	Soil, Sediment	TCL Volatiles, TCL Semivolatiles, Wet Chemistry	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Laura Maschhoff DataQual Environmental Services
IIa	Soil, Sediment	TCL Pesticides and PCBs	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Organic Data Review: Multi-Media, Multi-Concentration (Sept. 1994)	Nancy Weaver Environmental Data Services
IIa	Soil, Sediment	Total Metals	Medium	EPA CLP Region III Modifications to National Functional Guidelines for Inorganic Data Review (April 1993)	Jackie Cleveland DataQual Environmental Services

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table (continued)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Soil, Sediment	Explosives, Nitroglycerin, Nitroguanadine	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Nancy Weaver Environmental Data Services
IIa	Aqueous IDW	TCLP-VOCs, SVOCs, Pesticides, Herbicides, Metals, Reactivity, Corrosivity, Ignitability	Medium	Data will be reviewed against the analytical methods for outstanding QA/QC issues and anomalies by the laboratory. Issues will be summarized in the case narrative. CH2M HILL chemist and PM will review the analytical results and case narrative before the data is loaded to ensure no major problems exist.	Laboratory QA Officers Megan Hilton Laura Lampshire CH2M HILL
IIb	GW	TCL Volatiles, TCL Semivolatiles,	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW	TCL Pesticides and PCBs	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW, SW	Total Metals, Dissolved Metals	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	GW, SW	Explosives, Nitroglycerin, Nitroguanadine	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	SW, Soil, Sediment	TOC, pH, hardness, AVS/SEM	Medium	Region III Modifications to the National Functional Guidelines as appropriate, SOPs, Methodology	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	TCL Volatiles, TCL Semivolatiles, Wet Chemistry	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	TCL Pesticides and PCBs	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL

QAPP Worksheet #36—Validation (Steps IIa and IIb) Summary Table (continued)

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIb	Soil, Sediment	Total Metals	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Soil, Sediment	Explosives, Nitroglycerin, Nitroguanadine	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL
IIb	Aqueous IDW	TCLP-VOCs, SVOCs, Pesticides, Herbicides, Metals, Reactivity, Corrosivity, Ignitability	Medium	Action levels in Worksheet 15	Anita Dodson Laura Lampshire CH2M HILL

QAPP Worksheet #37—Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

Describe the procedures/methods/activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations of the use of the data will be handled.

☐ Worksheet Not Applicable (State Reason)

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: It is the joint responsibility of the contractor project chemist and the data validation subcontractor to ensure that the data meet the method detection limits, reporting limits, and laboratory QC limits listed in this Work Plan and the laboratory Scope of Work. In this approach, the entire analytical process is reconstructed and recalculated from the raw data, non-conformances are documented, and the data are qualified for use in decision making.
Describe the evaluative procedures used to assess overall measurement error associated with the project: In-depth assessment occurs during the data validation process. The third-party validation contractor will follow the national EPA and Region III data validation guidance for the EPA CLP to assess conformance with the quality control limits. The findings of the data validation reports and the qualifiers applied to the data will be considered in context with field logs and corrective action reports to assess overall usability.
Identify the personnel responsible for performing the usability assessment: The PM, Project Chemist, and other team members will be responsible for compiling the data. The data will then be presented to the Partnering Team who, as a whole, will evaluate the data usability according to project objectives.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The data validation reports will identify precision and accuracy outliers with respect to the laboratory performance of each batch of samples, as well as comparability of field and lab duplicates. All the results will be assembled and statistically reported for an overall quality assessment provided in the final project event report. Discussion will cover completeness and representativeness. Attachments supporting this report will include data validation narratives, corrective action forms, and field audit reports.

Attachment A
Field SOPs, Analytical Laboratory SOPs, Valid Values

Field SOPs

PMS 219

PMS 1795*

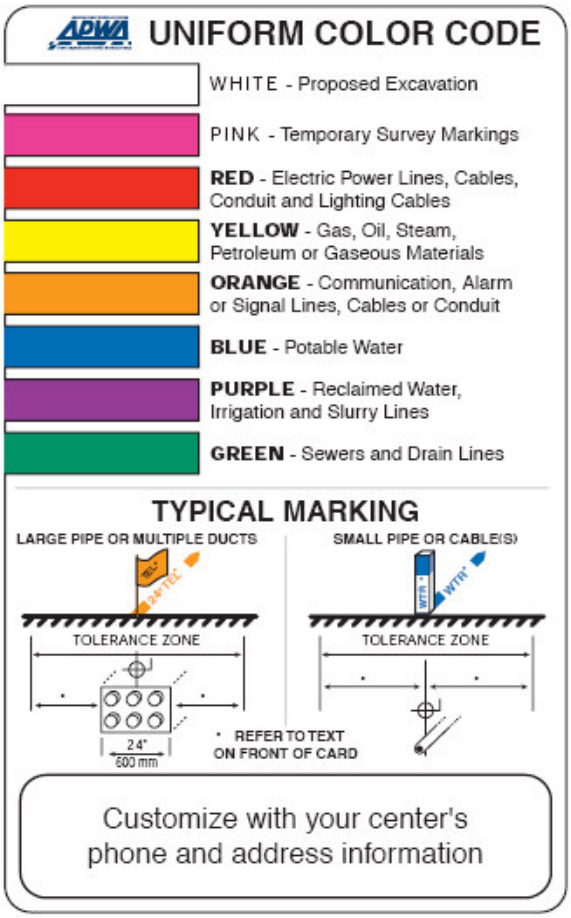
PMS 108

PMS 144*

13.5 parts process
2.5 parts reflex

PMS 253

PMS 3415



GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS
The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION
Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING
Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE
Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE
The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/99

STANDARD OPERATING PROCEDURE

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Millipore™ deionized water
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment.*

B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.

D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.

E. Document and ship samples in accordance with the procedures for other samples.

F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

Buried Utility Location Tracking Form

(Submit to CH2M HILL PM within 24 hrs of location activities)

Project Location:
CH2M HILL Project No.:
CH2M HILL Project Manager: Name/Phone:
Fax:
Email:
CH2M HILL Field Team Leader: Name/Phone:

CH2M HILL Purchase Order:

Utility Location Subcontractor:
Subcontractor POC:

Dates of location activities:

Check each box using an "X" if a buried utility is present within 5 feet of a marked Station ID. If color of the flag or paint differs from listed color, note change in color on the form.

Station ID	Gas (Yellow)	Electric (Red)	Fiber optic (Orange)	Cable (Orange)	Water (Blue)	San. Sewer (Green)	Storm Sewer (Green)	Steam (Yellow)	Petroleum (Yellow)	Compressed air (Yellow)	Other ___	Other ___	Other ___	Other ___	Date completed	Technician initials	Notes (methods/tools used

The findings of the buried utility location activities summarized herein were conducted in strict accordance with the CH2M HILL scope of work.

Subcontractor's Signature

Date

STANDARD OPERATING PROCEDURE

Chain-of-Custody

I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

V Procedures

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,

- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project - CTO Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 01/21/08).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/ location number should be included.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under "Relinquished by" entry.

- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.

- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

VI Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

VII Attachments

A. Sample Label
B. Chain of Custody Form
C. Custody Seal

VIII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® (or Alconox®)and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, squirt bottles for Liquinox® solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Phthalate-free gloves such as Nitrile
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox® solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with Liquinox® solution, remove, and discard into DOT-approved 55-gallon drum.

2. Wash outer gloves in Liquinox® solution, rinse, remove, and discard into DOT-approved 55-gallon drum.

3. Remove disposable coveralls ("Tyveks") and discard into DOT-approved 55-gallon drum.

4. Remove respirator (if worn).

5. Remove inner gloves and discard.

6. At the end of the work day, shower entire body, including hair, either at the work site or at home.

7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.

2. Spread plastic on the ground to keep equipment from touching the ground

3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.

4. Turn pump back on and pump 1 gallon of Liquinox® solution through the sampling pump.

5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).

6. Rinse with 1 gallon of tap water.

7. Rinse with 1 gallon of deionized water.

8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.

9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.

10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution.
5. Rinse with potable water.
6. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
7. Air dry.
8. Rinse with deionized water.
9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox® solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox® solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.

2. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility

2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox®, methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

STANDARD OPERATING PROCEDURE

Decontamination of Drilling Rigs and Equipment

I. Purpose and Scope

The purpose of this guideline is to provide methods for the decontamination of drilling rigs, downhole drilling tools, and water-level measurement equipment. Personnel decontamination procedures are not addressed in this SOP; refer to the site safety plan and SOP *Decontamination of Personnel and Equipment*. Sample bottles will not be field decontaminated; instead they will be purchased with certification of laboratory sterilization.

II. Equipment and Materials

- Portable steam cleaner and related equipment
- Potable water
- Phosphate-free detergent such as Liquinox®
- Buckets
- Brushes
- Distilled organic-free water
- Methanol, pesticide grade
- ASTM–Type II grade water or Lab Grade DI Water
- Aluminum foil

III. Procedures and Guidelines

A. Drilling Rigs and Monitoring Well Materials

Before the onset of drilling, after each borehole, before drilling through permanent isolation casing, and before leaving the site, heavy equipment and machinery will be decontaminated by steam cleaning at a designated area. The steam-cleaning area will be designed to contain decontamination wastes and waste waters and can be an HDPE-lined, bermed pad. A pumping system will be used to convey decontaminated water from the pad to drums.

Surface casings may be steam cleaned in the field if they are exposed to contamination at the site prior to use.

B. Downhole Drilling Tools

Downhole tools will be steam cleaned before the onset of drilling, prior to drilling through permanent isolation casing, and between boreholes, and prior to leaving the site. This will include, but is not limited to, rods, split spoons or similar samplers, coring equipment, augers, and casing.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for physical characterization, the sampler shall be cleaned by scrubbing with a detergent solution followed by a potable water rinse.

Before the use of a sampling device such as a split-spoon sampler for the collection of a soil sample for chemical analysis, the sampler shall be decontaminated following the procedures outlined in the following subsection.

C. Field Analytical Equipment

1. Water Level Indicators

   Water level indicators that consist of a probe that comes into contact with the groundwater must be decontaminated using the following steps:

   a. Rinse with tap water
   b. Rinse with de-ionized water
   c. Solvent rinse with methanol
   d. Rinse with de-ionized water

2. Probes

   Probes, for example, pH or specific ion electrodes, geophysical probes, or thermometers that would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise. For probes that make no direct contact, for example, OVM equipment, the probe will be wiped with clean paper-towels or cloth wetted with methanol.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- The effectiveness of field cleaning procedures will be monitored by rinsing decontaminated equipment with organic-free water and submitting the rinse water in standard sample containers for analysis. Anytime a sampling event occurs, at least one such quality control sample shall be collected.

STANDARD OPERATING PROCEDURE

Direct-Push Groundwater Sample Collection

I. Purpose

To provide a general guideline for the collection of groundwater samples using direct-push (e.g., Geoprobe®) sampling methods.

II. Scope

Standard direct-push (e.g., Geoprobe®) groundwater sampling methods.

III. Equipment and Materials

- Truck-mounted hydraulic percussion hammer.
- Direct-push (e.g., Geoprobe®) sampling rods and slotted lead rod
- Polyethylene sampling tubing and stainless steel foot valve
- Pre-cleaned sample containers
- Clean latex or surgical gloves.

IV. Procedures and Guidelines

1. Decontaminate slotted lead rod and other downhole equipment in accordance with SOP *Decontamination of Personnel and Equipment*.

2. Drive slotted steel lead rod to the desired sampling depth using the truck-mounted hydraulic percussion hammer.

3. Insert the stainless steel foot valve into the end of the polyethylene sampling tubing and insert tubing through the rods.

4. Fill all sample containers, beginning with the containers for VOC analysis.

5. Remove polyethylene sampling tubing from the rods. Remove the foot valve and discard polyethylene tubing.

6. Backfill borehole at each sampling location with grout or bentonite and repair the surface with like material (bentonite, asphalt patch, concrete, etc.), as required.

V. Key Checks and Items

- Verify that the hydraulic percussion hammer is clean and in proper working order.
- Ensure that the direct-push operator thoroughly completes the decontamination process between sampling locations.
- Ensure that the slotted lead rod has been inserted to the desired sampling depth.
- Verify that the borehole made during sampling activities has been properly backfilled.

STANDARD OPERATING PROCEDURE

Direct-Push Soil Sample Collection

I. Purpose

To provide a general guideline for the collection of soil samples using direct-push (e.g., Geoprobe®) sampling methods.

II. Scope

Standard direct-push (e.g., Geoprobe®) soil sampling methods.

III. Equipment and Materials

- Truck-mounted hydraulic percussion hammer.
- Sampling rods
- Sampling tubes and acetate liners
- Pre-cleaned sample containers and stainless-steel sampling implements
- Clean latex or surgical gloves.

IV. Procedures and Guidelines

1. Decontaminate sampling tubes and other non-dedicated downhole equipment in accordance with SOP *Decontamination of Personnel and Equipment*.

2. Drive sampling tube to the desired sampling depth using the truck-mounted hydraulic percussion hammer. If soil above the desired depth is not to be sampled, first drive the lead rod, without a sampling tube, to the top of the desired depth.

3. Remove the rods and sampling tube from the borehole and remove the sample from the tube.

4. Fill all sample containers, beginning with the containers for VOC analysis, using a decontaminated or dedicated sampling implement.

5. Decontaminate all non-dedicated downhole equipment (rods, sampling tubes, etc.) in accordance with SOP *Decontamination of Personnel and Equipment*.

6. Backfill borehole at each sampling location with grout or bentonite and repair the surface with like material (bentonite, asphalt patch, concrete, etc.), as required.

V. Key Checks and Items

1. Verify that the hydraulic percussion hammer is clean and in proper working order.

2. Ensure that the direct-push operator thoroughly completes the decontamination process between sampling locations.

3. Verify that the borehole made during sampling activities has been properly backfilled.

STANDARD OPERATING PROCEDURE

Homogenization of Soil and Sediment Samples

I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for VOCs or field GC screening; samples for these analyses should NOT be homogenized.

III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

Samples for VOCs should be taken immediately upon opening the spoon and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP *Decontamination of Personnel and Equipment* prior to homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

V. Attachments

None.

VI. Key Checks and Items

- Take VOC samples immediately and do not homogenize the soil.
- Homogenize soil for analyses other than VOCs in a clean, stainless steel bowl.

STANDARD OPERATING PROCEDURE

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using the Horiba® U-22 with Flow-through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using the Horiba® U-22 for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of groundwater samples. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Horiba® U-22 Water Quality Checker with flow-though cell
- Distilled water in squirt bottle
- Horiba® U-22 Auto-Calibration Standard Solution

III. Procedures and Guidelines

A. Parameters and Specifications:

Parameter	Range of measurement	Accuracy
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 ^{o}C	+/- 1.0 ^{o}C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using Horiba® Standard Solution. Calibration procedure:

1. Fill the calibration beaker to about 2/3 with the pH 4 standard solution.
2. Fit the probe into the beaker. All the parameter sensors will now be immersed in the standard solution except the D.O. sensor; the D.O. calibration is done using atmospheric air.
3. Turn power on.
4. Press CAL key to put the unit in the calibration mode.
5. Press the ENT key to start automatic calibration. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one by one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END. The instrument is now calibrated.
6. If the unit is calibrated properly, pH will read 4.0 +/- 3%, conductivity will read 4.49 +/- 3%, and turbidity will read 0 +/- 3%

C. Sample Measurement:

As water passes through the flow-through Cell, press MEAS to obtain reading; record in the field notebook.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

STANDARD OPERATING PROCEDURE

Preparing Field Log Books

I. Purpose

To provide general guidelines for entering field data into log books during site investigation and remediation field activities.

II. Scope

This is a general description of data requirements and format for field log books. Log books are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

Properly completed field log books are a requirement of much of the work we perform under the Navy CLEAN contract. Log books are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field log book entries.

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

1. Field notes commonly are kept in bound, orange-covered logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.

2. On the inside cover of the log book the following information should be included:

   - Company name and address
   - Log-holders name if log book was assigned specifically to that person

- Activity or location
- Project name
- Project manager's name
- Phone numbers of the company, supervisors, emergency response, etc.

3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."

4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.

5. Daily entries will be made chronologically.

6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.

7. Each page of the log book will have the date of the work and the note takers initials.

8. The final page of each day's notes will include the note-takers signature as well as the date.

9. Only information relevant to the subject project will be added to the log book.

10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.

2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.

3. Scope: Describe the general scope of work to be performed each day.

4. Weather: Record the weather conditions and any significant changes in the weather during the day.

5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.

7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.

8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.

9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.

10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.

11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.

12. Heath and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.

13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.

14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.

15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.

16. Any conditions that might adversely affect the work or any data

obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:

- Description of the general sampling area – site name, buildings and streets in the area, etc.
- Station/Location identifier
- Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field log book indicating sample location relative to these fixed points – include distances in feet.
- Sample matrix and type
- Sample date and time
- Sample identifier
- Draw a box around the sample ID so that it stands out in the field notes
- Information on how the sample was collected – distinguish between "grab," "composite," and "discrete" samples
- Number and type of sample containers collected
- Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
- Parameters to be analyzed for, if appropriate
- Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

1. Use the left side border to record times and the remainder of the page to record information (see attached example).

2. Use tables to record sampling information and field data from multiple samples.

3. Sketch sampling locations and other pertinent information.

4. Sketch well construction diagrams.

V. Attachments

Example field notes.

STANDARD OPERATING PROCEDURE

Low-Flow Groundwater Sampling from Monitoring Wells

I. Purpose and Scope

This procedure presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- Meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature (e.g., Horiba® U-22 or similar)
- Water-level indicator
- In-line disposable 0.45µm filters (QED® FF8100 or equivalent)
- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Generator
- Disposable polyethylene tubing
- Plastic sheeting
- Well-construction information
- Calibrated bucket or other container and watch with second indicator to determine flow rate
- Sample containers
- Shipping supplies (labels, coolers, and ice)
- Field book

III. Procedures and Guidelines

A. Setup and Purging

1. For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.

2. Instruments are calibrated according to manufacturer's instructions.

3. The well number, site, date, and condition are recorded in the field logbook.

4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.

5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with SOP *Decontamination of Personnel and Equipment*.

6. Water level measurements are collected in accordance with SOP *Water Level Measurements*. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well installation log.

7. Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake at least 2 feet above the bottom of the well to avoid mobilization of any sediment present in the bottom. Preferably, the pump should be in the middle of the screen.

8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.

9. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5-liter to 1 liter per minute. The initial field parameters of pH, specific conductance, dissolved oxygen, ORP, turbidity, and temperature of water are measured and recorded in the field logbook.

10. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.5-foot). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1- to 0.2-liter per minute) to avoid affecting well drawdown.

11. During purging, the field parameters are measured frequently (every 3 to 5 minutes) until the parameters have stabilized. Field parameters are considered stabilized when measurements meet the following criteria:

    - pH: within 0.1 pH units

- Specific conductance: within 3 percent
- Dissolved oxygen: within 10 percent
- Turbidity: within 10 percent or as low as practicable given sampling conditions
- ORP: within 10 mV

B. Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the logbook:

1. Sample identification (site name, location, and project number; sample name/number and location; sample type and matrix; whether the sample is filtered or not; time and date; sampler's identity)
2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservatives added; laboratory sent to, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
3. Samples may be field filtered before transfer to the sample bottle. Filtration must occur in the field immediately upon collection. Inorganics, including metals, are to be collected and preserved in the filtered form as well as the unfiltered form. The recommended method is through the use of a disposable in-line filtration module (0.45-micron

filter) using the pressure provided by the pumping device for its operation.

4. Samples for analysis for volatile organic compounds should be collected first, if such samples are required.

5. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.

6. The bottle is capped, then labeled clearly and carefully following the procedures in SOP *Packaging and Shipping Procedures*.

7. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.

C. Additional remarks

1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.

2. It may not be possible to prevent drawdown in the well if the water-bearing unit has sufficiently low permeability. If the water level was in the screen to start with, do not worry about it because there is no stagnant water in the riser above the screen to begin with.

   If the water level in the well is in the riser above the screen at the beginning of purging, then be sure you pump out sufficient volume from the well to remove the volume of water in the riser above the screen. For a 2-inch diameter well, each foot of riser contains 0.163 gallons; for a 4-inch riser, each foot of riser contains 0.653 gallons; for a 6-inch riser, each foot of riser contains 1.47 gallons.

   Alternatively, the water in the riser above the screen can be removed by lowering the pump into the well until the pump intake is just below the water level, starting the pump, running it at a low rate, and slowly lowering the pump as the water level in the riser declines. This approach can be terminated when the water level reaches the top of the screen, at which time the stagnant water in the riser has been removed. This may not be a practical approach for dedicated sampling equipment. As with typical low-flow sampling, the flow rate should be kept as low as practicable.

3. There may be circumstances where a positive-displacement or submersible pump cannot be used. An example is at isolated, hard-to-reach locations where the required power supply cannot be brought. In this case, a peristaltic pump may be used. Samples can be collected by the procedures described above for all but those for VOC analysis. The water to be placed in the vials for VOC analysis should not be run

through the peristaltic pump but instead should be collected by the following:

- Stop the pump when it is time to collect the VOC sample.
- Disconnect the tubing upstream from the pump (a connector must be installed in the line to do this).
- Pinching the tubing to keep the water in the tubing, remove the tubing from the well. Be sure that the tubing does not contact other than clean surfaces.
- Place the end of the tubing that was in the well into each VOC vial and fill the vial by removing the finger from the other end of the tube.
- Once the vials are filled, return the tubing to the well and collect any other samples required.

4. Nondedicated sampling equipment is removed from the well, cleaned, and decontaminated in accordance with SOP *Decontamination of Personnel and Equipment*. Disposable polyethylene tubing is disposed of with PPE and other site trash.

IV. Attachments

White paper on reasons and rationale for low-flow sampling.

V. Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5-foot to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- The highest purging rate should not exceed 1 liter per minute. This is to keep the drawdown minimized.
- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
    - Inspect sampling pump regularly and replace as warranted

- Inspect quick-connects regularly and replace as warranted
- Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

Attachment to the SOP on Low-Flow Sampling Groundwater Sampling from Monitoring Wells

White Paper on Low-Flow Sampling

EPA recommends low-flow sampling as a means of collecting groundwater samples in a way that minimizes the disturbance to the natural groundwater flow system and minimizes the introduction of contamination into the samples from extraneous sources. The following are details about these issues.

When a pump removes groundwater from the well at the same rate that groundwater enters the well through the screen, the natural groundwater-flow system around the well experiences a minimum of disturbance. Some disturbance is bound to occur because you are causing groundwater to flow to the well in a radial fashion that otherwise would have flowed past it. However, the resulting low-flow sample provides the most-representative indication we can get of groundwater quality in the immediate vicinity of the well.

Normally, when a well is pumped at an excessive rate that drops the water level in the well below the water level in the aquifer, the water cascades down the inside of the well screen when it enters the well. The turbulence from this cascading causes gases such as oxygen and carbon dioxide to mix with the water in concentrations that are not representative of the native groundwater and are higher than expected. This causes geochemical changes in the nature of the water that can change the concentrations of some analytes, particularly metals, in the groundwater sample, not mention it's effect on the dissolved oxygen levels that then will be measured in the flow-through cell. Such turbulence also may cause lower-than-expected concentrations of volatile organic compounds due to volatilization.

For wells in which the water level is above the top of the screen, the water up in the riser is out of the natural circulation of the groundwater and, therefore, can become stagnant. This stagnant water is no longer representative of natural groundwater quality because its pH, dissolved-oxygen content, and other geochemical characteristics change as it contacts the air in the riser. If we minimize the drawdown in the well when we pump, then we minimize the amount of this stagnant water that is brought down into the well screen and potentially into the pump. As a result, a more-representative sample is obtained.

Typically, wells contain some sediment in the bottom of the well, either as a residue from development that has settled out of the water column or that has sifted through the sand pack and screen since the well was installed. This sediment commonly has adsorbed on it such analytes as metals, SVOCs, and dioxins that normally would not be dissolved in the groundwater. If these sediments are picked up in the groundwater when the well is disturbed by excessive pumping, they can:

- Make filtering the samples for metals analysis more difficult
- Add unreasonably to the measured concentration of SVOCs and other organic compounds

The SOP for low-flow sampling has been modified recently and should be consulted for additional information about low-flow sampling and ways of dealing with wells in which the water level cannot be maintained at a constant level.

STANDARD OPERATING PROCEDURE

Preserving Non-VOC Aqueous Samples

I. Purpose

To provide general guidelines for preserving aqueous samples.

II. Scope

Standard aqueous sample preservation procedures for non-VOC samples are provided.

III. Equipment and Materials

- Disposable eye droppers
- Clean beakers for transfer of small portions of chemical preservative
- pH paper strips (range 0 to 14)
- Chemical preservatives, as appropriate
- Personal protection, as appropriate
- Clean out door or vented indoor area

IV. Procedures and Guidelines

1. Remove caps from sample containers to be chemically preserved in designated area. Add appropriate amount of chemical preservative to opened container. To determine the approximate amount of preservative required, preserve a sample of potable water and calculate the volume of preservative required.

2. After adding the appropriate preservatives to the sample containers, cap containers tightly. Invert sample container a few times to mix.

3. After preserving all the sample containers and mixing, open the container and check the pH of the sample by pouring out a small quantity of the sample to a clean receptacle and dipping a pH indicating strip into the sample. Add more preservative to the sample to adjust the pH, if necessary repeating steps 1 and 2. When three times the amount of preservative used to preserve a sample of potable water has been added, record the pH and notify the sample manager that the sample could not be preserved.

V. Attachments

None.

VI. Key Check Items

Be sure appropriate preservatives are used.

STANDARD OPERATING PROCEDURE

Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples during field operations.

II. Scope

The sediment sampling procedures generally describe the equipment and techniques needed to collect representative sediment samples. Operators manual , if available, should be consulted for specific details

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula for media transfer
- Measuring tape
- Log book
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Materials for classifying soils, particularly the percentage of fines
- Sample jars, including jars for Total Organic Carbon and pH, as appropriate

IV. Procedures and Guidelines

1. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas. In surface water bodies that are tidally influenced, sampling will be performed at low tide and under low flow conditions to minimize the dilution of possible contaminants. Sediment sampling activities will not occur immediately after periods of heavy rainfall.
2. Make a sketch of the sample area that shows important nearby river features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Also include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (along shore, mid-channel, etc).

3. Transfer sample into appropriate sample jars with a stainless steel utensil. Be especially careful to avoid the loss of the very fine clay/silt particles when collecting the sample. The fine particles have a higher adsorption capacity than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.

4. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.

5. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.

6. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.

7. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.

8. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

STANDARD OPERATING PROCEDURE

Soil Sampling

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for obtaining samples of surface and subsurface soils using hand and drilling-rig mounted equipment.

II. Equipment and Materials

- Stainless-steel trowel, shovel, scoop, coring device, hand auger, or other appropriate hand tool
- Stainless-steel, split-spoon samplers
- Thin-walled sampling tubes
- Drilling rig or soil-coring rig
- Stainless-steel pan or bowl
- Sample bottles

III. Procedures and Guidelines

Before sampling begins, equipment will be decontaminated using the procedures described in SOP *Decontamination of Drilling Rigs and Equipment*. The sampling point is located and recorded in the field logbook. Debris should be cleared from the sampling location.

A. Surface and Shallow Subsurface Sampling

A shovel, post-hole digger, or other tool can be used to remove soil to a point just above the interval to be sampled. A decontaminated sampling tool will be used to collect the sample when the desired sampling depth has been reached. Soil for semivolatile organic and inorganic analyses is placed in the bowl and mixed; soil for volatile organic analysis is not mixed or composited but is placed directly into the appropriate sample bottles. A stainless-steel or dedicated wooden tongue depressor is used to transfer the sample from the bowl to the container.

The soils removed from the borehole should be visually described in the field log book, including approximated depths.

When sampling is completed, photo-ionization device (PID) readings should be taken directly above the hole, and the hole is then backfilled.

More details are provided in the SOP *Shallow Soil Sampling.*

B. Split-Spoon Sampling

Using a drilling rig, a hole is advanced to the desired depth. For split-spoon sampling, the samples are then collected following the ASTM D 1586 standard (attached). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight ("hammer") dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. To collect the sample, the surface of the sample should be removed with a clean tool and disposed of. Samples collected for volatiles analysis should be placed directly into the sample containers from the desired depth in the split spoon. Material for samples for all other parameters should be removed to a decontaminated stainless steel tray. The sample for semivolatile organic and inorganic analyses should be homogenized in the field by breaking the sample into small pieces and removing gravel. The homogenized sample should be placed in the sample containers. If sample volume requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from below the sample and compositing the sample for non-volatile parameters only.

Split-spoon samples also will be collected using a tripod rig. When using a tripod rig the soil samples are collected using an assembly similar to that used by the drilling rig.

C. Thin-Walled Tube Sampling

Undisturbed samples may be collected for analysis for geotechnical parameters such as vertical hydraulic conductivity. These samples will be collected using thin-walled sampling tubes (sometimes called Shelby tubes) according to ASTM D 1587 (attached). Tubes will be 24- to 36 inches long and 3- to 4-inches in diameter, depending upon the quantity of sample required. Undisturbed samples will be obtained by smoothly pressing the sampling tube through the interval to be sampled using the weight of the drilling rig. Jerking the sample should be avoided. Once the sample is brought to the surface, the ends will be sealed with bees wax and then sealed with end caps and heavy tape. The sample designation, data and time of sampling, and the up direction will be noted on the sampling tube. The tube shall be kept upright as much as possible and will be protected from freezing, which could disrupt the undisturbed nature of the sample. Samples for analysis normally are not collected from thin-walled tube samples.

IV. Attachments

ASTM D 1586 *Standard Penetration Test Method for Penetration Test and Split-Barrel Sampling of Soils*

ASTM D 1587 *Standard Practice for Thin-Walled Tube Sampling of Soils*

V. Key Checks and Preventative Maintenance

- Check that decontamination of equipment is thorough.
- Check that sample collection is swift to avoid loss of volatile organics during sampling.

STANDARD OPERATING PROCEDURE

Surface Water Sampling

I. Purpose and Scope

This procedure presents the techniques used in collecting surface water samples. Materials, equipment, and procedures may vary; refer to the Field Sampling Plan and operators manuals for specific details.

II. Materials and Equipment

Materials and equipment vary depending on type of sampling; the Field Sampling Plan should be consulted for project-specific details. Typical equipment required includes:

- Open tube sampler
- Dip sampler
- Weighted bottle sampler
- Hand pump
- Kemmerer or Van Dorn sampler
- Depth-integrating sampler
- Sample containers
- Meters for specific conductance, temperature, pH, and dissolved oxygen

III. Procedures and Guidelines

Before surface water samples are taken, all sampler assemblies and sample containers are cleaned and decontaminated as described in SOP *Decontamination of Personnel and Equipment*. Surface water samples collected from water bodies tidally influenced should be collected at low tide and under low flow conditions to minimize the dilution of potential contaminants. Methods for surface water sample collection are described below.

A. Manual Sampling

Surface water samples are collected manually by submerging a clean glass, stainless steel, or Teflon container into the water body. Samples may be collected at depth with a covered bottle that can be removed with a tripline. The most common sampler types are beakers, sealable bottles and jars, pond samplers, and weighted bottle samplers. Pond samplers have a fixed or telescoping pole attached to the sample container. Weighted bottle samplers are lowered below water surface, where the attached bottle is opened, allowed to fill, and pulled out of the water. When retrieved, the bottle is tightly capped and removed from the sampler assembly.

Specific types of weighted bottle samplers include dissolved oxygen, Kemmerer, or Van Dorn, and are acceptable in most instances.

A sample is taken with the following specific steps:

1. The location and desired depth for water sampling are selected.
2. The sample site is approached from downstream in a manner that avoids disturbance of bottom sediments as much as possible. The sample bottle is gently submerged with the mouth pointed upstream and the bottle tilted slightly downstream. Bubbles and floating materials should be prevented from entering the bottle.
3. For weighted bottle samplers, the assembly is slowly lowered to the desired depth. The bottle stopper is unseated with a sharp tug and the bottle is allowed to fill until bubbles stop rising to the surface.
4. When the bottle is full, it is gently removed from the water. If sample transfer is required, it should be performed at this time.
5. Measure dissolved oxygen, specific conductance, temperature, and pH at the sampling location.

IV. Attachments

None.

V. Key Checks and Items

- Start downstream, work upstream
- Log exact locations using permanent features
- Beware of hidden hazards

STANDARD OPERATING PROCEDURE

Trenching for Landfill Delineation

I. Purpose

To provide reference material and general guidance on test pitting using a backhoe during landfill boundary confirmation activities.

II. Equipment and Materials

- Backhoe
- Shovels, picks, scoops
- Camera, dry-erase board (or other erasable material)
- Plastic sheeting and stakes and/or sand bags to cover test pits and excavated soil
- Barricades to secure area around excavation
- Onsite decontamination pad
- Level D personnel protection equipment and onsite site safety officer

IV. Procedures and Guidelines

General Considerations

Test pits will be excavated along the landfill boundary as indicated by the results of soil borings and/or geophysical surveys.

The onsite crew will photograph any significant features exposed by the test pit. Photographs will include a dry erase board (or other marker) marked with (at a minimum) test pit number, date and time of photograph, description of feature, and size scale (i.e., tape measurer). Other observations (including soil descriptions) will be recorded in the logbook.

Once test pitting is complete, the pits will be backfilled with the stockpiled soil and re-graded to mimic the original ground surface contour.

Trenching Activities

1. Establish work zone according to the site safety plan.
2. Calibrate all air quality monitoring instruments.
3. Using a clean backhoe (decontaminated following SOP *Decontamination of Personnel and Equipment*), begin excavating perpendicular to and just outside of the area defined as the landfill boundary during the geophysical survey. Carefully excavate towards the

boundary, recording all observations in the logbook, until buried material is encountered. Remove only enough soil to identify the landfill boundary.

4. Monitor the air quality in the breathing zone at 5-minute intervals during trenching activities to ensure the proper level of respiratory protection in being worn by all field team members.

5. Photograph and document the trenching activities as appropriate. Backfill and re-grade the test pit, discard plastic sheeting, decontaminate the backhoe, and set up at the next trenching location.

V. Attachments

None.

VI. Key Checks and Items

Ensure that staff are not allowed to enter the trench when it exceeds depth limitations specified by OSHA.

Standard Operating Procedure

Locating and Clearing Underground Utilities

I. Purpose

The purpose of this SOP is to provide general guidelines and specific procedures that must be followed on Navy CLEAN projects for locating underground utilities and clearing dig locations in order to maximize our ability to avoid hitting underground utilities and to minimize liabilities to CH2M HILL and its subcontractors and health and safety risks to our project staff.

This SOP shall be used by Activity Managers and Project Managers to, in-turn, develop Activity-specific and project-specific utility location procedures. The activity and project-specific procedures will become part of work plans and project instructions and will be used to prepare scopes of work (SOWs) for the procurement of utility location subcontractors to meet the needs of individual projects.

This SOP also identifies the types of utility locating services that are available from subcontractors and the various tools that are used to locate utilities, and discusses when each type of service and tool may or may not be applicable.

II. Scope

Depending on the Navy/Marine Activity we typically find ourselves in one of two scenarios:

Scenario 1

The Activity provides utility locating (or dig clearance) services through the public works department or similar organization, or has a contract with an outside utility clearance service. Some of these services are provided in the form of dig permits which are required before you can dig or drill. In other cases no official permit is required and the process is somewhat vague.

Scenario 2

The Activity does not get involved in any utility locating processes aside from possibly providing the most recent utility maps, and relies on CH2M HILL to clear the dig locations.

Table 1 provides an up to date summary of which scenarios apply to the various primary Activities served under the Navy CLEAN program.

Scenario 1 is preferred because under this scenario the Navy tends to assume the responsibility if the location is improperly cleared, a utility is struck, and property damage results. However, our experience has been that the clearance services provided

by the Navy do not meet the standards that we consider to be adequate, in that they often simply rely on available base maps to mark utilities and do not verify locations using field geophysics. And if they do use locating tools, they do not provide adequate documentation or marking to confirm that a location has been cleared. So while the Navy's process may protect us from liability for property damage, it does not adequately protect our staff and subcontractors from health risks nor does it compensate us for down time, should a utility be hit.

Therefore, regardless of what services the Navy provides, in most cases we still need to supplement this effort with clearance services from our own third party utility location subcontractor following the procedures and guideline outlined in Section IV of this SOP. The cost implications of providing this service will range from $500 to several $1,000 depending on the size of the project.

The scope of services that we ask our subcontractors to provide can involve utility marking/mapping or the clearing of individual dig locations. In the former we ask our subs to mark all utilities within a "site" and often ask them to prepare a map based on their work. In the later, we ask them to clear (identify if there are any utilities within) a certain radius of a proposed dig/drill location.

The appropriate requested scope of services for a project will depend on the project. Clearing individual boreholes is often less expensive and allows the sub to concentrate their efforts on a limited area. However if the scope of the investigation is fluid (all borehole locations are not predetermined) it may be best to mark and map an entire site or keep the subcontractor on call.

Clearance of individual dig locations should be done to a minimum 20 foot radius around the location.

An example SOW for a utility subcontractor procurement is provided in Attachment A.

III. Services and Equipment

This section provides a general description of the services available to help us locate subsurface utilities and describes the types of equipment that these services may (or may not) use to perform their work. It identifies the capabilities of each type of equipment to help the PM specify what they should require from our utility location subs.

Services

The services that are available to us for identifying and marking underground utilities are:

- The local public/private utility-run service such as Miss Utility
- Utility location subcontractors (hired by us)

Attachment B provides a detailed description of each type of organization. It also provides contact numbers and web sites for the various Miss-Utility-type organizations in the areas where we do work for the Navy and contacts and services provided by several subcontractors that we have used or spoken to in the past.

Equipment

Attachment C provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the PM determine if the equipment being used by a subcontractor is adequate.

It is important to make the potential subcontractors aware of the possible types of utilities (and utility materials) that are at the site, and to have them explain in their bid what types of equipment they will use to locate utilities /clear dig locations, and what the limitations of these equipment are.

A list of in-house experts that can be used to help you evaluate bids or answer questions you may have is provided in Appendix C.

IV. Procedures and Guidelines

This section presents specific procedures to be followed for the utility location work to be conducted by CH2M HILL and our subcontractors. In addition, a PM will have to follow the procedures required by the Activity to obtain their approvals, clearances and dig permits where necessary. These "dig permit" requirements vary by Activity and must be added to the project-specific SOP, or project instructions. It is preferable that the Activity perform their clearance processes before we follow up with our clearance work.

Activity Notification and Dig Permit Procedures

Identify Activity-specific permit and/or procedural requirements for excavation and drilling activities. Contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Activity Specific: To be provided by Activity or Project Manager

CH2M HILL Utility Clearance Procedures

Do not begin subsurface construction activities (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted by CH2M HILL as a follow-up to the services provided by the Navy. The use of as-built drawings and utility company searches must be supplemented with a geophysical or other survey by a qualified, independent survey contractor (subcontracted to CH2M HILL) to identify additional and undiscovered buried utilities.

Examples of the type of geophysical technologies include (these are further described in Attachment C):

- **Ground Penetrating Radar (GPR),** which can detect pipes, including gas pipes, tanks, conduits, cables etc, both metallic and non-metallic at depths up to 30 feet depending on equipment. Sensitivity for both minimum object size and maximum depth detectable depends on equipment selected, soil conditions, etc.
- **Radio Frequency (RF),** involves inducing an RF signal in the pipe or cable and using a receiver to trace it. Some electric and telephone lines emit RF naturally and can be

detected without an induced signal. This method requires knowing where the conductive utility can be accessed to induce RF field if necessary.

- **Dual RF**, a modified version of RF detection using multiple frequencies to enhance sensitivity but with similar limitations to RF
- **Ferromagnetic Detectors**, are metal detectors that will detect ferrous and non-ferrous utilities. Sensitivity is limited, e.g. a 100 mm iron disk to a depth of about one meter or a 25 mm steel paper clip to a depth of about 20 cm.
- **Electronic markers,** are emerging technologies that impart a unique electronic signature to materials such as polyethylene pipe to facilitate location and tracing after installation. Promising for future installations but not of help for most existing utilities already in place.

The following procedures shall be used to identify and mark underground utilities during subsurface construction activities on the project:

- Contact utility companies or the state/regional utility protection service (such as Miss Utility) at least two (2) working days prior to intrusive activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation: this is a law. These services will only mark the location of public-utility-owned lines and not Navy-owned utilities. In many cases there will not be any public-utility-owned lines on the Activity. There may also be Base-access issues to overcome.
- Procure and schedule the independent survey.
- The survey contractor shall determine the most appropriate geophysical technique or combinations of techniques to identify the buried utilities on the project site, based on the survey contractor's experience and expertise, types of utilities anticipated to be present and specific site conditions. ***The types of utilities must be provided to the bidding subcontractors in the SOW and procedures to be used must be specified by the bidder in their bid. It is extremely helpful to provide the sub with utility maps, with the caveat that all utilities are not necessarily depicted.***
- The survey subcontractor shall employ the same geophysical techniques used to identify the buried utilities, to survey the proposed path of subsurface investigation/construction work to confirm no buried utilities are present.
- Obtain utility clearances for subsurface work on both public and private property.
- Clearances provided by both the "Miss Utility" service and the CH2M HILL-subcontracted service are to be in writing, signed by the party conducting the clearance. The Miss Utility service will have standard notification forms/letters which typically simply state that they have been to the site and have done their work. The CH2M HILL subcontractor shall be required to fill out the form provided in Attachment D (this can be modified for a particular project) indicating that each dig/drill location has been addressed. ***This documentation requirement (with a copy of the form) needs to be provided in the subcontractor SOW.***

- Marking shall be done using the color coding presented in Attachment E. The type of material used for marking must be approved by the Activity prior to marking. Some base commanders have particular issues with persistent spray paint on their sidewalks and streets. ***Any particular marking requirements need to be provided in the subcontractor SOW.***
- Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
- Perform a field check prior to drilling/digging (preferably while the utility location sub is still at the site) to see if field utility markings coincide with locations on utility maps. Look for fire hydrants, valves, manholes, light poles, lighted signs, etc to see if they coincide with utilities identified by the subcontractor.
- Underground utility locations must be physically verified (or dig locations must be physically cleared) by hand digging using wood or fiberglass-handled tools, air knifing, or by some other acceptable means approved by CH2M HILL, when the dig location (e.g. mechanical drilling, excavating) is expected to be within 5 feet of a marked underground system. Hand clearance shall be done to a depth of four feet unless a utility cross-section is available that indicates the utility is at a greater depth. In that event, the hand clearance shall proceed until the documented depth of the utility is reached.
- Conduct a site briefing for employees at the start of the intrusive work regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon during drilling or change in color, texture or density during excavation that could indicate the ground has been previously disturbed).

IV. Attachments

A- Example SOW for Utility Location Subcontractor Procurement
B - Services Available for Identifying and Marking Underground Utilities
C – Equipment Used for Identifying Underground Utilities
D – Utility Clearance Documentation Form
E – Utility Marking Color Codes

Attachment A – Example SOW for Subcontracting Underground Utilities Locating Services

CTO-XXX

Scope of Work

Subsurface Utility Locating

Site XX

Navy Activity

City, State

A licensed and insured utility locator will be subcontracted to identify and mark out subsurface utilities for an environmental investigation/remediation project at Site XX of <<insert name of base, city, and state>>. The subcontractor will need to be available beginning at <<insert time>> on <<insert date>>. It is estimated that the work can be completed within XX days.

Proposed Scope of Work

The subcontractor will identify and mark all subsurface utilities (CHOOSE 1) that lie within a radius of 20 feet of each of XX sampling locations at Site XX shown on the attached Figure 1; (OR) that lie within the bounds of Site XX as delineated on the attached Figure 1. (If multiple sites are to be cleared, provide maps of each site with sample locations or clearance boundaries clearly delineated and a scale provided.)

Utilities will be identified using all reasonably available as-built drawings, electronic locating devices, and any other means necessary to maintain the safety of drilling and sampling personnel and the protection of the base infrastructure. The location of utilities identified from as-built drawings or other maps must be verified in the field prior to marking.

Base utility drawings for the Site(s) (CHOOSE 1) can be found at <<insert specific department and address or phone number on the base>> and should be reviewed by the subcontractor and referenced as part of the utility locating. (OR), will be provided to the subcontractor by CH2M HILL upon the award of the subcontract. (OR), are not available. Utility drawings shall not be considered definitive and must be field verified.

Field verification will include detection using nonintrusive subsurface detection equipment (magnetometers, GPR, etc) as well as opening manhole covers to verify pipe directions. As part of the bid, the Subcontractor shall provide a list of the various subsurface investigation tools they propose to have available and use at the site and what the limitations are of each tool.

A CH2M HILL representative shall be present to coordinate utility clearance activities and identify points and features to be cleared.

Field Marking and Documentation

All utilities located within **(CHOOSE 1)** ***a 20-ft radius of the XX proposed soil boring locations*** **(OR)** ***within the boundary of the site(s)*** as identified on the attached figure(s) will be marked using **paint** ***(some Bases such as the WNY may have restrictions on the use of permanent paint)*** and/or pin flags color coded to indicate electricity, gas, water, steam, telephone, TV cable, fiber optic, sewer, etc. The color coding shall match the industry standard as described on the attached form. In addition, the ***Buried Utility Location Tracking Form*** (attached) will be completed by the Subcontractor based upon what is identified in the field during the utility locating and submitted back to CH2M HILL (field staff or project manager) within 24 hours of completing the utility locating activities.

(OPTIONAL) ***The subcontractor shall also provide a map (or hand sketch) of the identified utilities to the Engineer within XX days of field demobilization. The map shall include coordinates or ties from fixed surface features to each identified subsurface utility.***

Bid Sheet/Payment Units

The subcontractor will bid on a time and materials basis for time spent on site and researching utility maps. Mobilization (including daily travel to the site) should be bid as a lump sum, as well as the preparation of the AHA and any required mapping. The per diem line item should be used if the field crew will require overnight accommodations at the project site.

Health and Safety Requirements

The utility locating subcontractor is to provide and assume responsibility for an adequate corporate Health and Safety Plan for onsite personnel. Standard personal safety equipment including: hard hat, safety glasses, steel-toed boots, gloves are recommended for all project activities. Specific health and safety requirements will be established by the Subcontractor for each project. The health and safety requirements will be subject to the review of CH2M HILL.

The subcontractor shall also prepare and provide to the Engineer, at least 48 hours prior to mobilization, an acceptable Activity Hazard Analysis (AHA) using the attached AHA form or similar.

It is also required that all subcontractor personnel who will be on site attend the daily 15-minute health and safety tailgate meeting at the start of each day in the field.

Subcontractor personnel showing indications of being under the influence of alcohol or illegal drugs will be sent off the job site and their employers will be notified. Subcontractor personnel under the influence of prescription or over-the-counter medication that may impair their ability to operate equipment will not be permitted to do so. It is expected that the subcontractor will assign them other work and provide a capable replacement (if necessary) to operate the equipment to continue work.

Security

The work will be performed on US Navy property. CH2M HILL will identify the Subcontractor personnel who will perform the work to the appropriate Navy facility point-of-contact, and will identify the Navy point-of-contact to the Subcontractor crew. The Subcontractor bears final responsibility for coordinating access of his personnel onto Navy property to perform required work. This responsibility includes arranging logistics and providing to CH2M HILL, in advance or at time of entry as specified, any required identification information for the Subcontractor personnel. Specifically, the following information should be submitted with the bid package for all personnel that will perform the work in question (this information is required to obtain a base pass):

- Name
- Birth Place
- Birth Date
- Social Security Number
- Drivers License State and Number
- Citizenship

Please be advised that no weapons, alcohol, or drugs will be permitted on the Navy facility at any time. If any such items are found, they will be confiscated, and the Subcontractor will be dismissed.

Quality Assurance

The Subcontractor will be licensed and insured to operate in the State of <<state>> and will comply with all applicable federal, state, county and local laws and regulations. The subcontractor will maintain, calibrate, and operate all electronic locating instruments in accordance with the manufacturer's recommendations. Additionally, the Subcontractor shall make all reasonable efforts to review as-built engineering drawings maintained by Base personnel, and shall notify the CH2M HILL Project Manager in writing (email is acceptable) whenever such documentation was not available or could not be reviewed.

Subcontractor Standby Time

At certain periods during the utility locating activities, the Subcontractor's personnel may be asked to stop work and standby when work may normally occur. During such times, the Subcontractor will cease activities until directed by the CH2M HILL representative to resume operations. Subcontractor standby time also will include potential delays caused by the CH2M HILL representative not arriving at the site by the agreed-upon meeting time for start of the work day. Standby will be paid to the

Subcontractor at the hourly rate specified in the Subcontractor's Bid Form attached to these specifications.

Cumulative Subcontractor standby will be accrued in increments no shorter than 15 minutes (i.e., an individual standby episode of less than 15 minutes is not chargeable).

During periods for which standby time is paid, the surveying equipment will not be demobilized and the team will remain at the site. At the conclusion of each day, the daily logs for the Subcontractor and CH2M HILL representative will indicate the amount of standby time incurred by the Subcontractor, if any. Payment will be made only for standby time recorded on CH2M HILL's daily logs.

Down Time

Should equipment furnished by the Subcontractor malfunction, preventing the effective and efficient prosecution of the work, or inclement weather conditions prevent safe and effective work from occurring, down time will be indicated in the Subcontractor's and CH2M Hill representative's daily logs. No payment will be made for down time.

Schedule

It is anticipated that the subsurface utility locating activities will occur on <<insert date>>. It is estimated that the above scope will be completed within XXX days.

Attachment B - Services Available for Identifying and Marking Underground Utilities

The services that are available to us for identifying and marking underground utilities are:

- The Activity's PWC (or similar organization)
- The local public/private utility -run service such as Miss Utility
- Utility location subcontractors (hired by CH2M HILL)

Each are discussed below.

Navy Public Works Department

A Public Works Department (PWD) is usually present at each Activity. The PWD is responsible for maintaining the public works at the base including management of utilities. In many cases, the PWD has a written permit process in place to identify and mark-out the locations of Navy-owned utilities [Note: The PWD is usually NOT responsible for the locations/mark-outs of non-Navy owned, public utilities (e.g., Washington Gas, Virginia Power, municipal water and sewer, etc.). Therefore, it is likely that we will have to contact other organizations besides the PWD in order to identify non-Navy owned, public utilities].

At some Activities, there may not be a PWD, the PWD may not have a written permit process in place, or the PWD may not take responsibility for utility locating and mark-outs. In these cases, the PWD should still be contacted since it is likely that they will have the best understanding of the utility locations at the Activity (i.e., engineering drawings, institutional knowledge, etc.). Subsequently, the PWD should be brought into a cooperative arrangement (if possible) with the other services employed in utility locating and mark-out in order to have the most comprehensive assessment performed.

At all Activities we should have a contact (name and phone number), and preferably an established relationship, with PWD, either directly or through the NAVFAC Atlantic, Midlant, or Washington NTR or Activity Environmental Office that we can work with and contact in the event of problems.

Miss Utility or "One Call" Services for Public Utility Mark-outs

Miss Utility or "One Call" service centers are information exchange centers for excavators, contractors and property owners planning any kind of excavation or digging. The "One Call" center notifies participating public utilities of the upcoming excavation work so they can locate and mark their underground utilities in advance to prevent possible damage to underground utility lines, injury, property damage and service outages. In some instances, such with southeastern Virginia bases, the Navy has entered into agreement with Ms. Utilities and is part of the response process for Miss

Utilities. Generally, a minimum of 48 hours is required for the public utility mark-outs to be performed. The "One Call" services are free to the public. Note that the "One Call" centers only coordinate with participating public utilities. There may be some public utilities that do NOT participate in the "One Call" center which may need to be contacted separately. For example, in Washington, DC, the Miss Utility "One Call" center does not locate and mark public sewer and water lines. Therefore, the municipal water and sewer authority must be contacted separately to have the sewer and water lines marked out. The AM should contact the appropriate one-call center to determine their scope of services.

A national listing of the "One Call" service centers for each state is presented on the web at http://www.underspace.com/refs/ocdir.htm. For the Mid-Atlantic region, the following "One Call" service centers are available.

Name	Phone	Website	Comments
Miss Utility of DELMARVA	800-257-7777	www.missutility.net	Public utility mark-outs in Delaware, Maryland, Washington, DC, and Northern Virginia
Miss Utility of Southern Virginia (One Call)	800-552-7001	not available	Public utility mark-outs in Southern Virginia
Miss Utility of Virginia	800-257-7777 800-552-7007	www.missutilityofvirginia.com	General information on public utility mark-outs in Virginia, with links to Miss Utility of DELMARVA and Miss Utility of Southern Virginia (One Call)
Miss Utility of West Virginia, Inc	800-245-4848	none	Call to determine what utilities they work with in West Virginia
North Carolina One Call Center	800-632-4949	www.ncocc.org/ncocc/default.htm	Public Utility Markouts in North Carolina

Private Subcontractors

1. Utility-locating support is required at some level for most all CH2M HILL field projects in "clearing" proposed subsurface boring locations on the project site. Utility location and sample clearance can include a comprehensive effort of GIS map interpretation, professional land surveying, field locating, and geophysical surveying. Since we can usually provide our own GIS-related services for projects and our professional land surveying services are normally procured separately, utility-locating subcontractors will normally only be required for some level of geophysical surveying support in the field. This level of geophysical surveying support can range widely from a simple electromagnetic (EM) survey over a known utility line, to a blind geophysical effort, including a ground-penetrating radar (GPR) survey and/or a comprehensive EM survey to delineate and characterize all unknown subsurface anomalies.

   The level of service required from the subcontractor will vary depending on the nature of the site. At sites where utility locations are well defined on the maps and

recent construction is limited, CH2M HILL may be confident with a limited effort from a traditional utility-locating subcontractor providing a simple EM survey. At sites where utility locations are not well defined, where recent constructions may have altered utility locations, or the nature of the site makes utility location difficult, CH2M HILL will require the services of a comprehensive geophysical surveying subcontractor, with a wide range of GPR and EM services available for use on an "as-needed" basis. Typical costs for geophysical surveying subcontractors will range from approximately $200 per day for a simple EM effort (usually one crew member and one instrument) to approximately $1,500 per day for a comprehensive geophysical surveying effort (usually a two-person crew and multiple instruments). Comprehensive geophysical surveying efforts may also include field data interpretation (and subsequent report preparation) and non-destructive excavation to field-verify utility depths and locations.

The following table provides a list of recommended geophysical surveying support subcontractors that can be used for utility-locating services:

Company Name and Address	Contact Name and Phone Number	Equipment[1]					Other Services[2]		
		1	2	3	4	5	A	B	C
US Radar, Inc.* PO Box 319 Matawan, NJ 07747	Ron LaBarca 732-566-2035			4					
Utilities Search, Inc.*	Jim Davis 703-369-5758	4				4	4	4	4
So Deep, Inc.* 8397 Euclid Avenue Manassas Park, VA 20111	703-361-6005	4					4	4	4
Accurate Locating, Inc. 1327 Ashton Rd., Suite 101 Hanover, MD 21076	Ken Shipley 410-850-0280	4	4						
NAEVA Geophysics, Inc. P.O. Box 7325 Charlottesville, VA 22906	Alan Mazurowski 434-978-3187	4	4	4	4	4	4	4	4
Earth Resources Technology. Inc. 8106 Stayton Rd. Jessup, MD 20794	Peter Li 240-554-0161	4	4	4	4	4	4	4	
Geophex, Ltd 605 Mercury Street Raleigh, NC 27603	I. J. Won 919-839-8515	4	4	4	4	4	4	4	4

Notes:

*Companies denoted with an asterisk have demonstrated reluctance to assume responsibility for damage to underground utilities or an inability to accommodate the insurance requirements that CH2M HILL requests for this type of work at many Navy sites.

[1]Equipment types are:

1. Simple electromagnetic instruments, usually hand-held
2. Other, more innovative, electromagnetic instruments, including larger instruments for more area coverage
3. Ground-penetrating radar systems of all kinds
4. Audio-frequency detectors of all kinds
5. Radio-frequency detectors of all kinds

[2]Other services include:

A. Data interpretation and/or report preparation to provide a permanent record of the geophysical survey results and a professional interpretation of the findings, including expected accuracy and precision.

B. Non-destructive excavation to field-verify the depths, locations, and types of subsurface utilities.

C. Concrete/asphalt coring and pavement/surface restoration.

Attachment C – Equipment Used for Identifying Underground Utilities

This attachment provides a summary of the various types of equipment used for subsurface utility location. It describes the capabilities and limitations of each in order to help the AM and PM determine if the equipment being proposed by a subcontractor or Navy is adequate. A list of in-house experts that can be used to answer questions you may have is provided below.

CH2M HILL In-house Utility Location Experts

Tamir Klaff/WDC

Home Office Phone – 703-669-9611

Electromagnetic Induction (EMI) Methods

EMI instruments, in general, induce an electromagnetic field into the ground (the primary field) and then record the response (the secondary field), if any. Lateral changes in subsurface conductivity, such as caused by the presence of buried metal or by significant soil variations, cause changes in the secondary field recorded by the instrument and thus enable detection and mapping of the subsurface features. It should be noted that EMI only works for electrically conductive materials--plastic or PVC pipes are generally not detected with EMI. Water and gas lines are commonly plastic, although most new lines include a copper "locator" strip on the top of the PVC to allow for detection with EMI.

EMI technology encompasses a wide range of instruments, each with inherent strengths and weaknesses for particular applications. One major division of EMI is between "time-domain" and "frequency-domain" instruments that differ in the aspect of the secondary field they detect. Another difference in EMI instruments is the operating frequency they use to transmit the primary field. Audio- and radio-frequencies are often used for utility detection, although other frequencies are also used. Consideration of the type of utility expected, surface features that could interfere with detection, and the "congestion" of utilities in an area, should be made when choosing a particular EMI instrument for a particular site.

One common EMI tool used for utility location is a handheld unit that can be used to quickly scan an area for utilities and allows for marking locations in "real time". This method is most commonly used by "dig-safe" contractors marking out known utilities prior to excavation. It should be noted that this method works best when a signal (the primary field) can be placed directly onto the line (i.e., by clamping or otherwise connecting to the end of the line visible at the surface, or for larger utilities such as sewers, by running a transmitter through the utility). These types of tools also have a limited capability to scan an area for unknown utilities. Usually this requires having enough area to separate a hand held transmitter at least a hundred feet from the

receiver. Whether hunting for unknown, or confirming known, utilities, this method will only detect continuous lengths of metallic conductors.

In addition to the handheld EMI units, larger, more powerful EMI tools are available that provide more comprehensive detection and mapping of subsurface features. Generally, data with these methods are collected on a regular grid in the investigation area, and are then analyzed to locate linear anomalies that can be interpreted as utilities. These methods will usually detect *all* subsurface metal (above a minimum size), including pieces of abandoned utilities. In addition, in some situations, backfill can be detected against native soils giving information on trenching and possible utility location. Drawbacks to these methods are that the secondary signals from utilities are often swamped (i.e., undetectable) close to buildings and other cultural features, and that the subsurface at heavily built-up sites may be too complicated to confidently interpret completely.

Hand-held metal detectors (treasure-finders) are usually based on EMI technology. They can be used to locate shallow buried metal associated with utilities (e.g., junctions, manholes, metallic locators). Advantages of these tools is the ease of use and real-time marking of anomalies. Drawbacks include limited depths of investigations and no data storage capacity.

Ground Penetrating Radar (GPR)

GPR systems transmit radio and microwave frequency (e.g., 80 megaHertz to 1,000 megaHertz) waves into the ground and then record reflections of those waves coming back to the surface. Reflections of the radar waves typically occur at lithologic changes, subsurface discontinuities, and subsurface structures. Plastic and PVC pipes can sometimes be detected in GPR data, especially if they are shallow, large, and full of a contrasting material such as air in a wet soil, or water in a dry soil. GPR data are usually collected in regular patterns over an area and then analyzed for linear anomalies that can be interpreted as utilities. GPR is usually very accurate in x-y location of utilities, and can be calibrated at a site to give very accurate depth information as well. A significant drawback to GPR is that depth of investigation is highly dependant on background soil conductivity, and it will not work on all sites. It is not uncommon to get only 1-2 feet of penetration with the signal in damp, clayey environments. Another drawback to GPR is that sites containing significant fill material (e.g., concrete rubble, scrap metal, garbage) will result in complicated anomalies that are difficult or impossible to interpret.

Magnetic Field Methods

Magnetic field methods rely on detecting changes to the earth's magnetic field caused by ferrous metal objects. This method is usually more sensitive to magnetic metal (i.e., deeper detection) than EMI methods. A drawback to this method is it is more susceptible to being swamped by surface features such as fences and cars. In addition, procedures must usually be implemented that account for natural variations in the earth's background field as it changes throughout the day. One common use of the method is to measure and analyze the gradient of the magnetic field, which eliminates most of the drawbacks to the method. It should be noted this method only detects

ferrous metal, primarily iron and steel for utility location applications. Some utility detector combine magnetic and EMI methods into a single hand-held unit.

Optical Methods

Down the hole cameras may be useful in visually reviewing a pipe for empty conduits and/or vaults.

Attachment D – Utility Clearance Documentation Form

Attachment E – Utility Marking Color Codes

The following is the standard color code used by industry to mark various types of utilities and other features at a construction site.

White – Proposed excavations and borings

Pink – Temporary survey markings

Red – Electrical power lines, cables, conduits and lighting cables

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, alarm or signal lines, cables, or conduits

Blue – Potable water

Purple – Reclaimed water, irrigation and slurry lines

Green – Sewer and storm drain lines

STANDARD OPERATING PROCEDURE

VOC Sampling--Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Site-specific details are discussed in the Field Sampling Plan.

III. Equipment and Materials

- Sample vials pre-preserved at laboratory with Hydrochloric acid (HCl)
- Surgical or latex gloves

IV. Procedures and Guidelines

1. Sample VOCs before sampling other analyte groups.

2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).

3. Keep the caps off the sample vials for as short a time as possible.

4. Wear clean latex or surgical gloves.

5. Fill the sample vial immediately, allowing the water stream to strike the inner wall of the vial to minimize formation of air bubbles. DO NOT RINSE THE SAMPLE VIALS BEFORE FILLING.

6. Fill the sample vial with a minimum of turbulence, until the water forms a positive meniscus at the brim.

7. Replace the cap by gently setting it on the water meniscus. Tighten firmly, but DO NOT OVERTIGHTEN.

8. Invert the vial and tap it lightly. If you see air bubbles in the sample, do not add more sample. Use another vial to collect another sample. Repeat if necessary until you obtain a proper sample.

V. Attachments

None.

VI. Key Checks and Items

- Check for possible sources of contamination.
- Fill slowly, with as little turbulence as possible.
- Check for air bubbles.

STANDARD OPERATING PROCEDURE

Water-Level Measurements

I. Purpose and Scope

The purpose of this procedure is to provide a guideline for the measurement of the depth to groundwater in piezometers and monitoring wells, even where a second phase of floating liquid (e.g., gasoline) is encountered, and on staff gages in surface-water bodies. This SOP includes guidelines for discrete measurements of static water levels and does not cover the use of continuously recording loggers (see SOP *Use of Data Loggers and Pressure Transducers)*.

II. Equipment and Materials

- Electronic water-level meter (Solinst® or equivalent) with a minimum 100-foot tape; the tape should have graduations in increments of 0.01 feet or less
- Interface probe (Solinst® Model 122 Interface Meter or equivalent)

III. Procedures and Guidelines

Verify that the unit is turned on and functioning properly. Slowly lower the probe on its cable into the piezometer or well until the probe just contacts the water surface; the unit will respond with a tone or light signal. Note the depth from a reference point indicated on the piezometer or well riser. Typically this is the top of the protective casing. If no reference is clearly visible, measure the depth to water from the northern edge of the riser. If access to the top of the riser is difficult, sight across the top of the locking casing adjacent to the measuring point, recording the position of the cable when the probe is at the water surface.

Measure the distance from this point to the closest interval marker on the tape, and record the water level reading in the logbook. Water levels will be measured to the nearest 0.01-foot. Also measure and record the three following readings: (1) the depth of the piezometer or well; (2) the distance from the reference point to the top of the protective casing; and (3) the distance to the surface of the concrete pad or to ground. The depth of the piezometer or well may be measured using the water-level probe with the instrument turned off.

Free product light or dense nonaqueous phase liquid may be present in the piezometer or well. If the presence of free product is suspected, the thickness of the product should be determined using appropriate equipment (e.g., Solinst® Model 122 Interface Meter). The depth to water also is determined with this equipment and the water-level meter should not be used in the piezometer or well as long as product is present. Typically, a

constant sound is emitted from the device when free product is encountered and an alternating on/off beep sound is emitted when water is encountered.

The apparent elevation of the water level in the well or piezometer is determined by measuring both the apparent depth to water and the thickness of free product. The corrected water-level elevation is calculated by the following equation:

$$WL_c = Wl_a + (\text{Free-product thickness} \times 0.80)$$

Where WL_c = Corrected water-level elevation

Wl_a = Apparent water-level elevation

0.80 = Typical value for the density of petroleum hydrocarbon products.

If free product is detected on the surface of the water in the piezometer or well, the value of sampling should be reconsidered because of the potential for contaminating the sampling equipment.

Staff gages may be installed in some surface-water bodies. These facilities typically are constructed by attaching a calibrated, marked staff gage to a wood or metal post, driving the post into the bottom of the surface-water body, and surveying the elevation of the top of the post to a resolution or 0.01-foot. The elevation of the water in the surface-water body then can be determined by reading off the distance the water level is from the top of the post. A shield or other protection may be needed to calm the fluctuations in water level if the gage is installed at a location exposed to wind or wave.

IV. Attachments

None.

V. Key Checks

- Before each use, verify that the battery is charged by pressing the test button on the water-level meter.
- Verify that the unit is operating correctly by testing the probe in distilled or de-ionized water. Leave the unit turned off when not in use.

SOPs

- Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using the Horiba® U-22 (HoribaU22.doc)
- Low-Flow Groundwater Sampling from Monitoring Wells (LowFlow.doc)
- Log Books (Log Books.doc) – attachment needed
- Preserving Non-VOC Aqueous Samples (Preserve.doc)
- Soil Sampling (soils.doc)
- Equipment and Field Rinse Blank Preparation (BlankPrep.doc)
- Water Level Measurements (WaterLevels.doc)
- Chain-of-Custody (COC.doc) – attachment needed

Analytical Laboratory SOPs

Laboratory SOPs are proprietary and confidential. They are held by CH2M HILL and the Navy and are available upon request

Valid Values

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office: format is UIC (6 char.) + FY (2 char.) + FAR code (1 char.) + Number (4 char.). (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012)
Phase	A8	RA	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20**	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20*	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15*	R	NIRIS code for the analytical method category (e.g. LEACH)
Lab_Code	A10**	R	CH2M HILL Code assigned to the laboratory (e.g. SHEA)
Lab_Name	A50**	R	The name of the laboratory that conducted the analysis.
Leachate_Method	A16*	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	RA	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16*	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	RA	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	RA	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/07 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab. (e.g. 03/24/07)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock. (e.g. 14:30:05)
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample.
Extraction_Time	HH:MM:SS	RA	Time of day that the lab extracted the sample. Use 24 hour clock.
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.
Dilution	N10,2	R	Dilution factor used. (e.g. 10)
Run_Number	N4	RA	Number distinguishing multiple or repeat analyses by the same method, on the same day. Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A45*	R	The compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A3*	R	Type of analysis performed (allowed: TIC or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria included. (eg. CLPA)
QC_Accuracy_Upper	N6,3	RA	Accuracy Upper Limit. Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Accuracy Lower Limit. Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter EnDat EDD's DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50**	R	Leave Blank. Name of Validator. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

Notes:

* - See Valid Value List or Lookup Table

** - See Naval Master List. Please request from the EIS. If name is new, corresponding NEDD must be submitted by EIS.

R - Required Field

RA - Required as Appropriate

NR - Not Required

EDD to be submitted in Excel

Appendix C
Historical Analytical Data

AOC 1—Historical Data

Table C-1
AOC 1 - 1999 Surface Soil Sampling Results
Cheatham Annex
Williamsburg, Virginia

Station ID	**Residential RSLs-Soil**	A1-HA01	A1-HA02	A1-HA-03	A1-HA04	A1-HA05	A1-HA05	A1-HA06
Sample ID		A1-HA01-00[2]	A1-HA02-00[2]	A1-HA03-00[2]	A1-HA04-00[2]	A1-HA05-00[2]	A1-HA05-00D[1,2]	A1-HA06-00[2]
Sample Date		11/12/99	11/12/99	11/12/99	11/12/99	11/12/99	11/12/99	11/14/99
Chemical Name								
Volatile Organic Compounds (UG/KG)								
1,1-Dichloroethene	250,000.00	20.07 U	15.22 UL	18.18 U	15.64 U	16.87 U	**4 J**	14.15 UL
2-Butanone	28,000,000.00	20.07 U	15.22 UL	18.18 U	15.64 U	4 B	3 B	**5**
Benzene	1,100.00	20.07 U	15.22 UL	18.18 U	15.64 U	16.87 U	**4 J**	14.15 UL
Chlorobenzene	310,000.00	20.07 UL	15.22 UL	18.18 U	15.64 U	16.87 U	**5 J**	14.15 UL
Toluene	5,000,000.00	20.07 UL	15.22 UL	18.18 U	15.64 U	16.87 U	**5 J**	14.15 UL
Trichloroethene	2,800.00	20.07 U	15.22 UL	18.18 U	15.64 U	16.87 U	**4 J**	14.15 UL
Semi-volatile Organic Compounds (UG/KG)								
Benzo(a)Anthracene	150.00	**280**	**65 J**	600 U	490 U	580 U	610 U	450 U
Benzo(a)Pyrene	15.00	**870**	**92 J**	600 U	490 U	580 U	610 U	450 U
Benzo(b)Fluoranthene	150.00	**1700**	**110 J**	600 U	490 U	**66 J**	**87 J**	450 U
Benzo(g,h,i)Perylene	1,500.00	**970**	**78 J**	600 U	490 U	580 U	610 U	450 U
Benzo(k)Fluoanthene	1,500.00	**970**	**96 J**	600 U	490 U	580 U	610 U	450 U
Bis(2-Ethylhexyl)Phthalate	35,000.00	620 UL	450 U	**1800**	**12000 J**	**69 J**	**88 J**	**47 J**
Chrysene	15,000.00	**830**	**92 J**	600 U	490 U	**67 J**	**73 J**	450 U
Dibenz(a,h)Anthracene	15.00	**350**	450 U	600 U	490 U	580 U	610 U	450 U
Di-n-Butyl phthalate	6,100,000.00	620 UL	**72 J**	**130 J**	**100 J**	**78 J**	**170 J**	**110 J**
Fluoranthene	2,300,000.00	**250**	**150 J**	600 U	490 U	**61 J**	610 U	450 U
Indeno(1,2,3-cd)Pyrene	150.00	**810**	**74 J**	600 U	490 U	580 U	610 U	450 U
Phenanthrene	17,000,000.00	**78**	**71 J**	600 U	490 U	580 U	610 U	450 U
Phenol	18,000,000.00	620 UL	450 U	600 U	490 U	580 U	610 U	450 U
Pyrene	1,700,000.00	**360**	**100 J**	600 U	490 U	**65 J**	610 U	450 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
4,4'-DDE	1,400.00	**18**	4.5 U	6 U	**1.5 L**	5.7 UL	6.1 U	4.5 U
4,4'-DDT	1,700.00	**15**	4.5 U	6 U	**120**	5.7 UL	6.1 U	4.5 U
Aroclor-1260	220.00	62 UL	45 U	60 U	**220 L**	57 UL	61 U	45 U
alpha-Chlordane	1,600.00	**4.3**	2.3 U	3.1 U	2.5 UL	2.9 UL	3.1 U	2.3 U
Endosulfan Sulfate	370,000.00	**14**	4.5 U	6 U	4.8 UL	5.7 UL	6.1 U	4.5 U
Explosives (UG/KG)								
No detections								
Total Metals (MG/KG)								
Aluminum	77,000.00	**9030 L**	**5620 L**	**8410 L**	**8400 L**	**3570 L**	**5200 L**	**6020 L**
Antimony	31.00	2.5 B	1.3 B	1.4 B	13.9 U	**5.7 J**	**5.9 J**	0.53 U
Arsenic	0.39	**23.5**	2.3 U	**7.6**	**2.4**	**1.4 J**	**1.8 J**	**1.7 J**
Barium	15,000.00	**151**	**147**	**116**	**70.3**	**91.6**	**94.9**	**38.2 J**
Cadmium	70.00	**0.89 J**	2.3 U	1.4 U	1.2 U	1.5 U	1.3 U	**0.52 J**
Calcium	--	**17900**	**11900**	**35900**	**8770**	**10600**	**11100**	**4480**
Chromium	120,000.00	**44.7**	**12.3**	**13**	**10**	**10.3**	**10.9**	**7.2**
Cobalt	--	**5.3 J**	**4.4 J**	**9.9 J**	**3.1 J**	**4.8 J**	**4.1 J**	1.5 U
Copper	3,100.00	**17.4**	**13.1**	11.3 B	**19.4**	**88.5**	**65**	**3.2 J**
Cyanide	1,600.00	0.9 UL	**0.08 J**	0.9 UL	0.7 UL	**0.2 J**	**0.2 J**	0.03 UL
Iron	55,000.00	**17300 L**	**35200 L**	**11200 L**	**12200 L**	**34900 L**	**29900 L**	**8050**
Lead	400.00	**194**	**86.3**	**46.2**	**35.2**	**493**	**501**	**16.2**
Magnesium	--	**1980**	**913 J**	**1390 J**	**1350**	**724 J**	**861 J**	**380 J**
Manganese	1,800.00	**523**	**291**	**481**	**460**	**375**	**389**	**122**
Mercury	6.70	**0.13 J**	**0.05 J**	**0.08 J**	**0.08 J**	**0.05 J**	**0.05 J**	0.03 UL
Nickel	1,600.00	**8.7 J**	**7.7 J**	**7.2 J**	**5.1 J**	**7 J**	**8.8 J**	3.4 B
Potassium	--	**652 J**	**622 J**	**579 J**	385 B	308 B	383 B	250 B
Vanadium	390.00	**26**	**18.8**	**21.6**	**15.5**	**15.4**	**17.1**	**14.6**
Zinc	23,000.00	**849**	**110**	**132**	59 B	**292**	**250**	**293**

NOTES:

[1]Duplicate of sample A1-HA05-00

[2]Data as reported in the *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Site* by Baker, May 10, 2001.

Detections of a chemical are indicated in bold font.

J = Estimated concentration below the quantitation limit

L = Analyte is present. The reported value may be biased low. The actual value is expected to be higher than reported.

B = Not detected substantially above the level reported in laboratory or field blanks.

UL = Not detected, quantitation limit is probably higher.

U = Not detected.

Table C-2
AOC 1 - 1999 Subsurface Soil Sampling Results
Cheatham Annex
Williamsburg, Virginia

Station ID	**Residential RSLs-Soil**	A1-HA02	A1-HA03	A1-HA04	A1-HA05-01	A1-HA05	A1-HA06
Sample ID		A1-HA02-02[2]	A1-HA03-02[2]	A1-HA04-02[2]	A1-HA05-01[2]	A1-HA05-01D[1,2]	A1-HA06-02[2]
Sample Date		11/12/99	11/12/99	11/12/99	11/14/99	11/14/99	11/14/99
Chemical Name							
Volatile Organic Compounds (UG/KG)							
Xylene (Total)	600,000.00	11.76 U	12.5 U	11.49 U	**2**	**3**	13.26 U
Semi-volatile Organic Compounds (UG/KG)							
Benzo(a)Anthracene	150.00	390 U	410 U	380 U	570 U	**64 J**	400 U
Benzo(a)Pyrene	15.00	390 U	410 U	380 U	570 U	**59 J**	400 U
Benzo(b)Fluoranthene	150.00	390 U	410 U	380 U	**79 J**	**88 J**	400 U
Benzo(g,h,i)Perylene	1,500.00	390 U	410 U	380 U	570 U	**71 J**	400 U
Benzo(k)Fluoanthene	1,500.00	390 U	410 U	380 U	**74 J**	**65 J**	400 U
Bis(2-Ethylhexyl)Phthalate	35,000.00	**76 J**	**54 J**	**46 J**	570 U	540 U	400 U
Butylbenzylphthalate	12,000,000.00	390 U	410 U	380 U	570 U	540 U	400 U
Chrysene	15,000.00	390 U	410 U	380 U	**83 J**	**81 J**	400 U
Di-n-Butylphthalate	6,100,000.00	**49 J**	**52 J**	**79 J**	110 J	**110 J**	**73 J**
Fluoranthene	2,300,000.00	390 U	410 U	380 U	100 J	**140 J**	400 U
Indeno(1,2,3-cd)Pyrene	150.00	390 U	410 U	380 U	570 U	**55 J**	400 U
Phenanthrene	17,000,000.00	390 U	410 U	380 U	570 U	**97 J**	400 U
Pyrene	1,700,000.00	390 U	410 U	380 U	**78 J**	**110 J**	400 U
Pesticide/Polychlorinated Biphenyls (UG/KG)							
No detections							
Explosives (UG/KG)							
No detections							
Total Metals (MG/KG)							
Aluminum	77,000.00	**4700 L**	**6240 L**	**5340 L**	**4410 L**	**4080 L**	**8830 L**
Antimony	31.00	**0.46 B**	0.6 B	10.9 U	**12 J**	**11.4 J**	**0.41 B**
Arsenic	0.39	**1.3 J**	**5.2**	**1.9**	**5.1**	**4.2**	**33.3**
Barium	15,000.00	**12.9 B**	**28.5 J**	**25.9 J**	**81.3**	**90.9**	**41.3**
Beryllium	160.00	**0.21 B**	1.1 B	0.5 B	**0.34 J**	**0.22 J**	**0.95**
Cadmium	70.00	0.9 U	1 U	**0.07 J**	0.08 U	0.08 U	0.06 U
Calcium	--	**1090**	**1960**	**1490**	**10200**	**10400**	**2920**
Chromium	120,000.00	**9.2**	**19.4**	**3.6**	**16.8**	**11.1**	**32.6**
Cobalt	--	**1.5 J**	**5.8 J**	**2.8 J**	**4.6 J**	**4.5 J**	**9.4**
Copper	3,100.00	**1.6 B**	2.1 B	1.5 B	**86**	**146**	3.5 B
Cyanide	1,600.00	**0.6 L**	0.6 U	0.6 U	**0.68 J**	**0.2 J**	**0.08 J**
Iron	55,000.00	**6590 L**	**19800 L**	**2630 L**	**30600**	**35300**	**39700**
Lead	400.00	**4.7**	**6.7**	**7.3**	**483**	**1120**	**7.7**
Magnesium	--	**1430**	**547 J**	81.4 B	**606 J**	**654 J**	**1040**
Manganese	1,800.00	**11**	**48.2**	**126**	**384**	**401**	**151**
Mercury	6.70	0.1 U	0.1 U	**0.02 J**	**0.06 L**	0.04 UL	0.03 UL
Nickel	1,600.00	**1.2 J**	**7.7 J**	**2.9 J**	**23.3 L**	13.6 B	12.3 B
Potassium	--	226 B	**690 J**	117 B	472 B	279 B	**1040**
Selenium	390.00	0.9 U	1 U	0.9 U	0.73 U	0.75 U	0.55 U
Silver	390.00	1.6 B	5.6 B	1.8 U	7.6 B	9.7 B	**11.3**
Vanadium	390.00	**19.5**	**20.2**	**6.9**	**16.7**	**14.4**	**40.8**
Zinc	23,000.00	4.2 B	25.7 B	5.6 B	**330**	**365**	35.3 B

NOTES:
[1]Duplicate of sample A1-HA05-01
[2]Data as reported in the *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Site* by Baker, May 10, 2001.
Detections of a chemical are indicated in bold font.
J = Estimated concentration below the quantitation limit
L = Analyte is present. The reported value may be biased low. The actual value is expected to be higher than reported.
B = Not detected substantially above the level reported in laboratory or field blanks.
UL = Not detected, quantitation limit is probably higher.
U = Not detected.

Table C-3
AOC 1 - 1999 Surface Water Sampling Results
Cheatham Annex
Williamsburg, Virginia

Station ID	**Residential RSLs-Soil**	A1-SW01	A1-SW02	A1-SW03	A1-SW03D
Sample ID		A1-SW01[2]	A1-SW02[2]	A1-SW03[2]	A1-SW03D[1,2]
Sample Date		11/14/99	11/14/99	11/14/99	11/14/99
Chemical Name					
Volatile Organic Compounds (UG/L)					
No detections					
Semivolatiles (UG/L)					
Bis(2-Ethylhexyl)Phthalate	35,000.00	10 U	**98**	**37 J**	**2 J**
Di-n-Octyl Phthalate	180,000.00	**3 J**	10 U	10 U	10 U
Pesticides/PCBs (UG/L)					
No detections					
Explosives (UG/L)					
No detections					
Inorganics (UG/L)					
Arsenic	0.39	3.4 U	3.4 U	**17.1**	**19**
Barium	15,000.00	55.6 B	33.8 B	**89.8 J**	**92 J**
Calcium	--	**129000**	**94900**	**134000**	**141000**
Iron	55,000.00	**339**	**520**	**25900**	**25700**
Magnesium	--	**2870 J**	**1780 J**	**4170 J**	**4390 J**
Manganese	1,800.00	**108**	**26.1**	**631**	**656**
Nickel	1,600.00	6 U	6 U	6 U	6 U
Potassium	--	**1710 J**	1340 B	**2360 J**	**2660 J**
Sodium	--	**6550 J**	**4570 J**	**6780 J**	**6970 J**

NOTES:
[1]Duplicate of sample A1-SW03
[2]Data as reported in the *Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Site* by Ba
Detections of a chemical are indicated in bold font.
J = Estimated concentration below the quantitation limit
U = Not detected.
B = Not detected substantially above the level reported in laboratory or field blanks.
UL = Not detected, quantitation limit is probably higher.

Table C-4
AOC 1 - 1999 Sediment Sampling Results
Cheatham Annex
Williamsburg, Virginia

Station ID	**Residential RSLs-Soil**	Northern portion o the drainage channel receiving runoff from AOC 1 near Jones Mill Pond	A1-SD01	A1-SD01	A1-SD02	A1-SD02	A1-SD03	A1-SD03	A1-SD03	A1-SD04	A1-SD04
Sample ID		PEN1-SED-04[2]	A1-SD01-00[3]	A1-SD01-01[3]	A1-SD02-00[3]	A1-SD02-01[3]	A1-SD03-00[3]	A1-SD03-00D[1,3]	A1-SD03-01[3]	A1-SD04-00[3]	A1-SD04-01[3]
Sample Date		01/13/99	11/14/99	11/14/99	11/14/99	11/14/99	11/14/99	11/14/99	11/14/99	11/14/99	11/14/99
Chemical Name											
Volatile Organic Compounds (UG/KG)											
2-Butanone	28,000,000.00	0.013 U	**3 J**	**5 J**	**5 J**	**4 J**	17 B	5 B	65 B	13.25 U	13.77 U
Ethylbenzene	5,700.00	0.013 U	**2 J**	**2 J**	12.95 U	13.2 U	15.94 U	16.39 U	17.9 U	13.25 U	**2 J**
Xylene (Total)	600,000.00	0.013 U	**6 J**	5 B	12.95 U	**2 J**	15.94 U	16.39 U	17.9 U	13.25 U	**4 J**
Semi-volatile Organic Compounds (UG/KG)											
2-Methylnaphthalene	310,000.00	**0.1275 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Benzo(a)Anthracene	150.00	**0.0058 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Benzo(a)Pyrene	15.00	**0.0024 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Benzo(b)Fluoranthene	150.00	**0.0026 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Benzo(k)Fluoanthene	1,500.00	**0.0026 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Bis(2-Ethylhexyl)Phthalate	35,000.00	0.068 B	480 U	**48 J**	450 U	**46 J**	510 U	**63 J**	580 U	**46 J**	**51 J**
Chrysene	15,000.00	**0.0112 J**	480 U	460 U	450 U	430 U	510 U	540 U	**63 J**	450 U	440 U
Di-n-Butyl phthalate	6,100,000.00	0.44 U	**120 J**	**120 J**	**93 J**	**81 J**	**110 J**	**85 J**	**80 J**	**98 J**	**64 J**
Fluoranthene	2,300,000.00	**0.0035 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	**47 J**	440 U
Naphthalene	3,900.00	**0.00675 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Phenanthrene	17,000,000.00	**0.0025 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Pyrene	1,700,000.00	**0.0029 J**	480 U	460 U	450 U	430 U	510 U	540 U	580 U	450 U	440 U
Pesticide/Polychlorinated Biphenyls (UG/KG)											
4,4'-DDD	2,000.00	**0.00023 J**	4.7 U	4.6 U	4.5 U	4.3 U	4.7 UL	5.4 U	5.8 U	4.4 U	4.4 U
4,4'-DDE	1,400.00	**0.000054 J**	4.7 U	4.6 U	4.5 U	4.3 U	4.7 UL	5.4 U	5.8 U	4.4 U	4.4 U
Aroclor-1260	220.00	0.044 U	47 U	46 U	45 U	43 U	47 UL	54 U	58 U	44 U	**14 J**
alpha-Chlordane	1,600.00	**0.0027 J**	2.4 U	2.4 U	2.3 U	2.2 U	2.4 UL	2.8 U	3 U	2.3 U	2.3 U
gamma-Chlordane	1,600.00	**0.0001 J**	2.4 U	2.4 U	2.3 U	2.2 U	2.4 UL	2.8 U	3 U	2.3 U	2.3 U
Endosulfan II	370,000.00	**0.000065 J**	4.7 U	4.6 U	4.5 U	4.3 U	4.7 UL	5.4 U	5.8 U	4.4 U	4.4 U
Endrin	1,800.00	**0.00006 J**	4.7 U	4.6 U	4.5 U	4.3 U	4.7 UL	5.4 U	5.8 U	4.4 U	4.4 U
Endrin Ketone	1,800.00	**0.0002 J**	4.7 U	4.6 U	4.5 U	4.3 U	4.7 UL	5.4 U	5.8 U	4.4 U	4.4 U
Methoxychlor	310,000.00	**0.00069 J**	24 U	24 U	23 U	22 U	24 UL	28 U	30 U	23 U	23 U
Explosives (UG/KG)											
No detections											
Total Metals (MG/KG)											
Aluminum	77,000.00	**5430**	**1790 L**	**2970 L**	**4230 L**	**2060 L**	**2480 L**	**3510 L**	**4170 L**	**6740 L**	**4600 L**
Antimony	31.00	UL	0.47 U	0.36 U	0.46 U	0.36 U	0.56 U	0.56 U	0.51 U	0.52 U	0.46 U
Arsenic	0.39	**10.8**	**1.5 J**	**1.4 J**	**1.6 J**	**1.1 J**	**7.1**	**10.5**	**7.4**	**2.1 J**	**1.8 J**
Barium	15,000.00	**54.7**	9.4 B	11.3 B	16.3 B	10.2 B	16 B	23.4 B	15.2 B	23.3 B	**18.1 J**
Beryllium	160.00	**0.36 J**	**0.22 J**	**0.23 J**	**0.29 J**	**0.22 J**	**0.18 J**	**0.22 J**	**0.16 J**	**0.16 U**	**0.26 J**
Cadmium	70.00	ND	0.07 U	0.06 U	0.07 U	0.05 U	0.09 U	0.09 U	0.08 U	0.08 U	0.07 U
Calcium	--	**15583.33333**	**1420**	**1250**	**1270**	**899 L**	**17900**	**19000**	**3630**	**1940 B**	**1760 J**
Chromium	120,000.00	**8.7**	**4.3**	**6.2**	**11.1**	**6.1**	**6.3**	**8.1**	**7.1**	**4.8**	**4.8**
Cobalt	--	**2**	**1.9 J**	1.9 **J**	**2.4 J**	**1.2 J**	**3.6 J**	**3.1 J**	**2.8 J**	1.5 U	1.3 U
Copper	3,100.00	**4.7**	1.2 U	0.89 U	2.6 B	0.87 U	3.4 B	4.4 B	2.9 B	26.9 B	**16 J**
Cyanide	1,600.00	**0.12**	0.03 UL	0.02 UL	0.03 UL	0.02 UL	0.03 UL	0.03 UL	0.03 UL	0.03 UL	0.03 UL
Iron	55,000.00	**15100 J**	**3490**	**3320**	**4690**	**3510**	**12600**	**18700**	**9230**	**4940**	**3730 L**
Lead	400.00	**11**	**3.8**	**3.6**	**4.8**	**3.1**	**12.6**	**12.6**	**11.4**	**10.3**	**7.5**
Magnesium	--	**1100**	76.9 B	177 B	**304 J**	154 B	266 B	**325 J**	211 B	299 B	**216 J**
Manganese	1,800.00	**168**	**10**	**9**	**12.9**	**6.5**	**215**	**309**	**38.6**	**257**	**160**
Mercury	6.70	ND	0.03 UL	0.03 UL	0.02 UL	0.02 UL	0.03 UL	0.04 UL	0.03 UL	**0.07 L**	**0.04 L**
Nickel	1,600.00	**3.4**	2.1 B	3.1 B	8.2 B	2.6 B	5.1 B	3.1 B	2.5 B	2.9 B	**2.1 J**
Potassium	--	**548**	106 B	194 B	374 B	223 B	134 B	253 B	163 B	266 B	**199 L**
Selenium	390.00	UL	0.65 U	0.49 U	0.63 U	0.48 U	0.8 J	0.77 U	0.7 U	0.71 U	0.63 U
Silver	390.00	**0.42 L**	0.89 B	0.69 B	1.4 B	1.1 B	3 B	5.2 B	3.2 B	1.6 B	1.5 B
Sodium	--	**93.5**	35.2 B	32.1 B	52.5 B	26.4 B	64.2 B	95.2 B	80.9 B	74.9 B	55.5 B
Thallium	5.10	UL	0.52 U	0.39 U	0.5 U	0.39 U	0.62 UJ	0.71 B	0.56 U	0.57 U	0.5 UL
Vanadium	390.00	**13.6**	**5.6 J**	**8.1 J**	**11.2**	**7.5 J**	9.9 B	**12.4 J**	**14.8**	**7.7 J**	**7.4 J**
Zinc	23,000.00	**59.6**	9.6 B	9.7 B	10.3 B	8.1 B	47.6 B	74.1 B	29.7 B	79.8 B	51 B

NOTES:
[1]Duplicate of sample A1-SD03-00
[2]Data as reported in the*Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia* by Roy F. Weston, Inc., August 9, 1999.
[3]Data as reported in the*Final Site Inspection Report, Site 4 and AOC 1, Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Site* by Baker, May 10, 2001.
Detections of a chemical are indicated in bold font.
J = Estimated concentration below the quantitation limit
L = Analyte is present. The reported value may be biased low. The actual value is expected to be higher than reported.
B = Not detected substantially above the level reported in laboratory or field blanks.
UL = Not detected, quantitation limit is probably higher.
U = Not detected.
ND = Not detected.

AOC 2—Historical Data

TABLE 4-1

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED - QA/QC SAMPLES
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02 11/12/1999	104-TB03 11/14/1999	104-TB05 03-FEB-2000	104-RS01 11/13/1999	104-RS03 11/13/1999	104-FB01 11/10/1999	104-FB02 11/10/1999
Volatiles (ug/L)							
1,1,2,2-Tetrachloroethane	10 U	1 J	10 U	10 U	10 U	10 U	10 U
2-Butanone	7 J	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	3 J	1 J	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	1 J	10 U	10 U	10 U	10 U	10 U
Acetone	8 J	7 J	10 U	6 J	10 U	5 J	6 J
Chloromethane	10 U	3 J	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	2 J	12 B	2 J	2 J	2 J	2 J	2 J
Semivolatiles (ug/L)							
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	2 J	10 U	2 J	10 U

TABLE 4-2

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED - QA/QC SAMPLES
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Rinsate Blanks		Field Blanks	
	104-RS01	104-RS03	104-FB01	104-FB02
	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Inorganics (ug/L)				
Aluminum	49.1 J	44 U	84.7 J	428
Barium	11.3 J	4.1 U	4.1 U	6.9 J
Calcium	85.4 U	85.4 U	85.4 U	87.7 J
Copper	5.4 U	5.4 U	5.4 U	7.3 J
Iron	37.5 J	27.4 J	65.4 J	151
Magnesium	143 J	117 U	117 U	117 U
Potassium	247 J	250 J	209 U	209 U
Silver	3.9 U	3.9 U	5.8 J	8.5 J
Sodium	86.5 J	42.3 U	236 J	194 J
Thallium	2.4 U	2.4 U	2.4 U	2.8 J
Zinc	9.8 J	9.8 J	40.7	64.3

TABLE 4-5

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SOIL
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Fill Zone									
		Test Pit							Stockpiled Soil [1]	Soil with Asphalt [2]	Composite of TP01-TP06
Sample ID	Comparison to	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F	A2-CS01	A2-CS04	A2-TPCOMP-01
Sample Date	Residential RSLs	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	02/03/2000	02/04/2000	11/14/1999
Volatiles (ug/kg)											
2-Butanone	28,000,000	14.12 U	4 B	11.9 U	5 B	11.79 U	12.15 UL	12.82 U	5 J	11 U	12.5 U
Benzene	1,100	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U	11 J	11 U	3 J
Ethylbenzene	5,700	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	10 J	12.82 U	11 U	11 U	12.5 U
Methylene Chloride	11,000	12 B	5 B	13 B	7 B	8 B	28 B	11 B	10 B	10 B	21 B
Styrene	6,500	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U	11 U	11 U	12.5 U
Xylene (Total)	600,000	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U	11 U	11 U	12.5 U
Semivolatiles (ug/kg)											
Benzo(b)Fluoranthene	150	800 U	420 U	390 U	400 U	400 U	390 U	420 U	380 U	42 J	NA
Bis(2-Ethylhexyl)Phthalate	35,000	800 U	56 J	44 J	2,500	660	150 J	420 U	63 J	370 U	NA
Chrysene	15,000	800 U	420 U	390 U	400 U	400 U	390 U	420 U	380 U	41 J	NA
Di-n-butylphthalate	6,100,000	800 U	76 J	65 J	68 J	79 J	65 J	420 U	40 B	44 J	NA
Fluoranthene	2,300,000	800 U	420 U	390 U	400 U	400 U	390 U	420 U	380 U	52 J	NA
Pyrene	1,700,000	800 U	420 U	390 U	400 U	400 U	390 U	420 U	380 U	58 J	NA
Pest/PCB (ug/kg)											
4,4'-DDD	2,000	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	18	NA
4,4'-DDE	1,400	4 UL	5.4 J	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	4.1 J	NA
4,4'-DDT	1,700	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	4.1 J	NA
Aroclor-1260	220	200	310	39 UL	40 UL	40 UL	39 UL	42 UL	38 U	350	NA
Dieldrin	30	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	9.6 J	NA
Endrin Aldehyde	18,000 [4]	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	4.1 J	NA
Endrin Ketone	18,000 [4]	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL	3.8 U	9.5 J	NA

Notes:
(1) Composite of soil stockpiled from respirator cartridge removal
(2) Collected from Test Pit 45
(3) Collected from bottom of respirator cartridge removal excavation area
(4) Screening value for endrin used as a surrogate.

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

TABLE 4-5(Continued)

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SOIL
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Native Soil								
		Test Pit							Bottom of Pit[3]	
Sample ID Sample Date	Comparison to Residential RSLs	A2-TP01-N 11/12/1999	A2-TP02-N 11/12/1999	A2-TP03-N 11/12/1999	A2-TP04-N 11/12/1999	A2-TP05-N 11/12/1999	A2-TP05-ND 11/12/1999	A2-TP06-N 11/12/1999	A2-CS02 02/03/2000	A2-CS03 02/03/2000
Volatiles (ug/kg)										
2-Butanone	28,000,000	7 B	10 UL	5 B	4 B	3 B	10 UL	10 UL	7 J	12 U
Benzene	1,100	12.4 U	10 UL	12.6 U	12.24 U	12.97 U	10 UL	10 UL	14 U	12 U
Ethylbenzene	5,700	12.4 U	10 UL	12.6 U	12.24 U	12.97 U	10 UL	0.7	14 U	12 U
Methylene Chloride	11,000	6 B	37 B	9 B	9 B	9 B	34	27	15 B	11 B
Styrene	6,500	12.4 U	10 UL	12.6 U	12.24 U	12.97 U	10 UL	4	5 J	12 U
Xylene (Total)	600,000	12.4 U	10 UL	12.6 U	1 J	2 J	2	2	14 U	12 U
Semivolatiles (ug/kg)										
Benzo(b)Fluoranthene	150	390 U	410 U	410 U	410 U	410 U	410 U	400 U	440 U	410 U
Bis(2-Ethylhexyl)Phthalate	35,000	390 U	43 J	42 J	410 U	410 U	410 U	400 U	110 J	410 U
Chrysene	15,000	390 U	410 U	410 U	410 U	410 U	410 U	400 U	440 U	410 U
Di-n-butylphthalate	6,100,000	390 U	50 J	46 J	46 J	51 J	410 U	47 J	440 U	410 U
Fluoranthene	2,300,000	390 U	410 U	410 U	410 U	410 U	410 U	400 U	440 U	410 U
Pyrene	1,700,000	390 U	410 U	410 U	410 U	410 U	410 U	400 U	440 U	410 U
Pest/PCB (ug/kg)										
4,4'-DDD	2,000	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U
4,4'-DDE	1,400	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U
4,4'-DDT	1,700	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U
Aroclor-1260	220	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL	44 U	41 U
Dieldrin	30	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U
Endrin Aldehyde	18,000 [4]	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U
Endrin Ketone	18,000 [4]	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL	4.4 U	4.1 U

Notes:
(1) Composite of soil stockpiled from respirator cartridge removal
(2) Collected from Test Pit 45
(3) Collected from bottom of respirator cartridge removal excavation area
(4) Screening value for endrin used as a surrogate.

TABLE 4-6

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED IN SOIL
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Fill Zone								
		Test Pit							Stockpiled Soil (1)	Soil with Asphalt (2)
Sample ID	Comparison to	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F	A2-CS01	A2-CS04
Sample Date	Residential RSLs	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	02/03/2000	02/04/2000
Inorganics (mg/kg)										
Aluminum	77,000	12,300 L	8,480 L	6,160 L	9,960 L	6,650 L	5,120 L	11,800 L	6,760 J	7,180 J
Antimony	31.0	0.84 B	0.69 B	2 B	12.7 U	0.46 B	11.9 U	11.6 U	0.5 UL	0.45 UL
Arsenic	0.39	3.3	5	3	7.9	9.2	1.9 J	4.3	2 L	3.2 L
Barium	15,000	53.1	35.8	32.2 J	31.7 J	31.6 J	26 J	44.5	30.5 J	27.3 J
Beryllium	160	0.6 B	0.46 B	0.38 B	0.65 B	0.39 B	0.23 B	0.45 B	0.4 J	0.72 J
Cadmium	70.0	2.1 U	1.8 U	12.3	2.1 U	0.9 U	1 U	1 U	1.7 L	0.07 UL
Calcium	--	36,400	13,100	732 J	1,590	1,150	885 J	1,180	1,100 J	63,700 J
Chromium	230 (4)	37.5	17.8	94.5	24.5	15.1	9.2	20.3	35.9 J	19.4 J
Cobalt	--	4.1 J	4 J	3.4 J	5.5 J	3 J	2.7 J	3.8 J	3.4 J	2.2 J
Copper	3,100	58.3	26.7	318	5.3 B	5.5 B	3.1 B	14.6	74.2	2.3 J
Cyanide	1,600	0.6 UL	0.6 UL	0.95 J	0.6 UL	0.6 UL	0.6 UL	0.6 UL	0.02 UL	0.02 UL
Iron	55,000	37,500 L	25,400 L	21,100 L	24,300 L	15,000 L	10,800 L	25,800 L	14,600 L	16,300 L
Lead	400 (5)	11.4	11.2	222	10.3	10.8	8	11.8	62.8 L	9.3 L
Magnesium	--	2,920	825 J	391 J	732 J	432 J	293 J	541 J	451 J	2,410
Manganese	1,800	96.2	112	104	100	94.7	103	121	94 J	85.9 J
Mercury	23.00 (6)	0.04 J	0.04 J	0.03 J	0.03 J	0.04 J	0.06 J	0.05 J	0.02 U	0.03 U
Nickel	1,600	7.2 J	11.2	11.8	12.4	5.1 J	4.3 J	8.4	10.9	5 J
Potassium	--	1120	666 J	312 J	852 J	429 J	332 J	676 J	379 J	1910
Silver	390	11	7 B	19.7	6.5 B	3.9 B	2.7 B	7.1 B	8	3.2
Sodium	--	194 B	70.4 B	25.9 B	30.6 B	31.3 B	20.4 B	32.6 B	50.9 B	356 J
Thallium	5.10	0.79 B	1.8 UL	0.64 B	2.1 UL	1.9 UL	2 UL	0.78 B	0.55 U	0.49 U
Vanadium	390	29.7	23.9	15.4	31.4	20.9	16.8	36.9	17.1	19.9
Zinc	23,000	120	69.9 B	127	44.8 B	60.4 B	23.7 B	96.2	43.5 J	23.8 J

Notes:
(1) Composite of soil stockpiled from respirator cartridge removal
(2) Collected from Test Pit 45
(3) Collected from bottom of respirator cartridge removal excavation area
(4) Screening value for chromium VI used.
(5) Action level for lead
(6) Screening values for mercuric chloride

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

TABLE 4-6 (Continued)

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED IN SOIL
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Native Soil								
		Test Pit							Bottom of Pit (3)	
Sample ID	Comparison to	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N	A2-CS02	A2-CS03
Sample Date	Residential RSLs	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	02/03/2000	02/03/2000
Inorganics (mg/kg)										
Aluminum	77,000	9,150 L	13,700 L	16,100 L	11,400 L	12,100 L	12,900 L	11,600 L	147,000 J	12,200 J
Antimony	31.0	0.51 U	0.51 UJ	0.63 J	0.81 B	0.64 B	0.5 B	0.84 B	0.52 UL	0.53 UL
Arsenic	0.39	9.4	4.2 L	36.5	36.1	16	16	21.2	12.6 L	13.4 L
Barium	15,000	30.7 J	26.6 J	50.2 J	66	17.2 J	17.5 J	29.7 J	20.9 J	10.9 J
Beryllium	160	0.59 B	0.9 B	1.3 J	0.81 B	0.96 J	0.92 J	0.97 J	0.1 J	1.3
Cadmium	70.0	0.08 U	0.16 U	0.17 U	0.08 UL	0.08 UL	0.08 UL	0.08 UL	0.16 UL	0.41 UL
Calcium	--	801 J	359	494 J	528 J	153 J	183 J	472 J	1,770 J	455 J
Chromium	230 (4)	23.3	60.3	44	43.3	34.8	38.8	29.8	33.5 J	69.1 J
Cobalt	--	3.8 J	6.6 J	10.2 J	4.6 J	5.8 J	6.3 J	9.2 J	4.3 J	10.6 J
Copper	3,100	4.6 B	137 J	6.5 B	5.6 B	6.8 B	6.2 B	134	5.8 J	8
Cyanide	1,600	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.03 UL	0.02 UL
Iron	55,000	20,700 L	38,400 L	38,800 L	24,600	33,800	36,700	34,300	36,300 L	99,900 L
Lead	400 (5)	8.3	14.6 J	12 J	16.2	9	9.1	12.6	14 L	16.1 L
Magnesium	--	456 J	1,130 J	1,530	1,080 J	954 J	1,020 J	844 J	1,280	623 J
Manganese	1,800	54.7	73.7 J	84.5 J	13.7	45.6	44.6	70.9	97.7 J	44.8 J
Mercury	23.00 (6)	0.04 J	0.03 U	0.03 U	0.03 B	0.05 B	0.03 B	0.07 J	0.03 U	0.03 B
Nickel	1,600	5.8 B	12.1	18.5	7.4 J	14.4	16.3	24.4	11.6	20.5
Potassium	--	711 J	1,560	1,820	1,650	1,270	1,340	1,130	1250	807 J
Silver	390	6.8 B	17.8 L	13 L	9 B	11.7 J	13.7 J	12 J	9	23.4
Sodium	--	18 B	38.5 B	57.5 B	25.9 B	39.5 B	33.9 B	36 B	58.6 B	63.9 B
Thallium	5.10	0.55 UL	0.84 L	0.58 UL	1.2 B	0.85 B	1.4 B	0.88 B	0.79 J	3.1
Vanadium	390	41.8	36.8 J	69.2 J	37.6	35.5	35.4	36.7	32	65
Zinc	23,000	17.9 B	42.5 B	52.4 B	42.8 B	39.8 B	47.9 B	61.4 B	38 J	45.8 J

Notes:
(1) Composite of soil stockpiled from respirator cartridge removal
(2) Collected from Test Pit 45
(3) Collected from bottom of respirator cartridge removal excavation area
(4) Screening value for chromium VI used.
(5) Action level for lead
(6) Screening values for mercuric chloride

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

TABLE 4-7

SUMMARY OF TCLP AND RCRA CHARACTERIZATION
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Aqueous IDW	Respirator Cartridge	Composite of TP01-TP06
	Characteristics of Hazardous Waste [1]	A2-AQWT-01 11/23/1999	A2-CART-01 11/23/1999	A2-TPCOMP-01 11/14/1999
Volatiles (ug/L)				
1,1-Dichloroethene	700	5 U	5 U	5 U
1,2-Dichloroethane	500	5 U	5 U	5 U
2-Butanone	200,000	10 U	1300 D [2]	10 U
Benzene	500	5 U	370 D [2]	5 U
Carbon Tetrachloride	500	5 U	5 U	5 U
Chlorobenzene	100	5 U	5 U	5 U
Chloroform	6,000	8	5 U	5 U
Tetrachloroethene	700	5 U	5 U	5 U
Trichloroethene	500	5 U	5 U	3 J
Vinyl Chloride	200	5 U	5 U	5 U
Semivolatiles (ug/L)				
1,4-Dichlorobenzene	7,500	40 U	40 U	40 U
2,4,5-Trichlorophenol	400,000	100 U	100 U	100 U
2,4,6-Trichlorophenol	2,000	40 U	40 U	40 U
2,4-Dinitrotoluene	130	40 U	40 U	40 U
2-Methylphenol	200,000	40 U	40 U	40 U
4-Methylphenol	200,000	40 U	40 U	40 U
Hexachlorobenzene	130	40 U	40 U	40 U
Hexachlorobutadiene	500	40 U	40 U	40 U
Hexachloroethane	3,000	40 U	40 U	40 U
Nitrobenzene	200	40 U	40 U	40 U
Pentachlorophenol	100,000	100 U	100 U	100 U
Pyridine	5,000	40 U	40 U	40 U

Notes:
(1) 40CFR261.20 Subpart C
(2) D indicates extraction dilution
Shading indicates that the detected concentration exceeds the Characteristics of Hazardous Waste value.

TABLE 4-7 (Continued)

SUMMARY OF TCLP AND RCRA CHARACTERIZATION
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

		Aqueous IDW	Respirator Cartridge	Composite of TP01-TP06
	Characteristics of Hazardous Waste (1)	A2-AQWT-01 11/23/1999	A2-CART-01 11/23/1999	A2-TPCOMP-01 11/14/1999
Pesticides (ug/L)				
Chlordane	30	4 U	4 U	4 U
Endrin	20	0.4 U	0.4 U	0.4 U
Heptachlor	8	0.2 U	0.2 U	0.2 U
Heptachlor Epoxide	8	0.2 U	0.2 U	0.2 U
Methoxychlor	10,000	2 U	2 U	2 U
Toxaphene	500	20 U	20 U	20 U
gamma-BHC	400	0.2 U	0.2 U	0.2 U
Herbicides (ug/L)				
2,4,5-T	NA	NA	0.4 U	0.4 U
2,4,5-TP (Silvex)	1,000	NA	0.4 U	0.4 U
2,4-D	10,000	NA	4 U	4 U
Dinoseb	NA	NA	2 U	2 U
Inorganics (ug/L)				
Arsenic	5,000	5.8 B	90 U	3.6 U
Barium	100,000	222 B	398 B	484 B
Cadmium	1,000	1.1 B	2480	112
Chromium	5,000	9.3 B	235	63.2
Lead	5,000	24.5 B	8600	135 B
Mercury	200	0.11 U	0.11 U	0.2 U
Selenium	1,000	2.1 U	52.5 U	2.1 U
Silver	5,000	3.7 U	28.8	14.7
RCRA Characteristics				
pH (SU)	2<pH<12.5	NA	NA	6.66
Flashpoint (^{o}F)	< 140°F	NA	NA	U
Reactive Cyanide (mg/kg)	NA	NA	NA	0.6 U
Reactive Sulfide (mg/kg)	NA	NA	NA	1.5 U

Notes:
(1) 40CFR261.20 Subpart C

Shading indicates that the detected concentration exceeds the Characteristics of Hazardous Waste value.

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - SURFACE SOIL
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	Residential RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
PESTICIDES/PCBs (ug/kg)								
4,4'-DDE	1,400	4.1 UJ	4.1 UJ	520 J	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
4,4'-DDT	1,700	4.1 UJ	4.1 UJ	640 J	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Heptachlor epoxide	53.0	2 UJ	4 J	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - SURFACE SOIL
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	Residential RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
INORGANICS (mg/kg)								
Aluminum	77,000	6,020	7,300	6,170	1,890	5,710	8,500	5,650
Antimony	31.0	0.56 UL	0.74 L	0.72 UL	0.58 UL	0.68 UL	0.63 UL	0.55 UL
Arsenic	0.39	11.1	14	6.6	3	3.5	20	5.5
Barium	15,000	64.5	77.2	47.2 J	18.4 J	36.5 J	38.7 J	48.6
Beryllium	160	0.55 J	0.64 J	0.43 J	0.14 J	0.2 J	0.77 J	0.43 J
Calcium	--	3,190	2,670	3,070	989	1,720	2,700	2,840
Chromium	230 (1)	24.6	39	15.3	3.9	12.5	29.4	11.5
Cobalt	--	4.1 J	5.6 J	4.2 J	1.5 U	2.4 J	6.1 J	2.8 J
Copper	3,100	20.2	20.5	6.2	2.2 J	2.4 J	7.8	4
Iron	55,000	22,700	28,600	14,800	3,180	13,800	44,000	15,000
Lead	400 (2)	57.1	104	89.9	13.3	8	29.3	20
Magnesium	--	795	906	697	269	384	1050	553
Manganese	1,800	240	238	176	62.7	152	169	170
Mercury	23.00 (3)	0.11 B	0.13 B	0.96 J	1.8	1.4	1.2 J	1.3
Nickel	1,600	10.6	12.5	6.9 J	2.3 U	4 J	12.1	5.6 J
Potassium	--	708	871	710	204 J	455	1,320	547
Selenium	390.0	0.51 U	0.53 U	0.66 U	0.53 U	0.63 U	0.64 K	0.71 K
Sodium	--	133 J	127 J	158 J	106 J	138 J	130 J	134 J
Vanadium	390	24.8	30.2	18.7	6 J	25.4	42.3	20.5
Zinc	23,000	49.9	53.6	96.9	9.5	21.3	55.9	22.8

Notes:
(1) Screening value for chromium VI used.
(2) Action level for lead
(3) Screening values for mercuric chloride

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	Residential RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH		1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
VOLATILES (ug/kg)												
Acetone	61,000,000	14 U	15 U	11 U	66	14 U	14 UL	13 U	11 U	13 U	11 U	13 U
PESTICIDES/PCBs (ug/kg)												
4,4'-DDE	1,400	4.6 UJ	4.9 UJ	120 J	4.8 UJ	4.6 UJ	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
4,4'-DDT	1,700	4.6 UJ	4.9 UJ	51 J	4.8 UJ	4.6 UJ	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03
SAMPLE DATE	Residential RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH		1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0
INORGANICS (mg/kg)									
Aluminum	77,000	12,500	11,000	6,450	5,390	5,210	5,630	2,370	6,680
Antimony	31.0	1 L	0.96 L	0.5 UL	0.65 UL	0.71 L	1.3 L	0.62 L	0.55 L
Arsenic	0.39	30.8	31.1	4.9	7.6	9.2	24.7	10.6	17.4
Barium	15,000	33.5 J	32.5 J	35.3 J	9 J	38.3 J	22.4 J	19.2 J	15.3 J
Beryllium	160	0.96 J	0.85 J	0.36 J	0.48 J	0.46 J	0.7 J	0.31 J	0.7 J
Cadmium	70.0	0.34 J	0.3 J	0.06 B	0.05 U	0.33 J	0.29 J	0.29 J	0.11 B
Calcium	--	1,690	1,720	1,290	499	156,000	2,580	152,000	309
Chromium	230.0 (1)	43.2	40.7	12.4	20.4	19.2	22.2	12.2	21.6
Cobalt	--	7 J	6.5 J	3.7 J	1.7 U	5.5 J	10.1 J	2.3 J	5.3 J
Copper	3,100	4.2	3.7	4.7	1.8 J	6.2	2.5 J	3.1	1.6 J
Iron	55,000	42,000	38,400	14,700	9,590	18,500	29,400	13,800	24,100
Lead	400 (2)	11.3	9.8	18.9	8.5	6.1	6.4	2.8	5.2
Magnesium	--	1,510	1,220	462	432	2,620	566	2,220	1,320
Manganese	1,800	79.5	74.6	99.9	7.1	97	75.9	43.1	54
Mercury	23.00 (3)	0.08 B	0.89 J	1	1.2	0.61 U	0.63 J	0.08 B	0.56 J
Nickel	1,600	21.8	21.2	6.6 J	2.6 U	10.8	15.3	5 J	9.8
Potassium	--	1,900	1,320	474	594	2,080	386	2,080	1,450
Selenium	390.0	0.68 K	0.63 U	0.46 U	0.6 U	0.56 U	0.6 U	0.54 U	0.47 U
Sodium	--	136 J	155 J	109 J	132 J	1,460	141 J	974	106 J
Vanadium	390	39.8	34.9	18.6	54.4	14.6	26.2	8.2 J	19.9
Zinc	23,000	49.9	47.4	49.8	7.3	37	45.8	21.4	32.7

Notes:
(1) Screening value for chromium VI used.
(2) Action level for lead
(3) Screening values for mercuric chloride

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	Residential RSLs	10-22-1998	10-23-1998	10-23-1998
DEPTH		18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
INORGANICS (mg/kg)				
Aluminum	77,000	2,910	8,030	4,330
Antimony	31.0	0.66 L	0.5 UL	0.64 L
Arsenic	0.39	9.3	2.7	7.2
Barium	15,000	19.5 J	12.1 J	29.8 J
Beryllium	160	0.46 J	0.25 J	0.6 J
Cadmium	70.0	0.29 J	0.04 U	0.37 J
Calcium	--	229,000	1,010	67,000
Chromium	230.0 (1)	13.2	27.5	19.2
Cobalt	--	2.5 J	3.5 J	4.6 J
Copper	3,100	2.8	2 J	1 U
Iron	55,000	21,600	11,000	45,300
Lead	400 (2)	2.1	3.7	3.8
Magnesium	--	3,390	1,180	2,860
Manganese	1,800	46	12.6	134
Mercury	23.00 (3)	0.95 J	0.94 J	0.69 J
Nickel	1,600	4.8 J	4.5 J	6.5 J
Potassium	--	4,720	1,100	4,520
Selenium	390.0	0.56 U	0.46 U	0.55 U
Sodium	--	1,240	102 J	252
Vanadium	390	9.4 J	32.7	14.8
Zinc	23,000	19	17.9	32.1

Notes:

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	Tapwater RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
SEMIVOLATILES (ug/L)						
Diethyl phthalate	29,000.0	1 J	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF UNFILTERED INORGANIC CONSTITUENTS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	Tapwater RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
UNFILTERED INORGANICS (ug/L)						
Aluminum	37,000	189,000	59,300	2,110	2,210	96,700
Antimony	15.0	13.8	7.7	2.4 U	2.4 U	11.3
Arsenic	0.045	181	89.9	3.7 J	5.1 J	430
Barium	7,300	510	195 J	36.5 J	38.3 J	275
Beryllium	73	9.6	3.3 J	0.2 U	0.2 U	5.7
Cadmium	18.0	8.7	5.9	4.3 U	4.3 U	6.5
Calcium	--	2,520,000	722,000	153,000	160,000	1,230,000
Chromium	110.0 (1)	595	229	9.6 J	10	364
Cobalt	--	73.7	32.2 J	6.3 U	6.3 U	45.6 J
Copper	1,500	99.5	37	4.1 U	4.1 U	45.9
Iron	26,000	380,000	133,000	5,550	5,630	262,000
Lead	400 (2)	94.6	36.1	1 U	1.2 B	53.7
Magnesium	--	51,900	17,900	2,270	2,340	31,800
Manganese	880	1,360	394	36.7	37.5	684
Nickel	730	170	70.7	9.6 U	9.6 U	109
Potassium	--	55,400	18,800	1,780 J	1,710 J	36,500
Selenium	180.0	2.2 U	4.6 K	2.2 U	2.9 K	2.2 U
Sodium	--	18,900	12,600	7,190	7,290	13,100
Thallium	2.4	1.2 L	2 J	1.2 U	1.2 U	1.2 U
Vanadium	260.0	417	205	6.1 J	4.8 J	309
Zinc	11,000	667	264	13.5 J	13.3 J	424

Notes:
(1) Screening value for chromium VI used.
(2) Action level for lead

Shading indicates that the detected concentration exceeds the Regional Screening Level value for tapwater (beta version, 5/27/08).

ANALYTICAL SUMMARY OF FILTERED INORGANIC CONSTITUENTS DETECTED
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FLEET INDUSTRIAL SUPPLY CENTER, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA

SAMPLE ID	Comparison to	A2-DPW01F	A2-DPW02F	A2-DPW03F	A2-DPW03DF	A2-DPW04F
SAMPLE DATE	Tapwater RSLs	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
FILTERED INORGANICS (ug/L)						
Aluminum	37,000	210	172 J	167 J	193 J	159 J
Arsenic	0.045	2.4 J	3.6 J	1.8 U	1.8 U	5.5 J
Barium	7,300	35.2 J	36.4 J	27.3 J	27 J	23.2 J
Calcium	--	158,000	143,000	132,000	132,000	133,000
Copper	1,500	4.1 U	4.2 J	4.1 U	4.5 J	6.5 J
Iron	26,000	56.6 J	53.2 J	92.7 J	86.2 J	208
Magnesium	--	2,240	3,730	1,600	1,620	1,710
Manganese	880	164	317	24.1	23.8	25
Potassium	--	1,000 J	2,060 J	869 J	861 J	1,060 J
Selenium	180.0	2.2 U	7.5 K	2.2 U	2.2 U	2.2 U
Sodium	--	6,980	9,840	7,040	6,910	6,080
Zinc	11,000	7.1 J	8 J	6.8 U	11.8 J	7.5 J

Shading indicates that the detected concentration exceeds the Regional Screening Level value for tapwater (beta version, 5/27/08).

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Volatiles (ug/L)							
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	1 J	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	7 J	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	3 J	1 J	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	1 J	10 U	10 U	10 U	10 U	10 U
Acetone	8 J	7 J	10 U	6 J	10 U	5 J	6 J
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	11 B	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon Tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	10 U	3 J	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	2 J	12 B	2 J	2 J	2 J	2 J	2 J
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Xylene (Total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Semivolatiles (ug/L)							
1,2,4-Trichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
2,2'-oxybis(1-Chloropropane)	NA	NA	NA	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	NA	NA	NA	25 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	NA	NA	NA	25 U	25 U	25 U	25 U
2,4-Dinitrotoluene	NA	NA	NA	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Chloronaphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Chlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2-Methylnaphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
2-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
2-Nitrophenol	NA	NA	NA	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	NA	NA	NA	10 U	10 U	10 U	10 U
3-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
4,6-Dinitro-2-Methylphenol	NA	NA	NA	25 U	25 U	25 U	25 U
4-Bromophenyl phenylether	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chloroaniline	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	NA	NA	NA	10 U	10 U	10 U	10 U
4-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
4-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
4-Nitrophenol	NA	NA	NA	25 U	25 U	25 U	25 U
Acenaphthene	NA	NA	NA	10 U	10 U	10 U	10 U
Acenaphthylene	NA	NA	NA	10 U	10 U	10 U	10 U
Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(a)Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Semivolatiles (ug/L) (Cont)							
Benzo(a)Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(b)Fluoranthene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(g,h,i)Perylene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(k)Fluoanthene	NA	NA	NA	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	2 J	10 U	2 J	10 U
Bis(2-chloroethoxy)Methane	NA	NA	NA	10 U	10 U	10 U	10 U
Bis(2-chloroethyl)Ether	NA	NA	NA	10 U	10 U	10 U	10 U
Butylbenzylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Carbazole	NA	NA	NA	10 U	10 U	10 U	10 U
Chrysene	NA	NA	NA	10 U	10 U	10 U	10 U
Di-n-Butylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Di-n-Octyl Phthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Dibenz(a,h)Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U
Dibenzofuran	NA	NA	NA	10 U	10 U	10 U	10 U
Diethylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Dimethyl Phthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Fluoranthene	NA	NA	NA	10 U	10 U	10 U	10 U
Fluorene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorobutadiene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachloroethane	NA	NA	NA	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U
Isophorone	NA	NA	NA	10 U	10 U	10 U	10 U
N-Nitroso-Di-n-Propylamine	NA	NA	NA	10 U	10 U	10 U	10 U
N-Nitrosodiphenylamine	NA	NA	NA	10 U	10 U	10 U	10 U
Naphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
Nitrobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
Pentachlorophenol	NA	NA	NA	25 U	25 U	25 U	25 U
Phenanthrene	NA	NA	NA	10 U	10 U	10 U	10 U
Phenol	NA	NA	NA	10 U	10 U	10 U	10 U
Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U

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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Pesticides/PCBs (ug/L)							
4,4'-DDD	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDE	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDT	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Aldrin	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Aroclor-1016	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1221	NA	NA	NA	2 U	2 U	2 U	2 U
Aroclor-1232	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1242	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1248	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1254	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1260	NA	NA	NA	1 U	1 U	1 U	1 U
Dieldrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan I	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan II	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan Sulfate	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin Aldehyde	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin Ketone	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Heptachlor	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor Epoxide	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U
Toxaphene	NA	NA	NA	5 U	5 U	5 U	5 U
alpha-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
alpha-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
gamma-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U

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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Explosives (ug/L)							
1,3,5-Trinitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
1,3-Dinitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
2,4,6-Trinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2,4-Dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2,6-Dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2-Amino-4,6-dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
3-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
4-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
4-Amino-2,6-dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
HMX	NA	NA	NA	1 U	1 U	1 U	1 U
Nitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
RDX	NA	NA	NA	1 U	1 U	1 U	1 U
Tetryl	NA	NA	NA	1 U	1 U	1 U	1 U

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS - QAQC
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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Inorganics (ug/L)							
Aluminum	NA	NA	NA	49.1 J	44 U	84.7 J	428
Antimony	NA	NA	NA	2.2 U	2.2 U	2.2 U	2.2 U
Arsenic	NA	NA	NA	3.4 U	3.4 U	3.4 U	3.4 U
Barium	NA	NA	NA	11.3 J	4.1 U	4.1 U	6.9 J
Beryllium	NA	NA	NA	0.66 U	0.66 U	0.66 U	0.66 U
Cadmium	NA	NA	NA	0.34 U	0.34 U	0.34 U	0.34 U
Calcium	NA	NA	NA	85.4 U	85.4 U	85.4 U	87.7 J
Chromium	NA	NA	NA	6.2 U	6.2 U	6.2 U	6.2 U
Cobalt	NA	NA	NA	6.2 U	6.2 U	6.2 U	6.2 U
Copper	NA	NA	NA	5.4 U	5.4 U	5.4 U	7.3 J
Cyanide	NA	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U
Iron	NA	NA	NA	37.5 J	27.4 J	65.4 J	151
Lead	NA	NA	NA	1.4 U	1.4 U	1.4 U	1.4 U
Magnesium	NA	NA	NA	143 J	117 U	117 U	117 U
Manganese	NA	NA	NA	3.9 U	3.9 U	3.9 U	3.9 U
Mercury	NA	NA	NA	0.06 U	0.06 U	0.07 U	0.06 U
Nickel	NA	NA	NA	6 U	6 U	6 U	6 U
Potassium	NA	NA	NA	247 J	250 J	209 U	209 U
Selenium	NA	NA	NA	3 U	3 U	3 U	3 U
Silver	NA	NA	NA	3.9 U	3.9 U	5.8 J	8.5 J
Sodium	NA	NA	NA	86.5 J	42.3 U	236 J	194 J
Thallium	NA	NA	NA	2.4 U	2.4 U	2.4 U	2.8 J
Vanadium	NA	NA	NA	5.7 U	5.7 U	5.7 U	5.7 U
Zinc	NA	NA	NA	9.8 J	9.8 J	40.7	64.3

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Soil Composites					Fill Zone						
Sample ID	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
Sample Date	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Volatiles (ug/kg)												
1,1,1-Trichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1,2,2-Tetrachloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1,2-Trichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1-Dichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1-Dichloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloroethene (total)	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloropropane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
2-Butanone	5 J	7 J	12 U	11 U	12.5 U	14.12 U	4 B	11.9 U	5 B	11.79 U	12.15 UL	12.82 U
2-Hexanone	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
4-Methyl-2-Pentanone	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Acetone	6 B	8 B	3 B	8 BJ	30 B	35 B	12.17 U	5 B	17 B	17 B	12.15 UL	12 B
Benzene	11 J	14 U	12 U	11 U	3 J	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromodichloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromoform	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromomethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Carbon Disulfide	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Carbon Tetrachloride	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chlorobenzene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloroform	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Dibromochloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Ethylbenzene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	10 J	12.82 U
Methylene Chloride	10 B	15 B	11 B	10 B	21 B	12 B	5 B	13 B	7 B	8 B	28 B	11 B
Styrene	11 U	5 J	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Tetrachloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Toluene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Trichloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Vinyl Chloride	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Xylene (Total)	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
cis-1,3-Dichloropropene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
trans-1,3-Dichloropropene	11 U	14 U	12 U	11 U	12.5 U	14.12 U	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Semivolatiles (ug/kg)												
1,2,4-Trichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
1,2-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
1,3-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
1,4-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Soil Composites					Fill Zone						
Sample ID	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
Sample Date	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
2,2'-oxybis(1-Chloropropan	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2,4,5-Trichlorophenol	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2,4,6-Trichlorophenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dichlorophenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dimethylphenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dinitrophenol	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2,4-Dinitrotoluene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2,6-Dinitrotoluene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2-Chloronaphthalene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2-Chlorophenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2-Methylnaphthalene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
2-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2-Nitrophenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
3,3'-Dichlorobenzidine	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
3-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4,6-Dinitro-2-Methylphenol	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4-Bromophenyl phenylether	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
4-Chloro-3-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
4-Chloroaniline	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
4-Chlorophenyl-phenylether	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
4-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
4-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4-Nitrophenol	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 UJ	990 UJ	1000 U	1000 U	990 U	1100 U
Acenaphthene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Acenaphthylene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Anthracene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(a)Anthracene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(a)Pyrene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Semivolatiles (ug/kg) (Cont)												
Benzo(b)Fluoranthene	380 U	440 U	410 U	42 J	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(g,h,i)Perylene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(k)Fluoanthene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-chloroethoxy)Methane	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-chloroethyl)Ether	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-Ethylhexyl)Phthalate	63 J	110 J	410 U	370 U	NA	800 U	56 J	44 J	2500	660	150 J	420 U
Butylbenzylphthalate	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Carbazole	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Chrysene	380 U	440 U	410 U	41 J	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Soil Composites					Fill Zone						
Sample ID	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
Sample Date	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Dibenz(a,h)Anthracene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Dibenzofuran	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Diethylphthalate	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Dimethyl Phthalate	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Di-n-butylphthalate	40 B	440 U	410 U	44 J	NA	800 U	76 J	65 J	68 J	79 J	65 J	420 U
Di-n-octylphthalate	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Fluoranthene	380 U	440 U	410 U	52 J	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Fluorene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorobutadiene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorocyclopentadiene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Hexachloroethane	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Indeno(1,2,3-cd)Pyrene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Isophorone	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Naphthalene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Nitrobenzene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
N-Nitroso-Di-n-Propylamine	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
N-Nitrosodiphenylamine	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Pentachlorophenol	960 U	1100 U	1000 U	930 U	NA	2000 U	1000 U	990 U	1000 U	1000 U	990 U	1100 U
Phenanthrene	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Phenol	380 U	440 U	410 U	370 U	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U
Pyrene	380 U	440 U	410 U	58 J	NA	800 U	420 U	390 U	400 U	400 U	390 U	420 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
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	Soil Composites					Fill Zone						
Sample ID	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
Sample Date	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Pesticides/PCBs (ug/kg)												
4,4'-DDD	3.8 U	4.4 U	4.1 U	18	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
4,4'-DDE	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL	5.4 J	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
4,4'-DDT	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Aldrin	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Aroclor-1016	38 U	44 U	41 U	36 U	NA	40 UL	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1221	78 U	90 U	82 U	73 U	NA	81 UL	85 U	80 UL	82 UL	80 UL	79 UL	85 UL
Aroclor-1232	38 U	44 U	41 U	36 U	NA	40 UL	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1242	38 U	44 U	41 U	36 U	NA	40 UL	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1248	38 U	44 U	41 U	36 U	NA	40 UL	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1254	38 U	44 U	41 U	36 U	NA	40 UL	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1260	38 U	44 U	41 U	350	NA	200	310	39 UL	40 UL	40 UL	39 UL	42 UL
Dieldrin	3.8 U	4.4 U	4.1 U	9.6 J	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endosulfan I	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Endosulfan II	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endosulfan Sulfate	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin Aldehyde	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin Ketone	3.8 U	4.4 U	4.1 U	9.5 J	NA	4 UL	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Heptachlor	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Heptachlor Epoxide	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Methoxychlor	20 U	23 U	21 U	19 U	NA	21 UL	22 U	20 UL	21 UL	20 UL	20 UL	22 UL
Toxaphene	200 U	230 U	210 U	190 U	NA	210 UL	220 U	200 UL	210 UL	200 UL	200 UL	220 UL
alpha-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
alpha-Chlordane	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
beta-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
delta-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
gamma-BHC (Lindane)	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
gamma-Chlordane	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL

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	Native Soil						
Sample ID	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
Sample Date	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Volatiles (ug/kg)							
1,1,1-Trichloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,1,2,2-Tetrachloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,1,2-Trichloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,1-Dichloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,1-Dichloroethene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,2-Dichloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,2-Dichloroethene (total)	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
1,2-Dichloropropane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
2-Butanone	7 B	10 UL	5 B	4 B	3 B	10 UL	10 UL
2-Hexanone	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
4-Methyl-2-Pentanone	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Acetone	9 B	14 B	6 B	6 B	6 B	17 B	36 B
Benzene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Bromodichloromethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Bromoform	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Bromomethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Carbon Disulfide	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Carbon Tetrachloride	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Chlorobenzene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Chloroethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Chloroform	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Chloromethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Dibromochloromethane	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Ethylbenzene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	0.7
Methylene Chloride	6 B	37 B	9 B	9 B	9 B	34	27
Styrene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	4
Tetrachloroethene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Toluene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Trichloroethene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Vinyl Chloride	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Xylene (Total)	12.4 U	10 UL	12.6 U	1 J	2 J	2	2
cis-1,3-Dichloropropene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
trans-1,3-Dichloropropene	12.4 U	10 UL	12.6 U	12.242 U	12.969 U	10 UL	10 UL
Semivolatiles (ug/kg)							
1,2,4-Trichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,2-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,3-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,4-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U

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	Native Soil						
Sample ID	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
Sample Date	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
2,2'-oxybis(1-Chloropropan	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4,5-Trichlorophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2,4,6-Trichlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dichlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dimethylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dinitrophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2,4-Dinitrotoluene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,6-Dinitrotoluene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Chloronaphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Chlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Methylnaphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2-Nitrophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
3,3'-Dichlorobenzidine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
3-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4,6-Dinitro-2-Methylphenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4-Bromophenyl phenylether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chloro-3-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chloroaniline	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chlorophenyl-phenylether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4-Nitrophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Acenaphthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Acenaphthylene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(a)Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(a)Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Semivolatiles (ug/kg) (Cont)							
Benzo(b)Fluoranthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(g,h,i)Perylene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(k)Fluoanthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-chloroethoxy)Methane	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-chloroethyl)Ether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-Ethylhexyl)Phthalate	390 U	43 J	42 J	410 U	410 U	410 U	400 U
Butylbenzylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Carbazole	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Chrysene	390 U	410 U	410 U	410 U	410 U	410 U	400 U

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	Native Soil						
Sample ID	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
Sample Date	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Dibenz(a,h)Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Dibenzofuran	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Diethylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Dimethyl Phthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Di-n-butylphthalate	390 U	50 J	46 J	46 J	51 J	410 U	47 J
Di-n-octylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Fluoranthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Fluorene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorobutadiene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorocyclopentadiene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachloroethane	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Indeno(1,2,3-cd)Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Isophorone	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Naphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Nitrobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
N-Nitroso-Di-n-Propylamine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
N-Nitrosodiphenylamine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Pentachlorophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Phenanthrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Phenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SOIL
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	Native Soil						
Sample ID	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
Sample Date	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Pesticides/PCBs (ug/kg)							
4,4'-DDD	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
4,4'-DDE	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
4,4'-DDT	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Aldrin	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Aroclor-1016	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1221	80 U	83 U	84 UL	85 UL	84 U	86 UL	82 UL
Aroclor-1232	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1242	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1248	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1254	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1260	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Dieldrin	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endosulfan I	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Endosulfan II	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endosulfan Sulfate	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin Aldehyde	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin Ketone	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Heptachlor	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Heptachlor Epoxide	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Methoxychlor	20 U	21 U	21 UL	21 UL	21 U	22 UL	21 UL
Toxaphene	200 U	210 U	210 UL	210 UL	210 U	220 UL	210 UL
alpha-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
alpha-Chlordane	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
beta-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
delta-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
gamma-BHC (Lindane)	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
gamma-Chlordane	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL

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CHEATHAM ANNEX SITE

	Soil Composites					Fill Zone						
Sample ID	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
Sample Date	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Inorganics (mg/kg)												
Aluminum	6760 J	1E+05 J	12200 J	7180 J	NA	12300 L	8480 L	6160 L	9960 L	6650 L	5120 L	11800 L
Antimony	0.5 UL	0.52 UL	0.53 UL	0.45 UL	NA	0.84 B	0.69 B	2 B	12.7 U	0.46 B	11.9 U	11.6 U
Arsenic	2 L	12.6 L	13.4 L	3.2 L	NA	3.3	5	3	7.9	9.2	1.9 J	4.3
Barium	30.5 J	20.9 J	10.9 J	27.3 J	NA	53.1	35.8	32.2 J	31.7 J	31.6 J	26 J	44.5
Beryllium	0.4 J	0.1 J	1.3	0.72 J	NA	0.6 B	0.46 B	0.38 B	0.65 B	0.39 B	0.23 B	0.45 B
Cadmium	1.7 L	0.16 UL	0.41 UL	0.07 UL	NA	2.1 U	1.8 U	12.3	2.1 U	0.9 U	1 U	1 U
Calcium	1100 J	1770 J	455 J	63700 J	NA	36400	13100	732 J	1590	1150	885 J	1180
Chromium	35.9 J	33.5 J	69.1 J	19.4 J	NA	37.5	17.8	94.5	24.5	15.1	9.2	20.3
Cobalt	3.4 J	4.3 J	10.6 J	2.2 J	NA	4.1 J	4 J	3.4 J	5.5 J	3 J	2.7 J	3.8 J
Copper	74.2	5.8 J	8	2.3 J	NA	58.3	26.7	318	5.3 B	5.5 B	3.1 B	14.6
Cyanide	0.02 UL	0.03 UL	0.02 UL	0.02 UL	NA	0.6 UL	0.6 UL	0.95 J	0.6 UL	0.6 UL	0.6 UL	0.6 UL
Iron	14600 L	36300 L	99900 L	16300 L	NA	37500 L	25400 L	21100 L	24300 L	15000 L	10800 L	25800 L
Lead	62.8 L	14 L	16.1 L	9.3 L	NA	11.4	11.2	222	10.3	10.8	8	11.8
Magnesium	451 J	1280	623 J	2410	NA	2920	825 J	391 J	732 J	432 J	293 J	541 J
Manganese	94 J	97.7 J	44.8 J	85.9 J	NA	96.2	112	104	100	94.7	103	121
Mercury	0.02 U	0.03 U	0.03 B	0.03 U	NA	0.04 J	0.04 J	0.03 J	0.03 J	0.04 J	0.06 J	0.05 J
Nickel	10.9	11.6	20.5	5 J	NA	7.2 J	11.2	11.8	12.4	5.1 J	4.3 J	8.4
Potassium	379 J	1250	807 J	1910	NA	1120	666 J	312 J	852 J	429 J	332 J	676 J
Selenium	0.69 U	0.71 U	0.72 U	0.62 U	NA	1 U	0.9 U	1.1 U	1.1 U	0.9 U	1 U	1 U
Silver	8	9	23.4	3.2	NA	11	7 B	19.7	6.5 B	3.9 B	2.7 B	7.1 B
Sodium	50.9 B	58.6 B	63.9 B	356 J	NA	194 B	70.4 B	25.9 B	30.6 B	31.3 B	20.4 B	32.6 B
Thallium	0.55 U	0.79 J	3.1	0.49 U	NA	0.79 B	1.8 UL	0.64 B	2.1 UL	1.9 UL	2 UL	0.78 B
Vanadium	17.1	32	65	19.9	NA	29.7	23.9	15.4	31.4	20.9	16.8	36.9
Zinc	43.5 J	38 J	45.8 J	23.8 J	NA	120	69.9 B	127	44.8 B	60.4 B	23.7 B	96.2

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	Native Soil						
Sample ID	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
Sample Date	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Inorganics (mg/kg)							
Aluminum	9150 L	13700 L	16100 L	11400 L	12100 L	12900 L	11600 L
Antimony	0.51 U	0.51 UJ	0.63 J	0.81 B	0.64 B	0.5 B	0.84 B
Arsenic	9.4	4.2 L	36.5	36.1	16	16	21.2
Barium	30.7 J	26.6 J	50.2 J	66	17.2 J	17.5 J	29.7 J
Beryllium	0.59 B	0.9 B	1.3 J	0.81 B	0.96 J	0.92 J	0.97 J
Cadmium	0.08 U	0.16 U	0.17 U	0.08 UL	0.08 UL	0.08 UL	0.08 UL
Calcium	801 J	359	494 J	528 J	153 J	183 J	472 J
Chromium	23.3	60.3	44	43.3	34.8	38.8	29.8
Cobalt	3.8 J	6.6 J	10.2 J	4.6 J	5.8 J	6.3 J	9.2 J
Copper	4.6 B	137 J	6.5 B	5.6 B	6.8 B	6.2 B	134
Cyanide	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL
Iron	20700 L	38400 L	38800 L	24600	33800	36700	34300
Lead	8.3	14.6 J	12 J	16.2	9	9.1	12.6
Magnesium	456 J	1130 J	1530	1080 J	954 J	1020 J	844 J
Manganese	54.7	73.7 J	84.5 J	13.7	45.6	44.6	70.9
Mercury	0.04 J	0.03 U	0.03 U	0.03 B	0.05 B	0.03 B	0.07 J
Nickel	5.8 B	12.1	18.5	7.4 J	14.4	16.3	24.4
Potassium	711 J	1560	1820	1650	1270	1340	1130
Selenium	0.69 U	0.7 U	0.73 U	0.7 UL	0.69 UL	0.69 UL	0.67 UL
Silver	6.8 B	17.8 L	13 L	9 B	11.7 J	13.7 J	12 J
Sodium	18 B	38.5 B	57.5 B	25.9 B	39.5 B	33.9 B	36 B
Thallium	0.55 UL	0.84 L	0.58 UL	1.2 B	0.85 B	1.4 B	0.88 B
Vanadium	41.8	36.8 J	69.2 J	37.6	35.5	35.4	36.7
Zinc	17.9 B	42.5 B	52.4 B	42.8 B	39.8 B	47.9 B	61.4 B

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
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SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
VOLATILES (ug/kg)							
1,1,1-Trichloroethane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
1,1,2,2-Tetrachloroethane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
1,1,2-Trichloroethane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
1,1-Dichloroethane	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
1,1-Dichloroethene	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
1,2-Dichloroethane	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
1,2-Dichloroethene, total	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
1,2-Dichloropropane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
2-Butanone	12 UJ	12 U	15 U	13 U	14 U	14 UJ	12 U
2-Hexanone	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
4-Methyl-2-pentanone	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Acetone	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Benzene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Bromodichloromethane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Bromoform	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Bromomethane	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Carbon disulfide	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Carbon tetrachloride	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Chlorobenzene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Chloroethane	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Chloroform	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Chloromethane	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
cis-1,3-Dichloropropene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Dibromochloromethane	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Ethylbenzene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Methylene chloride	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Styrene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Tetrachloroethene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Toluene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
trans-1,3-Dichloropropene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Trichloroethene	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U
Vinyl chloride	12 U	12 U	15 U	13 U	14 U	14 UJ	12 U
Xylenes, total	12 UJ	12 UJ	15 U	13 U	14 U	14 UJ	12 U

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SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
SEMIVOLATILES (ug/kg)							
1,2,4-Trichlorobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
1,2-Dichlorobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
1,3-Dichlorobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
1,4-Dichlorobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,2'-oxybis(1-Chloropropane)	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,4,5-Trichlorophenol	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
2,4,6-Trichlorophenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,4-Dichlorophenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,4-Dimethylphenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,4-Dinitrophenol	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
2,4-Dinitrotoluene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2,6-Dinitrotoluene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2-Chloronaphthalene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2-Chlorophenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2-Methyl-4,6-dinitrophenol	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
2-Methylnaphthalene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2-Methylphenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
2-Nitroaniline	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
2-Nitrophenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
3,3'-Dichlorobenzidine	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
3-Nitroaniline	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
4-Bromophenyl phenyl ether	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
4-Chloro-3-methylphenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
4-Chloroaniline	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
4-Chlorophenyl phenyl ether	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
4-Methylphenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
4-Nitroaniline	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
4-Nitrophenol	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
Acenaphthene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Acenaphthylene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Anthracene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Benz[a]anthracene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Benzo[a]pyrene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ

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SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Benzo[b]fluoranthene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Benzo[ghi]perylene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Benzo[k]fluoranthene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Benzyl butyl phthalate	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
bis(2-Chloroethoxy)methane	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
bis(2-Chloroethyl) ether	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
bis(2-Ethylhexyl) phthalate	54 BJ	42 BJ	78 BJ	43 BJ	480 UJ	79 BJ	390 UJ
Carbazole	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Chrysene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Dibenz[a,h]anthracene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Dibenzofuran	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Diethyl phthalate	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Dimethyl phthalate	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Di-n-butyl phthalate	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Di-n-octyl phthalate	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Fluoranthene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Fluorene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Hexachlorobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Hexachlorobutadiene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Hexachlorocyclopentadiene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Hexachloroethane	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Indeno[1,2,3-cd]pyrene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Isophorone	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Naphthalene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Nitrobenzene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
N-Nitrosodi-n-propylamine	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
N-Nitrosodiphenylamine	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Pentachlorophenol	1000 UJ	1000 UJ	1300 UJ	1100 UJ	1200 UJ	1200 UJ	980 UJ
Phenanthrene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Phenol	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ
Pyrene	410 UJ	410 UJ	510 UJ	420 UJ	480 UJ	470 UJ	390 UJ

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SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
PESTICIDES/PCB (ug/kg)							
4,4'-DDD	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
4,4'-DDE	4.1 UJ	4.1 UJ	520 J	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
4,4'-DDT	4.1 UJ	4.1 UJ	640 J	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Aldrin	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
alpha-BHC	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
alpha-Chlordane	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
beta-BHC	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
delta-BHC	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
Dieldrin	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Endosulfan I	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
Endosulfan II	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Endosulfan sulfate	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Endrin	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Endrin aldehyde	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
Endrin ketone	4.1 UJ	4.1 UJ	51 UJ	4.2 UJ	4.8 UJ	4.7 UJ	3.9 UJ
gamma-BHC	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
gamma-Chlordane	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
Heptachlor	2 UJ	2 UJ	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
Heptachlor epoxide	2 UJ	4 J	25 UJ	2.1 UJ	2.4 UJ	2.3 UJ	2 UJ
Methoxychlor	20 UJ	20 UJ	250 UJ	21 UJ	24 UJ	23 UJ	20 UJ
Toxaphene	200 UJ	200 UJ	2500 UJ	210 UJ	240 UJ	230 UJ	200 UJ
Aroclor 1016	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ
Aroclor 1221	81 UJ	81 UJ	1000 UJ	84 UJ	95 UJ	94 UJ	78 UJ
Aroclor 1232	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ
Aroclor 1242	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ
Aroclor 1248	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ
Aroclor 1254	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ
Aroclor 1260	41 UJ	41 UJ	510 UJ	42 UJ	48 UJ	47 UJ	39 UJ

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SURFACE SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
EXPLOSIVES (ug/kg)							
1,3,5-Trinitrobenzene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
1,3-Dinitrobenzene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
2,4,6-Trinitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
2,4-Dinitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
2,6-Dinitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
2-Amino-4,6-dinitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
2-Nitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
3-Nitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
4-Amino-2,6-dinitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
4-Nitrotoluene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
HMX	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
Nitrobenzene	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
Nitroglycerine	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
RDX	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U
Tetryl	1200 U	1200 U	1500 U	1300 U	1400 U	1400 U	1200 U

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
AREA OF CONCERN 2 - DEXTROSE DUMP - SURFACE SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	SAMPLE ID	A2-HA01-00	A2-HA01-00D	A2-HA02-00	A2-DPB01-00	A2-DPB02-00	A2-DPB03-00	A2-DPB04-00
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
	INORGANICS (mg/kg)							
7429-90-5	Aluminum	6020	7300	6170	1890	5710	8500	5650
7440-36-0	Antimony	0.56 UL	0.74 L	0.72 UL	0.58 UL	0.68 UL	0.63 UL	0.55 UL
7440-38-2	Arsenic	11.1	14	6.6	3	3.5	20	5.5
7440-39-3	Barium	64.5	77.2	47.2 J	18.4 J	36.5 J	38.7 J	48.6
7440-41-7	Beryllium	0.55 J	0.64 J	0.43 J	0.14 J	0.2 J	0.77 J	0.43 J
7440-43-9	Cadmium	0.14 B	0.05 U	0.19 B	0.05 U	0.06 U	0.05 U	0.05 U
7440-70-2	Calcium	3190	2670	3070	989	1720	2700	2840
7440-47-3	Chromium	24.6	39	15.3	3.9	12.5	29.4	11.5
7440-48-4	Cobalt	4.1 J	5.6 J	4.2 J	1.5 U	2.4 J	6.1 J	2.8 J
7440-50-8	Copper	20.2	20.5	6.2	2.2 J	2.4 J	7.8	4
57-12-5	Cyanide	0.25 U	0.25 U	0.31 U	0.25 U	0.29 U	0.27 U	0.24 U
7439-89-6	Iron	22700	28600	14800	3180	13800	44000	15000
7439-92-1	Lead	57.1	104	89.9	13.3	8	29.3	20
7439-95-4	Magnesium	795	906	697	269	384	1050	553
7439-96-5	Manganese	240	238	176	62.7	152	169	170
7439-97-6	Mercury	0.11 B	0.13 B	0.96 J	1.8	1.4	1.2 J	1.3
7440-02-0	Nickel	10.6	12.5	6.9 J	2.3 U	4 J	12.1	5.6 J
7440-09-7	Potassium	708	871	710	204 J	455	1320	547
7782-49-2	Selenium	0.51 U	0.53 U	0.66 U	0.53 U	0.63 U	0.64 K	0.71 K
7440-22-4	Silver	0.23 U	0.24 U	0.3 U	0.24 U	0.28 U	0.26 U	0.23 U
7440-23-5	Sodium	133 J	127 J	158 J	106 J	138 J	130 J	134 J
7440-28-0	Thallium	0.27 U	0.28 U	0.33 U	0.28 U	0.32 U	0.31 U	0.26 U
7440-62-2	Vanadium	24.8	30.2	18.7	6 J	25.4	42.3	20.5
7440-66-6	Zinc	49.9	53.6	96.9	9.5	21.3	55.9	22.8

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FIELD INVESTIGATION REPORT
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	SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0
	VOLATILES (ug/kg)					
71-55-6	1,1,1-Trichloroethane	14 U	15 U	11 U	14 U	14 U
79-34-5	1,1,2,2-Tetrachloroethane	14 U	15 U	11 U	14 U	14 U
79-00-5	1,1,2-Trichloroethane	14 U	15 U	11 U	14 U	14 U
75-34-3	1,1-Dichloroethane	14 U	15 U	11 U	14 U	14 U
75-35-4	1,1-Dichloroethene	14 U	15 U	11 U	14 U	14 U
107-06-2	1,2-Dichloroethane	14 U	15 U	11 U	14 U	14 U
540-59-0	1,2-Dichloroethene, total	14 U	15 U	11 U	14 U	14 U
78-87-5	1,2-Dichloropropane	14 U	15 U	11 U	14 U	14 U
78-93-3	2-Butanone	14 U	15 U	11 U	14 U	14 U
591-78-6	2-Hexanone	14 U	15 U	11 U	14 U	14 U
108-10-1	4-Methyl-2-pentanone	14 U	15 U	11 U	14 U	14 U
67-64-1	Acetone	14 U	15 U	11 U	66	14 U
71-43-2	Benzene	14 U	15 U	11 U	14 U	14 U
75-27-4	Bromodichloromethane	14 U	15 U	11 U	14 U	14 U
75-25-2	Bromoform	14 U	15 U	11 U	14 U	14 U
74-83-9	Bromomethane	14 U	15 U	11 U	14 U	14 U
75-15-0	Carbon disulfide	14 U	15 U	11 U	14 U	14 U
56-23-5	Carbon tetrachloride	14 U	15 U	11 U	14 U	14 U
108-90-7	Chlorobenzene	14 U	15 U	11 U	14 U	14 U
75-00-3	Chloroethane	14 U	15 U	11 U	14 U	14 U
67-66-3	Chloroform	14 U	15 U	11 U	14 U	14 U
74-87-3	Chloromethane	14 U	15 U	11 U	14 U	14 U
10061-01-5	cis-1,3-Dichloropropene	14 U	15 U	11 U	14 U	14 U
124-48-1	Dibromochloromethane	14 U	15 U	11 U	14 U	14 U
100-41-4	Ethylbenzene	14 U	15 U	11 U	14 U	14 U
75-09-2	Methylene chloride	14 U	15 U	11 U	14 U	14 U
100-42-5	Styrene	14 U	15 U	11 U	14 U	14 U
127-18-4	Tetrachloroethene	14 U	15 U	11 U	14 U	14 U
108-88-3	Toluene	14 U	15 U	11 U	14 U	14 U
10061-02-6	trans-1,3-Dichloropropene	14 U	15 U	11 U	14 U	14 U
79-01-6	Trichloroethene	14 U	15 U	11 U	14 U	14 U
75-01-4	Vinyl chloride	14 U	15 U	11 U	14 U	14 U
1330-20-7	Xylenes, total	14 U	15 U	11 U	14 U	14 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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	SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0
	SEMIVOLATILES (ug/kg)					
120-82-1	1,2,4-Trichlorobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
95-50-1	1,2-Dichlorobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
541-73-1	1,3-Dichlorobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
106-46-7	1,4-Dichlorobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
108-60-1	2,2'-oxybis(1-Chloropropane)	460 UJ	490 UJ	370 UJ	480 UJ	460 R
95-95-4	2,4,5-Trichlorophenol	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
88-06-2	2,4,6-Trichlorophenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
120-83-2	2,4-Dichlorophenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
105-67-9	2,4-Dimethylphenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
51-28-5	2,4-Dinitrophenol	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
121-14-2	2,4-Dinitrotoluene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
606-20-2	2,6-Dinitrotoluene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
91-58-7	2-Chloronaphthalene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
95-57-8	2-Chlorophenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
534-52-1	2-Methyl-4,6-dinitrophenol	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
91-57-6	2-Methylnaphthalene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
95-48-7	2-Methylphenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
88-74-4	2-Nitroaniline	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
88-75-5	2-Nitrophenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
91-94-1	3,3'-Dichlorobenzidine	460 UJ	490 UJ	370 UJ	480 UJ	460 R
99-09-2	3-Nitroaniline	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
101-55-3	4-Bromophenyl phenyl ether	460 UJ	490 UJ	370 UJ	480 UJ	460 R
35421-08-0	4-Chloro-3-methylphenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
106-47-8	4-Chloroaniline	460 UJ	490 UJ	370 UJ	480 UJ	460 R
7005-72-3	4-Chlorophenyl phenyl ether	460 UJ	490 UJ	370 UJ	480 UJ	460 R
106-44-5	4-Methylphenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
100-01-6	4-Nitroaniline	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
100-02-7	4-Nitrophenol	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
83-32-9	Acenaphthene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
208-96-8	Acenaphthylene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
120-12-7	Anthracene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
56-55-3	Benz[a]anthracene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
50-32-8	Benzo[a]pyrene	460 UJ	490 UJ	370 UJ	480 UJ	460 R

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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	SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0
205-99-2	Benzo[b]fluoranthene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
191-24-2	Benzo[ghi]perylene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
207-08-9	Benzo[k]fluoranthene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
85-68-7	Benzyl butyl phthalate	460 UJ	490 UJ	370 UJ	480 UJ	460 R
111-91-1	bis(2-Chloroethoxy)methane	460 UJ	490 UJ	370 UJ	480 UJ	460 R
111-44-4	bis(2-Chloroethyl) ether	460 UJ	490 UJ	370 UJ	480 UJ	460 R
117-81-7	bis(2-Ethylhexyl) phthalate	460 UJ	53 BJ	41 BJ	480 UJ	460 R
86-74-8	Carbazole	460 UJ	490 UJ	370 UJ	480 UJ	460 R
218-01-9	Chrysene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
53-70-3	Dibenz[a,h]anthracene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
132-64-9	Dibenzofuran	460 UJ	490 UJ	370 UJ	480 UJ	460 R
84-66-2	Diethyl phthalate	460 UJ	490 UJ	370 UJ	480 UJ	460 R
131-11-3	Dimethyl phthalate	460 UJ	490 UJ	370 UJ	480 UJ	460 R
84-74-2	Di-n-butyl phthalate	460 UJ	490 UJ	370 UJ	480 UJ	460 R
117-84-0	Di-n-octyl phthalate	460 UJ	490 UJ	370 UJ	480 UJ	460 R
206-44-0	Fluoranthene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
86-73-7	Fluorene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
118-74-1	Hexachlorobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
87-68-3	Hexachlorobutadiene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
77-47-4	Hexachlorocyclopentadiene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
67-72-1	Hexachloroethane	460 UJ	490 UJ	370 UJ	480 UJ	460 R
193-39-5	Indeno[1,2,3-cd]pyrene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
78-59-1	Isophorone	460 UJ	490 UJ	370 UJ	480 UJ	460 R
91-20-3	Naphthalene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
98-95-3	Nitrobenzene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
621-64-7	N-Nitrosodi-n-propylamine	460 UJ	490 UJ	370 UJ	480 UJ	460 R
86-30-6	N-Nitrosodiphenylamine	460 UJ	490 UJ	370 UJ	480 UJ	460 R
87-86-5	Pentachlorophenol	1200 UJ	1200 UJ	920 UJ	1200 UJ	1200 R
85-01-8	Phenanthrene	460 UJ	490 UJ	370 UJ	480 UJ	460 R
108-95-2	Phenol	460 UJ	490 UJ	370 UJ	480 UJ	460 R
129-00-0	Pyrene	460 UJ	490 UJ	370 UJ	480 UJ	460 R

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
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	SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0
	PESTICIDES/PCB (ug/kg)					
72-54-8	4,4'-DDD	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
72-55-9	4,4'-DDE	4.6 UJ	4.9 UJ	120 J	4.8 UJ	4.6 UJ
50-29-3	4,4'-DDT	4.6 UJ	4.9 UJ	51 J	4.8 UJ	4.6 UJ
309-00-2	Aldrin	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
319-84-6	alpha-BHC	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
5103-71-9	alpha-Chlordane	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
319-85-7	beta-BHC	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
319-86-8	delta-BHC	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
60-57-1	Dieldrin	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
959-98-8	Endosulfan I	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
33213-65-9	Endosulfan II	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
1031-07-8	Endosulfan sulfate	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
72-20-8	Endrin	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
7421-93-4	Endrin aldehyde	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
53494-70-5	Endrin ketone	4.6 UJ	4.9 UJ	3.7 UJ	4.8 UJ	4.6 UJ
58-89-9	gamma-BHC	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
5103-74-2	gamma-Chlordane	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
76-44-8	Heptachlor	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
1024-57-3	Heptachlor epoxide	2.3 UJ	2.5 UJ	1.8 UJ	2.4 UJ	2.3 UJ
72-43-5	Methoxychlor	23 UJ	25 UJ	18 UJ	24 UJ	23 UJ
8001-35-2	Toxaphene	230 UJ	250 UJ	180 UJ	240 UJ	230 UJ
12674-11-2	Aroclor 1016	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ
11104-28-2	Aroclor 1221	93 UJ	98 UJ	73 UJ	95 UJ	93 UJ
11141-16-5	Aroclor 1232	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ
53469-21-9	Aroclor 1242	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ
12672-29-6	Aroclor 1248	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ
11097-69-1	Aroclor 1254	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ
11096-82-5	Aroclor 1260	46 UJ	49 UJ	37 UJ	48 UJ	46 UJ

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	SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15
	SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
	DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0
	EXPLOSIVES (ug/kg)					
99-35-4	1,3,5-Trinitrobenzene	1400 U	1500 U	1100 U	1400 U	1400 U
99-65-0	1,3-Dinitrobenzene	1400 U	1500 U	1100 U	1400 U	1400 U
118-96-7	2,4,6-Trinitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
121-14-2	2,4-Dinitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
606-20-2	2,6-Dinitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
35572-78-2	2-Amino-4,6-dinitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
88-72-2	2-Nitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
99-08-1	3-Nitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
19406-51-0	4-Amino-2,6-dinitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
99-99-0	4-Nitrotoluene	1400 U	1500 U	1100 U	1400 U	1400 U
2691-41-0	HMX	1400 U	1500 U	1100 U	1400 U	1400 U
98-95-3	Nitrobenzene	1400 U	1500 U	1100 U	1400 U	1400 U
55-63-0	Nitroglycerine	1400 U	1500 U	1100 U	1400 U	1400 U
121-82-4	RDX	1400 U	1500 U	1100 U	1400 U	1400 U
479-45-8	Tetryl	1400 U	1500 U	1100 U	1400 U	1400 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
VOLATILES (ug/kg)						
1,1,1-Trichloroethane	14 UL	13 U	11 UJ	13 U	11 U	13 U
1,1,2,2-Tetrachloroethane	14 UL	13 U	11 U	13 U	11 U	13 U
1,1,2-Trichloroethane	14 UL	13 U	11 UJ	13 U	11 U	13 U
1,1-Dichloroethane	14 UL	13 U	11 U	13 U	11 U	13 U
1,1-Dichloroethene	14 UL	13 U	11 U	13 U	11 U	13 U
1,2-Dichloroethane	14 UL	13 U	11 U	13 U	11 U	13 U
1,2-Dichloroethene, total	14 UL	13 U	11 U	13 U	11 U	13 U
1,2-Dichloropropane	14 UL	13 U	11 UJ	13 U	11 U	13 U
2-Butanone	14 UL	13 U	11 U	13 U	11 U	13 U
2-Hexanone	14 UL	13 U	11 U	13 U	11 U	13 U
4-Methyl-2-pentanone	14 UL	13 U	11 U	13 U	11 U	13 U
Acetone	14 UL	13 U	11 U	13 U	11 U	13 U
Benzene	14 UL	13 U	11 UJ	13 U	11 U	13 U
Bromodichloromethane	14 UL	13 U	11 UJ	13 U	11 U	13 U
Bromoform	14 UL	13 U	11 UJ	13 U	11 U	13 U
Bromomethane	14 UL	13 U	11 U	13 U	11 U	13 U
Carbon disulfide	14 UL	13 U	11 U	13 U	11 U	13 U
Carbon tetrachloride	14 UL	13 U	11 UJ	13 U	11 U	13 U
Chlorobenzene	14 UL	13 U	11 U	13 U	11 U	13 U
Chloroethane	14 UL	13 U	11 U	13 U	11 U	13 U
Chloroform	14 UL	13 U	11 U	13 U	11 U	13 U
Chloromethane	14 UL	13 U	11 U	13 U	11 U	13 U
cis-1,3-Dichloropropene	14 UL	13 U	11 UJ	13 U	11 U	13 U
Dibromochloromethane	14 UL	13 U	11 UJ	13 U	11 U	13 U
Ethylbenzene	14 UL	13 U	11 U	13 U	11 U	13 U
Methylene chloride	14 UL	13 U	11 U	13 U	11 U	13 U
Styrene	14 UL	13 U	11 U	13 U	11 U	13 U
Tetrachloroethene	14 UL	13 U	11 U	13 U	11 U	13 U
Toluene	14 UL	13 U	11 U	13 U	11 U	13 U
trans-1,3-Dichloropropene	14 UL	13 U	11 UJ	13 U	11 U	13 U
Trichloroethene	14 UL	13 U	11 UJ	13 U	11 U	13 U
Vinyl chloride	14 UL	13 U	11 U	13 U	11 U	13 U
Xylenes, total	14 UL	13 U	11 U	13 U	11 U	13 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FIELD INVESTIGATION REPORT
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SAMPLE ID	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
SEMIVOLATILES (ug/kg)						
1,2,4-Trichlorobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
1,2-Dichlorobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
1,3-Dichlorobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
1,4-Dichlorobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,2'-oxybis(1-Chloropropane)	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,4,5-Trichlorophenol	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
2,4,6-Trichlorophenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,4-Dichlorophenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,4-Dimethylphenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,4-Dinitrophenol	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
2,4-Dinitrotoluene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2,6-Dinitrotoluene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2-Chloronaphthalene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2-Chlorophenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2-Methyl-4,6-dinitrophenol	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
2-Methylnaphthalene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2-Methylphenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
2-Nitroaniline	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
2-Nitrophenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
3,3'-Dichlorobenzidine	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
3-Nitroaniline	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
4-Bromophenyl phenyl ether	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
4-Chloro-3-methylphenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
4-Chloroaniline	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
4-Chlorophenyl phenyl ether	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
4-Methylphenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
4-Nitroaniline	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
4-Nitrophenol	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
Acenaphthene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Acenaphthylene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Anthracene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Benz[a]anthracene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Benzo[a]pyrene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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SAMPLE ID	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
Benzo[b]fluoranthene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Benzo[ghi]perylene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Benzo[k]fluoranthene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Benzyl butyl phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
bis(2-Chloroethoxy)methane	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
bis(2-Chloroethyl) ether	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
bis(2-Ethylhexyl) phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Carbazole	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Chrysene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Dibenz[a,h]anthracene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Dibenzofuran	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Diethyl phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Dimethyl phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Di-n-butyl phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Di-n-octyl phthalate	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Fluoranthene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Fluorene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Hexachlorobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Hexachlorobutadiene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Hexachlorocyclopentadiene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Hexachloroethane	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Indeno[1,2,3-cd]pyrene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Isophorone	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Naphthalene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Nitrobenzene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
N-Nitrosodi-n-propylamine	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
N-Nitrosodiphenylamine	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Pentachlorophenol	1200 R	1100 UJ	940 UJ	1100 UJ	930 UL	1100 UJ
Phenanthrene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Phenol	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ
Pyrene	470 R	440 UJ	370 UJ	420 UJ	370 UL	430 UJ

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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SAMPLE ID	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
PESTICIDES/PCB (ug/kg)						
4,4'-DDD	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
4,4'-DDE	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
4,4'-DDT	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Aldrin	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
alpha-BHC	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
alpha-Chlordane	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
beta-BHC	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
delta-BHC	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
Dieldrin	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Endosulfan I	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
Endosulfan II	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Endosulfan sulfate	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Endrin	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Endrin aldehyde	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
Endrin ketone	4.7 UJ	4.4 UJ	3.7 UJ	4.2 UJ	3.7 UJ	4.3 UJ
gamma-BHC	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
gamma-Chlordane	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
Heptachlor	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
Heptachlor epoxide	2.3 UJ	2.2 UJ	1.9 UJ	2.1 UJ	1.9 UJ	2.2 UJ
Methoxychlor	23 UJ	22 UJ	19 UJ	21 UJ	19 UJ	22 UJ
Toxaphene	230 UJ	220 UJ	190 UJ	210 UJ	190 UJ	220 UJ
Aroclor 1016	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ
Aroclor 1221	94 UJ	88 UJ	75 UJ	84 UJ	74 UJ	87 UJ
Aroclor 1232	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ
Aroclor 1242	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ
Aroclor 1248	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ
Aroclor 1254	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ
Aroclor 1260	47 UJ	44 UJ	37 UJ	42 UJ	37 UJ	43 UJ

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
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SAMPLE ID	A2-DPB02-03	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	6.0 - 8.0	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
EXPLOSIVES (ug/kg)						
1,3,5-Trinitrobenzene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
1,3-Dinitrobenzene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
2,4,6-Trinitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
2,4-Dinitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
2,6-Dinitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
2-Amino-4,6-dinitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
2-Nitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
3-Nitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
4-Amino-2,6-dinitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
4-Nitrotoluene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
HMX	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
Nitrobenzene	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
Nitroglycerine	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
RDX	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U
Tetryl	1400 U	1300 U	1100 U	1300 U	1100 U	1300 U

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-HA01-02	A2-HA01-02D	A2-HA02-01	A2-DPB01-03	A2-DPB01-15	A2-DPB02-03
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-22-1998
DEPTH	1.0 - 2.0	1.0 - 2.0	0.5 - 1.0	6.0 - 8.0	30.0 - 32.0	6.0 - 8.0
INORGANICS (mg/kg)						
Aluminum	12500	11000	6450	5390	5210	5630
Antimony	1 L	0.96 L	0.5 UL	0.65 UL	0.71 L	1.3 L
Arsenic	30.8	31.1	4.9	7.6	9.2	24.7
Barium	33.5 J	32.5 J	35.3 J	9 J	38.3 J	22.4 J
Beryllium	0.96 J	0.85 J	0.36 J	0.48 J	0.46 J	0.7 J
Cadmium	0.34 J	0.3 J	0.06 B	0.05 U	0.33 J	0.29 J
Calcium	1690	1720	1290	499	156000	2580
Chromium	43.2	40.7	12.4	20.4	19.2	22.2
Cobalt	7 J	6.5 J	3.7 J	1.7 U	5.5 J	10.1 J
Copper	4.2	3.7	4.7	1.8 J	6.2	2.5 J
Cyanide	0.29 U	0.31 U	0.3 U	0.3 U	0.27 U	0.29 U
Iron	42000	38400	14700	9590	18500	29400
Lead	11.3	9.8	18.9	8.5	6.1	6.4
Magnesium	1510	1220	462	432	2620	566
Manganese	79.5	74.6	99.9	7.1	97	75.9
Mercury	0.08 B	0.89 J	1	1.2	0.61 U	0.63 J
Nickel	21.8	21.2	6.6 J	2.6 U	10.8	15.3
Potassium	1900	1320	474	594	2080	386
Selenium	0.68 K	0.63 U	0.46 U	0.6 U	0.56 U	0.6 U
Silver	0.27 U	0.29 U	0.21 U	0.27 U	0.25 U	0.27 U
Sodium	136 J	155 J	109 J	132 J	1460	141 J
Thallium	0.32 U	0.33 U	0.24 U	0.32 U	0.32 U	0.32 U
Vanadium	39.8	34.9	18.6	54.4	14.6	26.2
Zinc	49.9	47.4	49.8	7.3	37	45.8

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
AREA OF CONCERN 2 - DEXTROSE DUMP - SUBSURFACE SOIL
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NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
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SAMPLE ID	A2-DPB02-10	A2-DPB03-03	A2-DPB03-09	A2-DPB04-03	A2-DPB04-09
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-23-1998	10-23-1998
DEPTH	20.0 - 22.0	6.0 - 8.0	18.0 - 20.0	6.0 - 8.0	18.0 - 20.0
INORGANICS (mg/kg)					
Aluminum	2370	6680	2910	8030	4330
Antimony	0.62 L	0.55 L	0.66 L	0.5 UL	0.64 L
Arsenic	10.6	17.4	9.3	2.7	7.2
Barium	19.2 J	15.3 J	19.5 J	12.1 J	29.8 J
Beryllium	0.31 J	0.7 J	0.46 J	0.25 J	0.6 J
Cadmium	0.29 J	0.11 B	0.29 J	0.04 U	0.37 J
Calcium	152000	309	229000	1010	67000
Chromium	12.2	21.6	13.2	27.5	19.2
Cobalt	2.3 J	5.3 J	2.5 J	3.5 J	4.6 J
Copper	3.1	1.6 J	2.8	2 J	1 U
Cyanide	0.27 U	0.23 U	0.24 U	0.22 U	0.27 U
Iron	13800	24100	21600	11000	45300
Lead	2.8	5.2	2.1	3.7	3.8
Magnesium	2220	1320	3390	1180	2860
Manganese	43.1	54	46	12.6	134
Mercury	0.08 B	0.56 J	0.95 J	0.94 J	0.69 J
Nickel	5 J	9.8	4.8 J	4.5 J	6.5 J
Potassium	2080	1450	4720	1100	4520
Selenium	0.54 U	0.47 U	0.56 U	0.46 U	0.55 U
Silver	0.25 U	0.21 U	0.25 U	0.21 U	0.25 U
Sodium	974	106 J	1240	102 J	252
Thallium	0.3 U	0.25 U	0.3 U	0.26 U	0.29 UL
Vanadium	8.2 J	19.9	9.4 J	32.7	14.8
Zinc	21.4	32.7	19	17.9	32.1

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
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SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
VOLATILES (ug/L)					
1,1,1-Trichloroethane	10 U	10 UL	10 UL	10 UL	10 UL
1,1,2,2-Tetrachloroethane	10 U	10 UL	10 UL	10 UL	10 UL
1,1,2-Trichloroethane	10 U	10 UL	10 UL	10 UL	10 UL
1,1-Dichloroethane	10 U	10 UL	10 UL	10 UL	10 UL
1,1-Dichloroethene	10 U	10 UL	10 UL	10 UL	10 UL
1,2-Dichloroethane	10 U	10 UL	10 UL	10 UL	10 UL
1,2-Dichloroethene, total	10 U	10 UL	10 UL	10 UL	10 UL
1,2-Dichloropropane	10 U	10 UL	10 UL	10 UL	10 UL
2-Butanone	10 U	10 UL	10 UL	10 UL	10 UL
2-Hexanone	10 U	10 UL	10 UL	10 UL	10 UL
4-Methyl-2-pentanone	10 U	10 UL	10 UL	10 UL	10 UL
Acetone	10 U	10 UL	10 UL	10 UL	10 UL
Benzene	10 U	10 UL	10 UL	10 UL	10 UL
Bromodichloromethane	10 U	10 UL	10 UL	10 UL	10 UL
Bromoform	10 U	10 UL	10 UL	10 UL	10 UL
Bromomethane	10 U	10 UL	10 UL	10 UL	10 UL
Carbon disulfide	10 U	10 UL	10 UL	10 UL	10 UL
Carbon tetrachloride	10 U	10 UL	10 UL	10 UL	10 UL
Chlorobenzene	10 U	10 UL	10 UL	10 UL	10 UL
Chloroethane	10 U	10 UL	10 UL	10 UL	10 UL
Chloroform	10 U	10 UL	10 UL	10 UL	10 UL
Chloromethane	10 U	10 UL	10 UL	10 UL	10 UL
cis-1,3-Dichloropropene	10 U	10 UL	10 UL	10 UL	10 UL
Dibromochloromethane	10 U	10 UL	10 UL	10 UL	10 UL
Ethylbenzene	10 U	10 UL	10 UL	10 UL	10 UL
Methylene chloride	10 U	10 UL	10 UL	10 UL	10 UL
Styrene	10 U	10 UL	10 UL	10 UL	10 UL
Tetrachloroethene	10 U	10 UL	10 UL	10 UL	10 UL
Toluene	10 U	10 UL	10 UL	10 UL	10 UL
trans-1,3-Dichloropropene	10 U	10 UL	10 UL	10 UL	10 UL
Trichloroethene	10 U	10 UL	10 UL	10 UL	10 UL
Vinyl chloride	10 U	10 UL	10 UL	10 UL	10 UL
Xylenes, total	10 U	10 UL	10 UL	10 UL	10 UL

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
SEMIVOLATILES (ug/L)					
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2,2'-oxybis(1-Chloropropane)	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	25 U	25 U	25 U	25 U	25 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
2-Methyl-4,6-dinitrophenol	25 U	25 U	25 U	25 U	25 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	25 U	25 U	25 U	25 U	25 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	25 U	25 U	25 U	25 U	25 U
4-Bromophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl phenyl ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	25 U	25 U	25 U	25 U	25 U
4-Nitrophenol	25 U	25 U	25 U	25 U	25 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Benz[a]anthracene	10 U	10 U	10 U	10 U	10 U
SEMIVOLATILES (ug/L) (cont)					
Benzo[a]pyrene	10 U	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
Benzo[b]fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo[ghi]perylene	10 U	10 U	10 U	10 U	10 U
Benzo[k]fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzyl butyl phthalate	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl) ether	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl) phthalate	3 B	2 B	1 B	2 B	2 B
Carbazole	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
Dibenz[a,h]anthracene	10 U	10 U	10 U	10 U	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U
Diethyl phthalate	1 J	10 U	10 U	10 U	10 U
Dimethyl phthalate	10 U	10 U	10 U	10 U	10 U
Di-n-butyl phthalate	10 U	10 U	10 U	10 U	10 U
Di-n-octyl phthalate	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Indeno[1,2,3-cd]pyrene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
N-Nitrosodi-n-propylamine	10 U	10 U	10 U	10 U	10 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	25 U	25 U	25 U	25 U	25 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U
Phenol	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
PESTICIDES/PCB (ug/L)					
4,4'-DDD	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
4,4'-DDE	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
4,4'-DDT	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Aldrin	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
alpha-BHC	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
alpha-Chlordane	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
beta-BHC	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
delta-BHC	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
Dieldrin	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Endosulfan I	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
Endosulfan II	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Endosulfan sulfate	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Endrin	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Endrin aldehyde	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
Endrin ketone	0.1 UJ	0.1 UJ	0.1 UJ	0.1 R	0.1 R
gamma-BHC	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
gamma-Chlordane	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
Heptachlor	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
Heptachlor epoxide	0.05 UJ	0.05 UJ	0.05 UJ	0.05 R	0.05 R
Methoxychlor	0.5 UJ	0.5 UJ	0.5 UJ	0.5 R	0.5 R
Toxaphene	5 UJ	5 UJ	5 UJ	5 R	5 R
Aroclor 1016	1 UJ	1 UJ	1 UJ	1 R	1 R
Aroclor 1221	2 UJ	2 UJ	2 UJ	2 R	2 R
Aroclor 1232	1 UJ	1 UJ	1 UJ	1 R	1 R
Aroclor 1242	1 UJ	1 UJ	1 UJ	1 R	1 R
Aroclor 1248	1 UJ	1 UJ	1 UJ	1 R	1 R
Aroclor 1254	1 UJ	1 UJ	1 UJ	1 R	1 R
Aroclor 1260	1 UJ	1 UJ	1 UJ	1 R	1 R

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
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SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
EXPLOSIVES (ug/L)					
1,3,5-Trinitrobenzene	1 U	1 U	1 U	1 U	1 U
1,3-Dinitrobenzene	1 U	1 U	1 U	1 U	1 U
2,4,6-Trinitrotoluene	1 U	1 U	1 U	1 U	1 U
2,4-Dinitrotoluene	1 U	1 U	1 U	1 U	1 U
2,6-Dinitrotoluene	1 U	1 U	1 U	1 U	1 U
2-Amino-4,6-dinitrotoluene	1 U	1 U	1 U	1 U	1 U
2-Nitrotoluene	1 U	1 U	1 U	1 U	1 U
3-Nitrotoluene	1 U	1 U	1 U	1 U	1 U
4-Amino-2,6-dinitrotoluene	1 U	1 U	1 U	1 U	1 U
4-Nitrotoluene	1 U	1 U	1 U	1 U	1 U
HMX	1 U	1 U	1 U	1 U	1 U
Nitrobenzene	1 U	1 U	1 U	1 U	1 U
Nitroglycerine	1 U	1 U	1 U	1 U	1 U
RDX	1 U	1 U	1 U	1 U	1 U
Tetryl	1 U	1 U	1 U	1 U	1 U

ANALYTICAL SUMMARY OF UNFILTERED INORGANIC CONSTITUENTS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPW01	A2-DPW02	A2-DPW03	A2-DPW03D	A2-DPW04
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
UNFILTERED INORGANICS (ug/L)					
Aluminum	189000	59300	2110	2210	96700
Antimony	13.8	7.7	2.4 U	2.4 U	11.3
Arsenic	181	89.9	3.7 J	5.1 J	430
Barium	510	195 J	36.5 J	38.3 J	275
Beryllium	9.6	3.3 J	0.2 U	0.2 U	5.7
Cadmium	8.7	5.9	4.3 U	4.3 U	6.5
Calcium	2520000	722000	153000	160000	1230000
Chromium	595	229	9.6 J	10	364
Cobalt	73.7	32.2 J	6.3 U	6.3 U	45.6 J
Copper	99.5	37	4.1 U	4.1 U	45.9
Cyanide	10 U	10 U	10 U	10 U	10 U
Iron	380000	133000	5550	5630	262000
Lead	94.6	36.1	1 U	1.2 B	53.7
Magnesium	51900	17900	2270	2340	31800
Manganese	1360	394	36.7	37.5	684
Mercury	0.15 B	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	170	70.7	9.6 U	9.6 U	109
Potassium	55400	18800	1780 J	1710 J	36500
Selenium	2.2 U	4.6 K	2.2 U	2.9 K	2.2 U
Silver	1 U	1 U	1 U	1 U	1 U
Sodium	18900	12600	7190	7290	13100
Thallium	1.2 L	2 J	1.2 U	1.2 U	1.2 U
Vanadium	417	205	6.1 J	4.8 J	309
Zinc	667	264	13.5 J	13.3 J	424

ANALYTICAL SUMMARY OF FILTERED INORGANIC CONSTITUENTS
AREA OF CONCERN 2 - DEXTROSE DUMP - GROUNDWATER
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

SAMPLE ID	A2-DPW01F	A2-DPW02F	A2-DPW03F	A2-DPW03DF	A2-DPW04F
SAMPLE DATE	10-22-1998	10-22-1998	10-22-1998	10-22-1998	10-23-1998
FILTERED INORGANICS (ug/L)					
Aluminum	210	172 J	167 J	193 J	159 J
Antimony	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U
Arsenic	2.4 J	3.6 J	1.8 U	1.8 U	5.5 J
Barium	35.2 J	36.4 J	27.3 J	27 J	23.2 J
Beryllium	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Cadmium	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U
Calcium	158000	143000	132000	132000	133000
Chromium	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
Cobalt	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U
Copper	4.1 U	4.2 J	4.1 U	4.5 J	6.5 J
Iron	56.6 J	53.2 J	92.7 J	86.2 J	208
Lead	1 B	1.5 B	1 U	1.7 B	1.9 B
Magnesium	2240	3730	1600	1620	1710
Manganese	164	317	24.1	23.8	25
Mercury	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nickel	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
Potassium	1000 J	2060 J	869 J	861 J	1060 J
Selenium	2.2 U	7.5 K	2.2 U	2.2 U	2.2 U
Silver	1 U	1 U	1 U	1 U	1 U
Sodium	6980	9840	7040	6910	6080
Thallium	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Vanadium	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Zinc	7.1 J	8 J	6.8 U	11.8 J	7.5 J

	Soil Composites					
	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F
	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999
Volatiles (ug/kg)						
1,1,1-Trichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,1,2,2-Tetrachloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,1,2-Trichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,1-Dichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,1-Dichloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,2-Dichloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,2-Dichloroethene (total)	11 U	14 U	12 U	11 U	12.5 U	14.12 U
1,2-Dichloropropane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
2-Butanone	5 J	7 J	12 U	11 U	12.5 U	14.12 U
2-Hexanone	11 U	14 U	12 U	11 U	12.5 U	14.12 U
4-Methyl-2-Pentanone	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Acetone	6 B	8 B	3 B	8 BJ	30 B	35 B
Benzene	11 J	14 U	12 U	11 U	3 J	14.12 U
Bromodichloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Bromoform	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Bromomethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Carbon Disulfide	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Carbon Tetrachloride	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Chlorobenzene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Chloroethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Chloroform	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Chloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Dibromochloromethane	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Ethylbenzene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Methylene Chloride	10 B	15 B	11 B	10 B	21 B	12 B
Styrene	11 U	5 J	12 U	11 U	12.5 U	14.12 U
Tetrachloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Toluene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Trichloroethene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Vinyl Chloride	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Xylene (Total)	11 U	14 U	12 U	11 U	12.5 U	14.12 U
cis-1,3-Dichloropropene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
trans-1,3-Dichloropropene	11 U	14 U	12 U	11 U	12.5 U	14.12 U
Semivolatiles (ug/kg)						
1,2,4-Trichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U
1,2-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U
1,3-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U
1,4-Dichlorobenzene	380 U	440 U	410 U	370 U	NA	800 U
2,2'-oxybis(1-Chloropropan	380 U	440 U	410 U	370 U	NA	800 U
2,4,5-Trichlorophenol	960 U	1100 U	1000 U	930 U	NA	2000 U
2,4,6-Trichlorophenol	380 U	440 U	410 U	370 U	NA	800 U
2,4-Dichlorophenol	380 U	440 U	410 U	370 U	NA	800 U
2,4-Dimethylphenol	380 U	440 U	410 U	370 U	NA	800 U
2,4-Dinitrophenol	960 U	1100 U	1000 U	930 U	NA	2000 U
2,4-Dinitrotoluene	380 U	440 U	410 U	370 U	NA	800 U
2,6-Dinitrotoluene	380 U	440 U	410 U	370 U	NA	800 U
2-Chloronaphthalene	380 U	440 U	410 U	370 U	NA	800 U
2-Chlorophenol	380 U	440 U	410 U	370 U	NA	800 U
2-Methylnaphthalene	380 U	440 U	410 U	370 U	NA	800 U
2-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U
2-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U
2-Nitrophenol	380 U	440 U	410 U	370 U	NA	800 U
3,3'-Dichlorobenzidine	380 U	440 U	410 U	370 U	NA	800 U
3-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U
4,6-Dinitro-2-Methylphenol	960 U	1100 U	1000 U	930 U	NA	2000 U
4-Bromophenyl phenylether	380 U	440 U	410 U	370 U	NA	800 U
4-Chloro-3-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U
4-Chloroaniline	380 U	440 U	410 U	370 U	NA	800 U
4-Chlorophenyl-phenylether	380 U	440 U	410 U	370 U	NA	800 U
4-Methylphenol	380 U	440 U	410 U	370 U	NA	800 U

	Soil Composites					
	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F
	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999
4-Nitroaniline	960 U	1100 U	1000 U	930 U	NA	2000 U
4-Nitrophenol	960 U	1100 U	1000 U	930 U	NA	2000 U
Acenaphthene	380 U	440 U	410 U	370 U	NA	800 U
Acenaphthylene	380 U	440 U	410 U	370 U	NA	800 U
Anthracene	380 U	440 U	410 U	370 U	NA	800 U
Benzo(a)Anthracene	380 U	440 U	410 U	370 U	NA	800 U
Benzo(a)Pyrene	380 U	440 U	410 U	370 U	NA	800 U
Benzo(b)Fluoranthene	380 U	440 U	410 U	42 J	NA	800 U
Benzo(g,h,i)Perylene	380 U	440 U	410 U	370 U	NA	800 U
Benzo(k)Fluoanthene	380 U	440 U	410 U	370 U	NA	800 U
Bis(2-chloroethoxy)Methane	380 U	440 U	410 U	370 U	NA	800 U
Bis(2-chloroethyl)Ether	380 U	440 U	410 U	370 U	NA	800 U
Bis(2-Ethylhexyl)Phthalate	63 J	110 J	410 U	370 U	NA	800 U
Butylbenzylphthalate	380 U	440 U	410 U	370 U	NA	800 U
Carbazole	380 U	440 U	410 U	370 U	NA	800 U
Chrysene	380 U	440 U	410 U	41 J	NA	800 U
Dibenz(a,h)Anthracene	380 U	440 U	410 U	370 U	NA	800 U
Dibenzofuran	380 U	440 U	410 U	370 U	NA	800 U
Diethylphthalate	380 U	440 U	410 U	370 U	NA	800 U
Dimethyl Phthalate	380 U	440 U	410 U	370 U	NA	800 U
Di-n-butylphthalate	40 B	440 U	410 U	44 J	NA	800 U
Di-n-octylphthalate	380 U	440 U	410 U	370 U	NA	800 U
Fluoranthene	380 U	440 U	410 U	52 J	NA	800 U
Fluorene	380 U	440 U	410 U	370 U	NA	800 U
Hexachlorobenzene	380 U	440 U	410 U	370 U	NA	800 U
Hexachlorobutadiene	380 U	440 U	410 U	370 U	NA	800 U
Hexachlorocyclopentadiene	380 U	440 U	410 U	370 U	NA	800 U
Hexachloroethane	380 U	440 U	410 U	370 U	NA	800 U
Indeno(1,2,3-cd)Pyrene	380 U	440 U	410 U	370 U	NA	800 U
Isophorone	380 U	440 U	410 U	370 U	NA	800 U
Naphthalene	380 U	440 U	410 U	370 U	NA	800 U
Nitrobenzene	380 U	440 U	410 U	370 U	NA	800 U
N-Nitroso-Di-n-Propylamine	380 U	440 U	410 U	370 U	NA	800 U
N-Nitrosodiphenylamine	380 U	440 U	410 U	370 U	NA	800 U
Pentachlorophenol	960 U	1100 U	1000 U	930 U	NA	2000 U
Phenanthrene	380 U	440 U	410 U	370 U	NA	800 U
Phenol	380 U	440 U	410 U	370 U	NA	800 U
Pyrene	380 U	440 U	410 U	58 J	NA	800 U
Pest/PCB (ug/kg)						
4,4'-DDD	3.8 U	4.4 U	4.1 U	18	NA	4 UL
4,4'-DDE	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL
4,4'-DDT	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL
Aldrin	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
Aroclor-1016	38 U	44 U	41 U	36 U	NA	40 UL
Aroclor-1221	78 U	90 U	82 U	73 U	NA	81 UL
Aroclor-1232	38 U	44 U	41 U	36 U	NA	40 UL
Aroclor-1242	38 U	44 U	41 U	36 U	NA	40 UL
Aroclor-1248	38 U	44 U	41 U	36 U	NA	40 UL
Aroclor-1254	38 U	44 U	41 U	36 U	NA	40 UL
Aroclor-1260	38 U	44 U	41 U	350	NA	200
Dieldrin	3.8 U	4.4 U	4.1 U	9.6 J	NA	4 UL
Endosulfan I	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
Endosulfan II	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL
Endosulfan Sulfate	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL
Endrin	3.8 U	4.4 U	4.1 U	3.6 U	NA	4 UL
Endrin Aldehyde	3.8 U	4.4 U	4.1 U	4.1 J	NA	4 UL
Endrin Ketone	3.8 U	4.4 U	4.1 U	9.5 J	NA	4 UL
Heptachlor	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
Heptachlor Epoxide	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
Methoxychlor	20 U	23 U	21 U	19 U	NA	21 UL
Toxaphene	200 U	230 U	210 U	190 U	NA	210 UL

	Soil Composites					
	A2-CS01	A2-CS02	A2-CS03	A2-CS04	A2-TPCOMP-01	A2-TP01-F
	02/03/2000	02/03/2000	02/03/2000	02/04/2000	11/14/1999	11/12/1999
alpha-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
alpha-Chlordane	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
beta-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
delta-BHC	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
gamma-BHC (Lindane)	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
gamma-Chlordane	2 U	2.3 U	2.1 U	1.9 U	NA	2.1 UL
Inorganics (mg/kg)						
Aluminum	6760 J	147000 J	12200 J	7180 J	NA	12300 L
Antimony	0.5 UL	0.52 UL	0.53 UL	0.45 UL	NA	0.84 B
Arsenic	2 L	12.6 L	13.4 L	3.2 L	NA	3.3
Barium	30.5 J	20.9 J	10.9 J	27.3 J	NA	53.1
Beryllium	0.4 J	0.1 J	1.3	0.72 J	NA	0.6 B
Cadmium	1.7 L	0.16 UL	0.41 UL	0.07 UL	NA	2.1 U
Calcium	1100 J	1770 J	455 J	63700 J	NA	36400
Chromium	35.9 J	33.5 J	69.1 J	19.4 J	NA	37.5
Cobalt	3.4 J	4.3 J	10.6 J	2.2 J	NA	4.1 J
Copper	74.2	5.8 J	8	2.3 J	NA	58.3
Cyanide	0.02 UL	0.03 UL	0.02 UL	0.02 UL	NA	0.6 UL
Iron	14600 L	36300 L	99900 L	16300 L	NA	37500 L
Lead	62.8 L	14 L	16.1 L	9.3 L	NA	11.4
Magnesium	451 J	1280	623 J	2410	NA	2920
Manganese	94 J	97.7 J	44.8 J	85.9 J	NA	96.2
Mercury	0.02 U	0.03 U	0.03 B	0.03 U	NA	0.04 J
Nickel	10.9	11.6	20.5	5 J	NA	7.2 J
Potassium	379 J	1250	807 J	1910	NA	1120
Selenium	0.69 U	0.71 U	0.72 U	0.62 U	NA	1 U
Silver	8	9	23.4	3.2	NA	11
Sodium	50.9 B	58.6 B	63.9 B	356 J	NA	194 B
Thallium	0.55 U	0.79 J	3.1	0.49 U	NA	0.79 B
Vanadium	17.1	32	65	19.9	NA	29.7
Zinc	43.5 J	38 J	45.8 J	23.8 J	NA	120

	Fill Zone					
	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Volatiles (ug/kg)						
1,1,1-Trichloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1,2,2-Tetrachloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1,2-Trichloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1-Dichloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,1-Dichloroethene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloroethene (total)	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
1,2-Dichloropropane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
2-Butanone	4 B	11.9 U	5 B	11.79 U	12.15 UL	12.82 U
2-Hexanone	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
4-Methyl-2-Pentanone	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Acetone	12.17 U	5 B	17 B	17 B	12.15 UL	12 B
Benzene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromodichloromethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromoform	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Bromomethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Carbon Disulfide	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Carbon Tetrachloride	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chlorobenzene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloroethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloroform	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Chloromethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Dibromochloromethane	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Ethylbenzene	12.17 U	11.9 U	11.5 U	11.79 U	10 J	12.82 U
Methylene Chloride	5 B	13 B	7 B	8 B	28 B	11 B
Styrene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Tetrachloroethene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Toluene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Trichloroethene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Vinyl Chloride	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Xylene (Total)	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
cis-1,3-Dichloropropene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
trans-1,3-Dichloropropene	12.17 U	11.9 U	11.5 U	11.79 U	12.15 UL	12.82 U
Semivolatiles (ug/kg)						
1,2,4-Trichlorobenzene	420 U	390 U	400 U	400 U	390 U	420 U
1,2-Dichlorobenzene	420 U	390 U	400 U	400 U	390 U	420 U
1,3-Dichlorobenzene	420 U	390 U	400 U	400 U	390 U	420 U
1,4-Dichlorobenzene	420 U	390 U	400 U	400 U	390 U	420 U
2,2'-oxybis(1-Chloropropan	420 U	390 U	400 U	400 U	390 U	420 U
2,4,5-Trichlorophenol	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2,4,6-Trichlorophenol	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dichlorophenol	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dimethylphenol	420 U	390 U	400 U	400 U	390 U	420 U
2,4-Dinitrophenol	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2,4-Dinitrotoluene	420 U	390 U	400 U	400 U	390 U	420 U
2,6-Dinitrotoluene	420 U	390 U	400 U	400 U	390 U	420 U
2-Chloronaphthalene	420 U	390 U	400 U	400 U	390 U	420 U
2-Chlorophenol	420 U	390 U	400 U	400 U	390 U	420 U
2-Methylnaphthalene	420 U	390 U	400 U	400 U	390 U	420 U
2-Methylphenol	420 U	390 U	400 U	400 U	390 U	420 U
2-Nitroaniline	1000 U	990 U	1000 U	1000 U	990 U	1100 U
2-Nitrophenol	420 U	390 U	400 U	400 U	390 U	420 U
3,3'-Dichlorobenzidine	420 U	390 U	400 U	400 U	390 U	420 U
3-Nitroaniline	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4,6-Dinitro-2-Methylphenol	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4-Bromophenyl phenylether	420 U	390 U	400 U	400 U	390 U	420 U
4-Chloro-3-Methylphenol	420 U	390 U	400 U	400 U	390 U	420 U
4-Chloroaniline	420 U	390 U	400 U	400 U	390 U	420 U
4-Chlorophenyl-phenylether	420 U	390 U	400 U	400 U	390 U	420 U
4-Methylphenol	420 U	390 U	400 U	400 U	390 U	420 U

	Fill Zone					
	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
4-Nitroaniline	1000 U	990 U	1000 U	1000 U	990 U	1100 U
4-Nitrophenol	1000 UJ	990 UJ	1000 U	1000 U	990 U	1100 U
Acenaphthene	420 U	390 U	400 U	400 U	390 U	420 U
Acenaphthylene	420 U	390 U	400 U	400 U	390 U	420 U
Anthracene	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(a)Anthracene	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(a)Pyrene	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(b)Fluoranthene	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(g,h,i)Perylene	420 U	390 U	400 U	400 U	390 U	420 U
Benzo(k)Fluoanthene	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-chloroethoxy)Methane	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-chloroethyl)Ether	420 U	390 U	400 U	400 U	390 U	420 U
Bis(2-Ethylhexyl)Phthalate	56 J	44 J	2500	660	150 J	420 U
Butylbenzylphthalate	420 U	390 U	400 U	400 U	390 U	420 U
Carbazole	420 U	390 U	400 U	400 U	390 U	420 U
Chrysene	420 U	390 U	400 U	400 U	390 U	420 U
Dibenz(a,h)Anthracene	420 U	390 U	400 U	400 U	390 U	420 U
Dibenzofuran	420 U	390 U	400 U	400 U	390 U	420 U
Diethylphthalate	420 U	390 U	400 U	400 U	390 U	420 U
Dimethyl Phthalate	420 U	390 U	400 U	400 U	390 U	420 U
Di-n-butylphthalate	76 J	65 J	68 J	79 J	65 J	420 U
Di-n-octylphthalate	420 U	390 U	400 U	400 U	390 U	420 U
Fluoranthene	420 U	390 U	400 U	400 U	390 U	420 U
Fluorene	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorobenzene	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorobutadiene	420 U	390 U	400 U	400 U	390 U	420 U
Hexachlorocyclopentadiene	420 U	390 U	400 U	400 U	390 U	420 U
Hexachloroethane	420 U	390 U	400 U	400 U	390 U	420 U
Indeno(1,2,3-cd)Pyrene	420 U	390 U	400 U	400 U	390 U	420 U
Isophorone	420 U	390 U	400 U	400 U	390 U	420 U
Naphthalene	420 U	390 U	400 U	400 U	390 U	420 U
Nitrobenzene	420 U	390 U	400 U	400 U	390 U	420 U
N-Nitroso-Di-n-Propylamine	420 U	390 U	400 U	400 U	390 U	420 U
N-Nitrosodiphenylamine	420 U	390 U	400 U	400 U	390 U	420 U
Pentachlorophenol	1000 U	990 U	1000 U	1000 U	990 U	1100 U
Phenanthrene	420 U	390 U	400 U	400 U	390 U	420 U
Phenol	420 U	390 U	400 U	400 U	390 U	420 U
Pyrene	420 U	390 U	400 U	400 U	390 U	420 U
Pest/PCB (ug/kg)						
4,4'-DDD	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
4,4'-DDE	5.4 J	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
4,4'-DDT	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Aldrin	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Aroclor-1016	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1221	85 U	80 UL	82 UL	80 UL	79 UL	85 UL
Aroclor-1232	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1242	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1248	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1254	42 U	39 UL	40 UL	40 UL	39 UL	42 UL
Aroclor-1260	310	39 UL	40 UL	40 UL	39 UL	42 UL
Dieldrin	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endosulfan I	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Endosulfan II	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endosulfan Sulfate	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin Aldehyde	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Endrin Ketone	4.2 U	3.9 UL	4 UL	4 UL	3.9 UL	4.2 UL
Heptachlor	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Heptachlor Epoxide	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Methoxychlor	22 U	20 UL	21 UL	20 UL	20 UL	22 UL
Toxaphene	220 U	200 UL	210 UL	200 UL	200 UL	220 UL

	Fill Zone					
	A2-TP01-FD	A2-TP02-F	A2-TP03-F	A2-TP04-F	A2-TP05-F	A2-TP06-F
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
alpha-BHC	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
alpha-Chlordane	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
beta-BHC	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
delta-BHC	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
gamma-BHC (Lindane)	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
gamma-Chlordane	2.2 U	2 UL	2.1 UL	2 UL	2 UL	2.2 UL
Inorganics (mg/kg)						
Aluminum	8480 L	6160 L	9960 L	6650 L	5120 L	11800 L
Antimony	0.69 B	2 B	12.7 U	0.46 B	11.9 U	11.6 U
Arsenic	5	3	7.9	9.2	1.9 J	4.3
Barium	35.8	32.2 J	31.7 J	31.6 J	26 J	44.5
Beryllium	0.46 B	0.38 B	0.65 B	0.39 B	0.23 B	0.45 B
Cadmium	1.8 U	12.3	2.1 U	0.9 U	1 U	1 U
Calcium	13100	732 J	1590	1150	885 J	1180
Chromium	17.8	94.5	24.5	15.1	9.2	20.3
Cobalt	4 J	3.4 J	5.5 J	3 J	2.7 J	3.8 J
Copper	26.7	318	5.3 B	5.5 B	3.1 B	14.6
Cyanide	0.6 UL	0.95 J	0.6 UL	0.6 UL	0.6 UL	0.6 UL
Iron	25400 L	21100 L	24300 L	15000 L	10800 L	25800 L
Lead	11.2	222	10.3	10.8	8	11.8
Magnesium	825 J	391 J	732 J	432 J	293 J	541 J
Manganese	112	104	100	94.7	103	121
Mercury	0.04 J	0.03 J	0.03 J	0.04 J	0.06 J	0.05 J
Nickel	11.2	11.8	12.4	5.1 J	4.3 J	8.4
Potassium	666 J	312 J	852 J	429 J	332 J	676 J
Selenium	0.9 U	1.1 U	1.1 U	0.9 U	1 U	1 U
Silver	7 B	19.7	6.5 B	3.9 B	2.7 B	7.1 B
Sodium	70.4 B	25.9 B	30.6 B	31.3 B	20.4 B	32.6 B
Thallium	1.8 UL	0.64 B	2.1 UL	1.9 UL	2 UL	0.78 B
Vanadium	23.9	15.4	31.4	20.9	16.8	36.9
Zinc	69.9 B	127	44.8 B	60.4 B	23.7 B	96.2

	Native Soil						
	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
Volatiles (ug/kg)							
1,1,1-Trichloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,1,2,2-Tetrachloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,1,2-Trichloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,1-Dichloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,1-Dichloroethene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,2-Dichloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,2-Dichloroethene (total)	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
1,2-Dichloropropane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
2-Butanone	7 B	10 UL	5 B	4 B	3 B	10 UL	10 UL
2-Hexanone	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
4-Methyl-2-Pentanone	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Acetone	9 B	14 B	6 B	6 B	6 B	17 B	36 B
Benzene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Bromodichloromethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Bromoform	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Bromomethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Carbon Disulfide	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Carbon Tetrachloride	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Chlorobenzene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Chloroethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Chloroform	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Chloromethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Dibromochloromethane	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Ethylbenzene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	0.7
Methylene Chloride	6 B	37 B	9 B	9 B	9 B	34	27
Styrene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	4
Tetrachloroethene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Toluene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Trichloroethene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Vinyl Chloride	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Xylene (Total)	12.4 U	10 UL	12.6 U	1 J	2 J	2	2
cis-1,3-Dichloropropene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
trans-1,3-Dichloropropene	12.4 U	10 UL	12.6 U	12.242 U	13 U	10 UL	10 UL
Semivolatiles (ug/kg)							
1,2,4-Trichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,2-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,3-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
1,4-Dichlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,2'-oxybis(1-Chloropropan	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4,5-Trichlorophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2,4,6-Trichlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dichlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dimethylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,4-Dinitrophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2,4-Dinitrotoluene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2,6-Dinitrotoluene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Chloronaphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Chlorophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Methylnaphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
2-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
2-Nitrophenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
3,3'-Dichlorobenzidine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
3-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4,6-Dinitro-2-Methylphenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4-Bromophenyl phenylether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chloro-3-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chloroaniline	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Chlorophenyl-phenylether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
4-Methylphenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U

	Native Soil						
	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
4-Nitroaniline	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
4-Nitrophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Acenaphthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Acenaphthylene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(a)Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(a)Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(b)Fluoranthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(g,h,i)Perylene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Benzo(k)Fluoanthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-chloroethoxy)Methane	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-chloroethyl)Ether	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Bis(2-Ethylhexyl)Phthalate	390 U	43 J	42 J	410 U	410 U	410 U	400 U
Butylbenzylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Carbazole	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Chrysene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Dibenz(a,h)Anthracene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Dibenzofuran	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Diethylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Dimethyl Phthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Di-n-butylphthalate	390 U	50 J	46 J	46 J	51 J	410 U	47 J
Di-n-octylphthalate	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Fluoranthene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Fluorene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorobutadiene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachlorocyclopentadiene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Hexachloroethane	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Indeno(1,2,3-cd)Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Isophorone	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Naphthalene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Nitrobenzene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
N-Nitroso-Di-n-Propylamine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
N-Nitrosodiphenylamine	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Pentachlorophenol	990 U	1000 U	1000 U	1000 U	1000 U	1000 U	1000 U
Phenanthrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Phenol	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Pyrene	390 U	410 U	410 U	410 U	410 U	410 U	400 U
Pest/PCB (ug/kg)							
4,4'-DDD	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
4,4'-DDE	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
4,4'-DDT	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Aldrin	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Aroclor-1016	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1221	80 U	83 U	84 UL	85 UL	84 U	86 UL	82 UL
Aroclor-1232	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1242	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1248	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1254	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Aroclor-1260	39 U	41 U	41 UL	42 UL	41 U	42 UL	40 UL
Dieldrin	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endosulfan I	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Endosulfan II	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endosulfan Sulfate	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin Aldehyde	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Endrin Ketone	3.9 U	4.1 U	4.1 UL	4.2 UL	4.1 U	4.2 UL	4 UL
Heptachlor	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Heptachlor Epoxide	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Methoxychlor	20 U	21 U	21 UL	21 UL	21 U	22 UL	21 UL
Toxaphene	200 U	210 U	210 UL	210 UL	210 U	220 UL	210 UL

	Native Soil						
	A2-TP01-N	A2-TP02-N	A2-TP03-N	A2-TP04-N	A2-TP05-N	A2-TP05-ND	A2-TP06-N
	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999	11/12/1999
alpha-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
alpha-Chlordane	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
beta-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
delta-BHC	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
gamma-BHC (Lindane)	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
gamma-Chlordane	2 U	2.1 U	2.1 UL	2.1 UL	2.1 U	2.2 UL	2.1 UL
Inorganics (mg/kg)							
Aluminum	9150 L	13700 L	16100 L	11400 L	#### L	#### L	#### L
Antimony	0.51 U	0.51 UJ	0.63 J	0.81 B	0.64 B	0.5 B	0.84 B
Arsenic	9.4	4.2 L	36.5	36.1	16	16	21.2
Barium	30.7 J	26.6 J	50.2 J	66	17.2 J	17.5 J	29.7 J
Beryllium	0.59 B	0.9 B	1.3 J	0.81 B	0.96 J	0.92 J	0.97 J
Cadmium	0.08 U	0.16 U	0.17 U	0.08 UL	0.08 UL	0.08 UL	0.08 UL
Calcium	801 J	359	494 J	528 J	153 J	183 J	472 J
Chromium	23.3	60.3	44	43.3	34.8	38.8	29.8
Cobalt	3.8 J	6.6 J	10.2 J	4.6 J	5.8 J	6.3 J	9.2 J
Copper	4.6 B	137 J	6.5 B	5.6 B	6.8 B	6.2 B	134
Cyanide	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL	0.02 UL
Iron	20700 L	38400 L	38800 L	24600	####	####	####
Lead	8.3	14.6 J	12 J	16.2	9	9.1	12.6
Magnesium	456 J	1130 J	1530	1080 J	954 J	1020 J	844 J
Manganese	54.7	73.7 J	84.5 J	13.7	45.6	44.6	70.9
Mercury	0.04 J	0.03 U	0.03 U	0.03 B	0.05 B	0.03 B	0.07 J
Nickel	5.8 B	12.1	18.5	7.4 J	14.4	16.3	24.4
Potassium	711 J	1560	1820	1650	1270	1340	1130
Selenium	0.69 U	0.7 U	0.73 U	0.7 UL	0.69 UL	0.69 UL	0.67 UL
Silver	6.8 B	17.8 L	13 L	9 B	11.7 J	13.7 J	12 J
Sodium	18 B	38.5 B	57.5 B	25.9 B	39.5 B	33.9 B	36 B
Thallium	0.55 UL	0.84 L	0.58 UL	1.2 B	0.85 B	1.4 B	0.88 B
Vanadium	41.8	36.8 J	69.2 J	37.6	35.5	35.4	36.7
Zinc	17.9 B	42.5 B	52.4 B	42.8 B	39.8 B	47.9 B	61.4 B

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect
Volatiles (ug/kg)					
1,1,1-Trichloroethane	10 UL	14.12 U	0	0	
1,1,2,2-Tetrachloroethane	10 UL	14.12 U	0	0	
1,1,2-Trichloroethane	10 UL	14.12 U	0	0	
1,1-Dichloroethane	10 UL	14.12 U	0	0	
1,1-Dichloroethene	10 UL	14.12 U	0	0	
1,2-Dichloroethane	10 UL	14.12 U	0	0	
1,2-Dichloroethene (total)	10 UL	14.12 U	0	0	
1,2-Dichloropropane	10 UL	14.12 U	0	0	
2-Butanone	3 B	14.12 U	5 J	7 J	A2-CS02
2-Hexanone	10 UL	14.12 U	0	0	
4-Methyl-2-Pentanone	10 UL	14.12 U	0	0	
Acetone	3 B	36 B	0	0	
Benzene	10 UL	14.12 U	3 J	11 J	A2-CS01
Bromodichloromethane	10 UL	14.12 U	0	0	
Bromoform	10 UL	14.12 U	0	0	
Bromomethane	10 UL	14.12 U	0	0	
Carbon Disulfide	10 UL	14.12 U	0	0	
Carbon Tetrachloride	10 UL	14.12 U	0	0	
Chlorobenzene	10 UL	14.12 U	0	0	
Chloroethane	10 UL	14.12 U	0	0	
Chloroform	10 UL	14.12 U	0	0	
Chloromethane	10 UL	14.12 U	0	0	
Dibromochloromethane	10 UL	14.12 U	0	0	
Ethylbenzene	10 UL	14.12 U	0.7	10 J	A2-TP05-F
Methylene Chloride	5 B	37 B	27	34	A2-TP05-ND
Styrene	10 UL	14.12 U	4	5 J	A2-CS02
Tetrachloroethene	10 UL	14.12 U	0	0	
Toluene	10 UL	14.12 U	0	0	
Trichloroethene	10 UL	14.12 U	0	0	
Vinyl Chloride	10 UL	14.12 U	0	0	
Xylene (Total)	10 UL	14.12 U	1 J	2	A2-TP05-N,A2-TP05-ND,A2-TP06-N
cis-1,3-Dichloropropene	10 UL	14.12 U	0	0	
trans-1,3-Dichloropropene	10 UL	14.12 U	0	0	
Semivolatiles (ug/kg)	0	0	0	0	
1,2,4-Trichlorobenzene	370 U	800 U	0	0	
1,2-Dichlorobenzene	370 U	800 U	0	0	
1,3-Dichlorobenzene	370 U	800 U	0	0	
1,4-Dichlorobenzene	370 U	800 U	0	0	
2,2'-oxybis(1-Chloropropan	370 U	800 U	0	0	
2,4,5-Trichlorophenol	930 U	2000 U	0	0	
2,4,6-Trichlorophenol	370 U	800 U	0	0	
2,4-Dichlorophenol	370 U	800 U	0	0	
2,4-Dimethylphenol	370 U	800 U	0	0	
2,4-Dinitrophenol	930 U	2000 U	0	0	
2,4-Dinitrotoluene	370 U	800 U	0	0	
2,6-Dinitrotoluene	370 U	800 U	0	0	
2-Chloronaphthalene	370 U	800 U	0	0	
2-Chlorophenol	370 U	800 U	0	0	
2-Methylnaphthalene	370 U	800 U	0	0	
2-Methylphenol	370 U	800 U	0	0	
2-Nitroaniline	930 U	2000 U	0	0	
2-Nitrophenol	370 U	800 U	0	0	
3,3'-Dichlorobenzidine	370 U	800 U	0	0	
3-Nitroaniline	930 U	2000 U	0	0	
4,6-Dinitro-2-Methylphenol	930 U	2000 U	0	0	
4-Bromophenyl phenylether	370 U	800 U	0	0	
4-Chloro-3-Methylphenol	370 U	800 U	0	0	
4-Chloroaniline	370 U	800 U	0	0	

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect
4-Chlorophenyl-phenylether	370 U	800 U	0	0	
4-Methylphenol	370 U	800 U	0	0	
4-Nitroaniline	930 U	2000 U	0	0	
4-Nitrophenol	930 U	2000 U	0	0	
Acenaphthene	370 U	800 U	0	0	
Acenaphthylene	370 U	800 U	0	0	
Anthracene	370 U	800 U	0	0	
Benzo(a)Anthracene	370 U	800 U	0	0	
Benzo(a)Pyrene	370 U	800 U	0	0	
Benzo(b)Fluoranthene	380 U	800 U	42 J	42 J	A2-CS04
Benzo(g,h,i)Perylene	370 U	800 U	0	0	
Benzo(k)Fluoanthene	370 U	800 U	0	0	
Bis(2-chloroethoxy)Methane	370 U	800 U	0	0	
Bis(2-chloroethyl)Ether	370 U	800 U	0	0	
Bis(2-Ethylhexyl)Phthalate	370 U	800 U	42 J	2500	A2-TP03-F
Butylbenzylphthalate	370 U	800 U	0	0	
Carbazole	370 U	800 U	0	0	
Chrysene	380 U	800 U	41 J	41 J	A2-CS04
Dibenz(a,h)Anthracene	370 U	800 U	0	0	
Dibenzofuran	370 U	800 U	0	0	
Diethylphthalate	370 U	800 U	0	0	
Dimethyl Phthalate	370 U	800 U	0	0	
Di-n-butylphthalate	40 B	800 U	44 J	79 J	A2-TP04-F
Di-n-octylphthalate	370 U	800 U	0	0	
Fluoranthene	380 U	800 U	52 J	52 J	A2-CS04
Fluorene	370 U	800 U	0	0	
Hexachlorobenzene	370 U	800 U	0	0	
Hexachlorobutadiene	370 U	800 U	0	0	
Hexachlorocyclopentadiene	370 U	800 U	0	0	
Hexachloroethane	370 U	800 U	0	0	
Indeno(1,2,3-cd)Pyrene	370 U	800 U	0	0	
Isophorone	370 U	800 U	0	0	
Naphthalene	370 U	800 U	0	0	
Nitrobenzene	370 U	800 U	0	0	
N-Nitroso-Di-n-Propylamine	370 U	800 U	0	0	
N-Nitrosodiphenylamine	370 U	800 U	0	0	
Pentachlorophenol	930 U	2000 U	0	0	
Phenanthrene	370 U	800 U	0	0	
Phenol	370 U	800 U	0	0	
Pyrene	380 U	800 U	58 J	58 J	A2-CS04
Pest/PCB (ug/kg)	0	0	0	0	
4,4'-DDD	3.8 U	4.4 U	18	18	A2-CS04
4,4'-DDE	3.8 U	4.4 U	4.1 J	5.4 J	A2-TP01-FD
4,4'-DDT	3.8 U	4.4 U	4.1 J	4.1 J	A2-CS04
Aldrin	1.9 U	2.3 U	0	0	
Aroclor-1016	36 U	44 U	0	0	
Aroclor-1221	73 U	90 U	0	0	
Aroclor-1232	36 U	44 U	0	0	
Aroclor-1242	36 U	44 U	0	0	
Aroclor-1248	36 U	44 U	0	0	
Aroclor-1254	36 U	44 U	0	0	
Aroclor-1260	38 U	44 U	200	350	A2-CS04
Dieldrin	3.8 U	4.4 U	9.6 J	9.6 J	A2-CS04
Endosulfan I	1.9 U	2.3 U	0	0	
Endosulfan II	3.6 U	4.4 U	0	0	
Endosulfan Sulfate	3.6 U	4.4 U	0	0	
Endrin	3.6 U	4.4 U	0	0	
Endrin Aldehyde	3.8 U	4.4 U	4.1 J	4.1 J	A2-CS04
Endrin Ketone	3.8 U	4.4 U	9.5 J	9.5 J	A2-CS04

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect
Heptachlor	1.9 U	2.3 U	0	0	
Heptachlor Epoxide	1.9 U	2.3 U	0	0	
Methoxychlor	19 U	23 U	0	0	
Toxaphene	190 U	230 U	0	0	
alpha-BHC	1.9 U	2.3 U	0	0	
alpha-Chlordane	1.9 U	2.3 U	0	0	
beta-BHC	1.9 U	2.3 U	0	0	
delta-BHC	1.9 U	2.3 U	0	0	
gamma-BHC (Lindane)	1.9 U	2.3 U	0	0	
gamma-Chlordane	1.9 U	2.3 U	0	0	
Inorganics (mg/kg)	0	0	0	0	
Aluminum	0	0	5120 L	147000 J	A2-CS02
Antimony	0.45 UL	12.7 U	0.63 J	0.63 J	A2-TP03-N
Arsenic	0	0	1.9 J	36.5	A2-TP03-N
Barium	0	0	10.9 J	66	A2-TP04-N
Beryllium	0.23 B	0.9 B	0.1 J	1.3 J	A2-CS03,A2-TP03-N
Cadmium	0.07 UL	2.1 U	1.7 L	12.3	A2-TP02-F
Calcium	0	0	153 J	63700 J	A2-CS04
Chromium	0	0	9.2	94.5	A2-TP02-F
Cobalt	0	0	2.2 J	10.6 J	A2-CS03
Copper	3.1 B	6.8 B	2.3 J	318	A2-TP02-F
Cyanide	0.02 UL	0.6 UL	0.95 J	0.95 J	A2-TP02-F
Iron	0	0	10800 L	99900 L	A2-CS03
Lead	0	0	8	222	A2-TP02-F
Magnesium	0	0	293 J	2920	A2-TP01-F
Manganese	0	0	13.7	121	A2-TP06-F
Mercury	0.02 U	0.05 B	0.03 J	0.07 J	A2-TP06-N
Nickel	5.8 B	5.8 B	4.3 J	24.4	A2-TP06-N
Potassium	0	0	312 J	1910	A2-CS04
Selenium	0.62 U	1.1 U	0	0	
Silver	2.7 B	9 B	3.2	23.4	A2-CS03
Sodium	18 B	194 B	356 J	356 J	A2-CS04
Thallium	0.49 U	2.1 UL	0.79 J	3.1	A2-CS03
Vanadium	0	0	15.4	69.2 J	A2-TP03-N
Zinc	17.9 B	69.9 B	23.8 J	127	A2-TP02-F
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	

	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects	Arithmatic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Volatiles (ug/kg)						
1,1,1-Trichloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,1,2,2-Tetrachloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,1,2-Trichloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,1-Dichloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,1-Dichloroethene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,2-Dichloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,2-Dichloroethene (total)	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
1,2-Dichloropropane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
2-Butanone	2/19	6	6	4.7442	1.8206	5.4685
2-Hexanone	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
4-Methyl-2-Pentanone	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Acetone	0/19	#DIV/0!	#NUM!	6.8242	4.9602	8.7975
Benzene	2/19	7	7	6.0964	1.4876	6.6882
Bromodichloromethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Bromoform	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Bromomethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Carbon Disulfide	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Carbon Tetrachloride	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Chlorobenzene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Chloroethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Chloroform	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Chloromethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Dibromochloromethane	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Ethylbenzene	2/19	5.35	5.35	5.9582	1.6562	6.6171
Methylene Chloride	2/19	30.5	30.5	9.0263	8.6112	12.452
Styrene	2/19	4.5	4.5	5.82	0.6955	6.0967
Tetrachloroethene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Toluene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Trichloroethene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Vinyl Chloride	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Xylene (Total)	4/19	1.75	2	5.1566	1.8791	5.9041
cis-1,3-Dichloropropene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
trans-1,3-Dichloropropene	0/19	#DIV/0!	#NUM!	5.9779	0.5922	6.2135
Semivolatiles (ug/kg)	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
1,2,4-Trichlorobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
1,2-Dichlorobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
1,3-Dichlorobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
1,4-Dichlorobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,2'-oxybis(1-Chloropropan	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,4,5-Trichlorophenol	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
2,4,6-Trichlorophenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,4-Dichlorophenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,4-Dimethylphenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,4-Dinitrophenol	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
2,4-Dinitrotoluene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2,6-Dinitrotoluene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2-Chloronaphthalene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2-Chlorophenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2-Methylnaphthalene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2-Methylphenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
2-Nitroaniline	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
2-Nitrophenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
3,3'-Dichlorobenzidine	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
3-Nitroaniline	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
4,6-Dinitro-2-Methylphenol	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
4-Bromophenyl phenylether	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
4-Chloro-3-Methylphenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
4-Chloroaniline	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173

	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects	Arithmatic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
4-Chlorophenyl-phenylether	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
4-Methylphenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
4-Nitroaniline	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
4-Nitrophenol	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
Acenaphthene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Acenaphthylene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Anthracene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Benzo(a)Anthracene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Benzo(a)Pyrene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Benzo(b)Fluoranthene	1/18	42	42	204.8333	62.0571	230.2785
Benzo(g,h,i)Perylene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Benzo(k)Fluoanthene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Bis(2-chloroethoxy)Methane	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Bis(2-chloroethyl)Ether	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Bis(2-Ethylhexyl)Phthalate	9/18	407.56	63	315.4444	564.968	547.0978
Butylbenzylphthalate	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Carbazole	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Chrysene	1/18	41	41	204.7778	62.2117	230.2864
Dibenz(a,h)Anthracene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Dibenzofuran	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Diethylphthalate	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Dimethyl Phthalate	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Di-n-butylphthalate	11/18	57.91	51	116.2222	100.1197	157.2742
Di-n-octylphthalate	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Fluoranthene	1/18	52	52	205.3889	60.5399	230.212
Fluorene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Hexachlorobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Hexachlorobutadiene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Hexachlorocyclopentadiene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Hexachloroethane	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Indeno(1,2,3-cd)Pyrene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Isophorone	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Naphthalene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Nitrobenzene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
N-Nitroso-Di-n-Propylamine	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
N-Nitrosodiphenylamine	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Pentachlorophenol	0/18	#DIV/0!	#NUM!	529.4444	119.0883	578.2741
Phenanthrene	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Phenol	0/18	#DIV/0!	#NUM!	212.7778	47.41	232.2173
Pyrene	1/18	58	58	205.7222	59.6557	230.1828
Pest/PCB (ug/kg)	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
4,4'-DDD	1/18	18	18	2.9194	3.7643	4.4629
4,4'-DDE	2/18	4.75	4.75	2.3306	0.9107	2.704
4,4'-DDT	1/18	4.1	4.1	2.1472	0.4927	2.3492
Aldrin	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
Aroclor-1016	0/18	#DIV/0!	#NUM!	20.1944	0.9097	20.5674
Aroclor-1221	0/18	#DIV/0!	#NUM!	41.0833	1.857	41.8447
Aroclor-1232	0/18	#DIV/0!	#NUM!	20.1944	0.9097	20.5674
Aroclor-1242	0/18	#DIV/0!	#NUM!	20.1944	0.9097	20.5674
Aroclor-1248	0/18	#DIV/0!	#NUM!	20.1944	0.9097	20.5674
Aroclor-1254	0/18	#DIV/0!	#NUM!	20.1944	0.9097	20.5674
Aroclor-1260	3/18	286.67	310	64.6944	105.5666	107.9798
Dieldrin	1/18	9.6	9.6	2.4528	1.7852	3.1848
Endosulfan I	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
Endosulfan II	0/18	#DIV/0!	#NUM!	2.0194	0.091	2.0567
Endosulfan Sulfate	0/18	#DIV/0!	#NUM!	2.0194	0.091	2.0567
Endrin	0/18	#DIV/0!	#NUM!	2.0194	0.091	2.0567
Endrin Aldehyde	1/18	4.1	4.1	2.1472	0.4927	2.3492
Endrin Ketone	1/18	9.5	9.5	2.4472	1.7616	3.1695

	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects	Arithmatic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Heptachlor	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
Heptachlor Epoxide	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
Methoxychlor	0/18	#DIV/0!	#NUM!	10.4444	0.4817	10.6419
Toxaphene	0/18	#DIV/0!	#NUM!	104.4444	4.8169	106.4195
alpha-BHC	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
alpha-Chlordane	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
beta-BHC	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
delta-BHC	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
gamma-BHC (Lindane)	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
gamma-Chlordane	0/18	#DIV/0!	#NUM!	1.0444	0.0482	1.0642
Inorganics (mg/kg)	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
Aluminum	18/18	17808.89	11500	17808.8889	32380.3313	31085.7692
Antimony	1/18	0.63	0.63	1.3128	2.1825	2.2077
Arsenic	18/18	11.4	8.55	11.4	10.6556	15.7691
Barium	18/18	32.36	30.6	32.3556	13.7099	37.9771
Beryllium	8/18	0.83	0.94	0.5222	0.3992	0.6859
Cadmium	2/18	7	7	1.0631	2.8453	2.2298
Calcium	18/18	6947.33	843	6947.3333	16624.1621	13763.7247
Chromium	18/18	36.17	34.15	36.1722	21.1204	44.8322
Cobalt	18/18	5.19	4.2	5.1944	2.5215	6.2283
Copper	10/18	77.89	42.5	44.4833	81.25	77.7982
Cyanide	1/18	0.95	0.95	0.1592	0.241	0.258
Iron	18/18	30794.44	25600	30794.4444	19525.3221	38800.396
Lead	18/18	26.08	11.6	26.0833	50.4193	46.7567
Magnesium	18/18	995.11	834.5	995.1111	699.9778	1282.1224
Manganese	18/18	80.06	89.95	80.0556	28.7859	91.8587
Mercury	9/18	0.04	0.04	0.03	0.0177	0.0373
Nickel	17/18	11.85	11.6	11.3556	5.8567	13.757
Potassium	18/18	1011.89	986	1011.8889	514.885	1223.0068
Selenium	0/18	#DIV/0!	#NUM!	0.4058	0.0818	0.4393
Silver	11/18	12.95	12	9.1111	6.6197	11.8254
Sodium	1/18	356	356	42.775	80.6007	75.8236
Thallium	3/18	1.58	0.84	0.7214	0.6561	0.9904
Vanadium	18/18	33.44	33.7	33.4444	14.8029	39.514
Zinc	7/18	70.61	45.8	41.4472	35.3353	55.9357
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!
	0/0	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!	#DIV/0!

	Log Arithmatic Mean Half Non-Detects	H Statistic	Log Upper 95% Confidence Level	Frequency of Detection	Log Standard Deviation	Degree of Freedom
Volatiles (ug/kg)						
1,1,1-Trichloroethane	1.78	1.781	6.2376	19	0.1	18
1,1,2,2-Tetrachloroethane	1.78	1.781	6.2376	19	0.1	18
1,1,2-Trichloroethane	1.78	1.781	6.2376	19	0.1	18
1,1-Dichloroethane	1.78	1.781	6.2376	19	0.1	18
1,1-Dichloroethene	1.78	1.781	6.2376	19	0.1	18
1,2-Dichloroethane	1.78	1.781	6.2376	19	0.1	18
1,2-Dichloroethene (total)	1.78	1.781	6.2376	19	0.1	18
1,2-Dichloropropane	1.78	1.781	6.2376	19	0.1	18
2-Butanone	1.46	2.009	6.1176	19	0.49	18
2-Hexanone	1.78	1.781	6.2376	19	0.1	18
4-Methyl-2-Pentanone	1.78	1.781	6.2376	19	0.1	18
Acetone	1.7	2.221	9.8566	19	0.68	18
Benzene	1.78	1.845	6.774	19	0.24	18
Bromodichloromethane	1.78	1.781	6.2376	19	0.1	18
Bromoform	1.78	1.781	6.2376	19	0.1	18
Bromomethane	1.78	1.781	6.2376	19	0.1	18
Carbon Disulfide	1.78	1.781	6.2376	19	0.1	18
Carbon Tetrachloride	1.78	1.781	6.2376	19	0.1	18
Chlorobenzene	1.78	1.781	6.2376	19	0.1	18
Chloroethane	1.78	1.781	6.2376	19	0.1	18
Chloroform	1.78	1.781	6.2376	19	0.1	18
Chloromethane	1.78	1.781	6.2376	19	0.1	18
Dibromochloromethane	1.78	1.781	6.2376	19	0.1	18
Ethylbenzene	1.71	2.11	8.1746	19	0.52	18
Methylene Chloride	1.91	2.342	13.0136	19	0.72	18
Styrene	1.75	1.781	6.1475	19	0.13	18
Tetrachloroethene	1.78	1.781	6.2376	19	0.1	18
Toluene	1.78	1.781	6.2376	19	0.1	18
Trichloroethene	1.78	1.781	6.2376	19	0.1	18
Vinyl Chloride	1.78	1.781	6.2376	19	0.1	18
Xylene (Total)	1.53	2.11	7.1312	19	0.56	18
cis-1,3-Dichloropropene	1.78	1.781	6.2376	19	0.1	18
trans-1,3-Dichloropropene	1.78	1.781	6.2376	19	0.1	18
Semivolatiles (ug/kg)	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
1,2,4-Trichlorobenzene	5.34	1.787	228.2186	18	0.17	17
1,2-Dichlorobenzene	5.34	1.787	228.2186	18	0.17	17
1,3-Dichlorobenzene	5.34	1.787	228.2186	18	0.17	17
1,4-Dichlorobenzene	5.34	1.787	228.2186	18	0.17	17
2,2'-oxybis(1-Chloropropan	5.34	1.787	228.2186	18	0.17	17
2,4,5-Trichlorophenol	6.26	1.787	568.013	18	0.17	17
2,4,6-Trichlorophenol	5.34	1.787	228.2186	18	0.17	17
2,4-Dichlorophenol	5.34	1.787	228.2186	18	0.17	17
2,4-Dimethylphenol	5.34	1.787	228.2186	18	0.17	17
2,4-Dinitrophenol	6.26	1.787	568.013	18	0.17	17
2,4-Dinitrotoluene	5.34	1.787	228.2186	18	0.17	17
2,6-Dinitrotoluene	5.34	1.787	228.2186	18	0.17	17
2-Chloronaphthalene	5.34	1.787	228.2186	18	0.17	17
2-Chlorophenol	5.34	1.787	228.2186	18	0.17	17
2-Methylnaphthalene	5.34	1.787	228.2186	18	0.17	17
2-Methylphenol	5.34	1.787	228.2186	18	0.17	17
2-Nitroaniline	6.26	1.787	568.013	18	0.17	17
2-Nitrophenol	5.34	1.787	228.2186	18	0.17	17
3,3'-Dichlorobenzidine	5.34	1.787	228.2186	18	0.17	17
3-Nitroaniline	6.26	1.787	568.013	18	0.17	17
4,6-Dinitro-2-Methylphenol	6.26	1.787	568.013	18	0.17	17
4-Bromophenyl phenylether	5.34	1.787	228.2186	18	0.17	17
4-Chloro-3-Methylphenol	5.34	1.787	228.2186	18	0.17	17
4-Chloroaniline	5.34	1.787	228.2186	18	0.17	17

	Log Arithmatic Mean Half Non-Detects	H Statistic	Log Upper 95% Confidence Level	Frequency of Detection	Log Standard Deviation	Degree of Freedom
4-Chlorophenyl-phenylether	5.34	1.787	228.2186	18	0.17	17
4-Methylphenol	5.34	1.787	228.2186	18	0.17	17
4-Nitroaniline	6.26	1.787	568.013	18	0.17	17
4-Nitrophenol	6.26	1.787	568.013	18	0.17	17
Acenaphthene	5.34	1.787	228.2186	18	0.17	17
Acenaphthylene	5.34	1.787	228.2186	18	0.17	17
Anthracene	5.34	1.787	228.2186	18	0.17	17
Benzo(a)Anthracene	5.34	1.787	228.2186	18	0.17	17
Benzo(a)Pyrene	5.34	1.787	228.2186	18	0.17	17
Benzo(b)Fluoranthene	5.26	2.021	257.3987	18	0.41	17
Benzo(g,h,i)Perylene	5.34	1.787	228.2186	18	0.17	17
Benzo(k)Fluoanthene	5.34	1.787	228.2186	18	0.17	17
Bis(2-chloroethoxy)Methane	5.34	1.787	228.2186	18	0.17	17
Bis(2-chloroethyl)Ether	5.34	1.787	228.2186	18	0.17	17
Bis(2-Ethylhexyl)Phthalate	5.11	3.021	598.7164	18	1.03	17
Butylbenzylphthalate	5.34	1.787	228.2186	18	0.17	17
Carbazole	5.34	1.787	228.2186	18	0.17	17
Chrysene	5.26	2.021	258.3027	18	0.42	17
Dibenz(a,h)Anthracene	5.34	1.787	228.2186	18	0.17	17
Dibenzofuran	5.34	1.787	228.2186	18	0.17	17
Diethylphthalate	5.34	1.787	228.2186	18	0.17	17
Dimethyl Phthalate	5.34	1.787	228.2186	18	0.17	17
Di-n-butylphthalate	4.45	2.362	184.7272	18	0.8	17
Di-n-octylphthalate	5.34	1.787	228.2186	18	0.17	17
Fluoranthene	5.27	1.931	248.194	18	0.37	17
Fluorene	5.34	1.787	228.2186	18	0.17	17
Hexachlorobenzene	5.34	1.787	228.2186	18	0.17	17
Hexachlorobutadiene	5.34	1.787	228.2186	18	0.17	17
Hexachlorocyclopentadiene	5.34	1.787	228.2186	18	0.17	17
Hexachloroethane	5.34	1.787	228.2186	18	0.17	17
Indeno(1,2,3-cd)Pyrene	5.34	1.787	228.2186	18	0.17	17
Isophorone	5.34	1.787	228.2186	18	0.17	17
Naphthalene	5.34	1.787	228.2186	18	0.17	17
Nitrobenzene	5.34	1.787	228.2186	18	0.17	17
N-Nitroso-Di-n-Propylamine	5.34	1.787	228.2186	18	0.17	17
N-Nitrosodiphenylamine	5.34	1.787	228.2186	18	0.17	17
Pentachlorophenol	6.26	1.787	568.013	18	0.17	17
Phenanthrene	5.34	1.787	228.2186	18	0.17	17
Phenol	5.34	1.787	228.2186	18	0.17	17
Pyrene	5.28	1.931	245.0336	18	0.35	17
Pest/PCB (ug/kg)	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
4,4'-DDD	0.83	2.124	3.4152	18	0.52	17
4,4'-DDE	0.8	1.853	2.6225	18	0.28	17
4,4'-DDT	0.75	1.787	2.3057	18	0.17	17
Aldrin	0.04	1.733	1.0649	18	0.05	17
Aroclor-1016	3	1.733	20.5859	18	0.05	17
Aroclor-1221	3.71	1.733	41.8819	18	0.05	17
Aroclor-1232	3	1.733	20.5859	18	0.05	17
Aroclor-1242	3	1.733	20.5859	18	0.05	17
Aroclor-1248	3	1.733	20.5859	18	0.05	17
Aroclor-1254	3	1.733	20.5859	18	0.05	17
Aroclor-1260	3.45	3.021	109.7573	18	1.01	17
Dieldrin	0.79	1.931	2.8142	18	0.37	17
Endosulfan I	0.04	1.733	1.0649	18	0.05	17
Endosulfan II	0.7	1.733	2.0586	18	0.05	17
Endosulfan Sulfate	0.7	1.733	2.0586	18	0.05	17
Endrin	0.7	1.733	2.0586	18	0.05	17
Endrin Aldehyde	0.75	1.787	2.3057	18	0.17	17
Endrin Ketone	0.79	1.931	2.8072	18	0.37	17

	Log Arithmatic Mean Half Non-Detects	H Statistic	Log Upper 95% Confidence Level	Frequency of Detection	Log Standard Deviation	Degree of Freedom
Heptachlor	0.04	1.733	1.0649	18	0.05	17
Heptachlor Epoxide	0.04	1.733	1.0649	18	0.05	17
Methoxychlor	2.35	1.733	10.6493	18	0.05	17
Toxaphene	4.65	1.733	106.4944	18	0.05	17
alpha-BHC	0.04	1.733	1.0649	18	0.05	17
alpha-Chlordane	0.04	1.733	1.0649	18	0.05	17
beta-BHC	0.04	1.733	1.0649	18	0.05	17
delta-BHC	0.04	1.733	1.0649	18	0.05	17
gamma-BHC (Lindane)	0.04	1.733	1.0649	18	0.05	17
gamma-Chlordane	0.04	1.733	1.0649	18	0.05	17
Inorganics (mg/kg)	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
Aluminum	9.33	2.362	21995.2976	18	0.71	17
Antimony	-0.61	3.021	2.5439	18	1.17	17
Arsenic	2.04	2.638	21.3615	18	0.93	17
Barium	3.39	2.021	40.4017	18	0.43	17
Beryllium	-0.94	2.362	0.8497	18	0.8	17
Cadmium	-1.54	3.867	4.6556	18	1.71	17
Calcium	7.11	3.867	22509.7219	18	1.65	17
Chromium	3.44	2.124	49.1413	18	0.57	17
Cobalt	1.55	2.021	6.4819	18	0.45	17
Copper	2.36	3.867	237.0233	18	1.73	17
Cyanide	-3.2	4.314	1.3275	18	1.79	17
Iron	10.2	2.124	39746.0248	18	0.51	17
Lead	2.68	2.496	33.5177	18	0.82	17
Magnesium	6.71	2.238	1397.2936	18	0.62	17
Manganese	4.29	2.124	109.3565	18	0.53	17
Mercury	-3.67	2.124	0.0411	18	0.59	17
Nickel	2.29	2.124	15.638	18	0.57	17
Potassium	6.77	2.124	1405.5374	18	0.59	17
Selenium	-0.92	1.787	0.4415	18	0.19	17
Silver	1.91	2.496	16.179	18	0.85	17
Sodium	3.17	2.496	58.5553	18	0.87	17
Thallium	-0.56	2.238	1.0069	18	0.66	17
Vanadium	3.42	2.021	41.3948	18	0.43	17
Zinc	3.46	2.362	61.7917	18	0.71	17
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1
	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	-1

	Minimum Non-Detect	Maximum Non-Detect	Minimum Detected	Maximum Detected	Location of Maximum Detect
Volatiles (ug/kg)					
2-Butanone	3 B	14.12 U	5 J	7 J	A2-CS02
Benzene	10 UL	14.12 U	3 J	11 J	A2-CS01
Ethylbenzene	10 UL	14.12 U	0.7	10 J	A2-TP05-F
Methylene Chloride	5 B	37 B	27	34	A2-TP05-ND
Styrene	10 UL	14.12 U	4	5 J	A2-CS02
Xylene (Total)	10 UL	14.12 U	1 J	2	A2-TP05-N,A2-TP05-ND,A2-TP06-N
Semivolatiles (ug/kg)					
Benzo(b)Fluoranthene	380 U	800 U	42 J	42 J	A2-CS04
Bis(2-Ethylhexyl)Phthalate	370 U	800 U	42 J	2500	A2-TP03-F
Chrysene	380 U	800 U	41 J	41 J	A2-CS04
Di-n-butylphthalate	40 B	800 U	44 J	79 J	A2-TP04-F
Fluoranthene	380 U	800 U	52 J	52 J	A2-CS04
Pyrene	380 U	800 U	58 J	58 J	A2-CS04
Pest/PCB (ug/kg)					
4,4'-DDD	3.8 U	4.4 U	18	18	A2-CS04
4,4'-DDE	3.8 U	4.4 U	4.1 J	5.4 J	A2-TP01-FD
4,4'-DDT	3.8 U	4.4 U	4.1 J	4.1 J	A2-CS04
Aroclor-1260	38 U	44 U	200	350	A2-CS04
Dieldrin	3.8 U	4.4 U	9.6 J	9.6 J	A2-CS04
Endrin Aldehyde	3.8 U	4.4 U	4.1 J	4.1 J	A2-CS04
Endrin Ketone	3.8 U	4.4 U	9.5 J	9.5 J	A2-CS04
Inorganics (mg/kg)					
Aluminum	0	0	5120 L	147000 J	A2-CS02
Antimony	0.45 UL	12.7 U	0.63 J	0.63 J	A2-TP03-N
Arsenic	0	0	1.9 J	36.5	A2-TP03-N
Barium	0	0	10.9 J	66	A2-TP04-N
Beryllium	0.23 B	0.9 B	0.1 J	1.3 J	A2-CS03,A2-TP03-N
Cadmium	0.07 UL	2.1 U	1.7 L	12.3	A2-TP02-F
Calcium	0	0	153 J	63700 J	A2-CS04
Chromium	0	0	9.2	94.5	A2-TP02-F
Cobalt	0	0	2.2 J	10.6 J	A2-CS03
Copper	3.1 B	6.8 B	2.3 J	318	A2-TP02-F
Cyanide	0.02 UL	0.6 UL	0.95 J	0.95 J	A2-TP02-F
Iron	0	0	10800 L	99900 L	A2-CS03
Lead	0	0	8	222	A2-TP02-F
Magnesium	0	0	293 J	2920	A2-TP01-F
Manganese	0	0	13.7	121	A2-TP06-F
Mercury	0.02 U	0.05 B	0.03 J	0.07 J	A2-TP06-N
Nickel	5.8 B	5.8 B	4.3 J	24.4	A2-TP06-N
Potassium	0	0	312 J	1910	A2-CS04
Silver	2.7 B	9 B	3.2	23.4	A2-CS03
Sodium	18 B	194 B	356 J	356 J	A2-CS04
Thallium	0.49 U	2.1 UL	0.79 J	3.1	A2-CS03
Vanadium	0	0	15.4	69.2 J	A2-TP03-N
Zinc	17.9 B	69.9 B	23.8 J	127	A2-TP02-F

	Frequency of Detection	Arithmatic Mean Positive Detects	Median Positive Detects	Arithmatic Mean Half Non-Detects	Standard Deviation	Upper 95% Confidence Level
Volatiles (ug/kg)						
2-Butanone	2/19	6	6	4.7442	1.8206	5.4685
Benzene	2/19	7	7	6.0964	1.4876	6.6882
Ethylbenzene	2/19	5.35	5.35	5.9582	1.6562	6.6171
Methylene Chloride	2/19	30.5	30.5	9.0263	8.6112	12.452
Styrene	2/19	4.5	4.5	5.82	0.6955	6.0967
Xylene (Total)	4/19	1.75	2	5.1566	1.8791	5.9041
Semivolatiles (ug/kg)						
Benzo(b)Fluoranthene	1/18	42	42	204.8333	62.0571	230.2785
Bis(2-Ethylhexyl)Phthalate	9/18	407.56	63	315.4444	564.968	547.0978
Chrysene	1/18	41	41	204.7778	62.2117	230.2864
Di-n-butylphthalate	11/18	57.91	51	116.2222	100.1197	157.2742
Fluoranthene	1/18	52	52	205.3889	60.5399	230.212
Pyrene	1/18	58	58	205.7222	59.6557	230.1828
Pest/PCB (ug/kg)						
4,4'-DDD	1/18	18	18	2.9194	3.7643	4.4629
4,4'-DDE	2/18	4.75	4.75	2.3306	0.9107	2.704
4,4'-DDT	1/18	4.1	4.1	2.1472	0.4927	2.3492
Aroclor-1260	3/18	286.67	310	64.6944	105.5666	107.9798
Dieldrin	1/18	9.6	9.6	2.4528	1.7852	3.1848
Endrin Aldehyde	1/18	4.1	4.1	2.1472	0.4927	2.3492
Endrin Ketone	1/18	9.5	9.5	2.4472	1.7616	3.1695
Inorganics (mg/kg)						
Aluminum	18/18	17808.89	11500	17808.8889	32380.3313	31085.7692
Antimony	1/18	0.63	0.63	1.3128	2.1825	2.2077
Arsenic	18/18	11.4	8.55	11.4	10.6556	15.7691
Barium	18/18	32.36	30.6	32.3556	13.7099	37.9771
Beryllium	8/18	0.83	0.94	0.5222	0.3992	0.6859
Cadmium	2/18	7	7	1.0631	2.8453	2.2298
Calcium	18/18	6947.33	843	6947.3333	16624.1621	13763.7247
Chromium	18/18	36.17	34.15	36.1722	21.1204	44.8322
Cobalt	18/18	5.19	4.2	5.1944	2.5215	6.2283
Copper	10/18	77.89	42.5	44.4833	81.25	77.7982
Cyanide	1/18	0.95	0.95	0.1592	0.241	0.258
Iron	18/18	30794.44	25600	30794.4444	19525.3221	38800.396
Lead	18/18	26.08	11.6	26.0833	50.4193	46.7567
Magnesium	18/18	995.11	834.5	995.1111	699.9778	1282.1224
Manganese	18/18	80.06	89.95	80.0556	28.7859	91.8587
Mercury	9/18	0.04	0.04	0.03	0.0177	0.0373
Nickel	17/18	11.85	11.6	11.3556	5.8567	13.757
Potassium	18/18	1011.89	986	1011.8889	514.885	1223.0068
Silver	11/18	12.95	12	9.1111	6.6197	11.8254
Sodium	1/18	356	356	42.775	80.6007	75.8236
Thallium	3/18	1.58	0.84	0.7214	0.6561	0.9904
Vanadium	18/18	33.44	33.7	33.4444	14.8029	39.514
Zinc	7/18	70.61	45.8	41.4472	35.3353	55.9357

	Log Arithmatic Mean Half Non-Detects	H Statistic	Log Upper 95% Confidence Level	Frequency of Detection	Log Standard Deviation	Degree of Freedom
Volatiles (ug/kg)						
2-Butanone	1.46	2.009	6.1176	19	0.49	18
Benzene	1.78	1.845	6.774	19	0.24	18
Ethylbenzene	1.71	2.11	8.1746	19	0.52	18
Methylene Chloride	1.91	2.342	13.0136	19	0.72	18
Styrene	1.75	1.781	6.1475	19	0.13	18
Xylene (Total)	1.53	2.11	7.1312	19	0.56	18
Semivolatiles (ug/kg)						
Benzo(b)Fluoranthene	5.26	2.021	257.3987	18	0.41	17
Bis(2-Ethylhexyl)Phthalate	5.11	3.021	598.7164	18	1.03	17
Chrysene	5.26	2.021	258.3027	18	0.42	17
Di-n-butylphthalate	4.45	2.362	184.7272	18	0.8	17
Fluoranthene	5.27	1.931	248.194	18	0.37	17
Pyrene	5.28	1.931	245.0336	18	0.35	17
Pest/PCB (ug/kg)						
4,4'-DDD	0.83	2.124	3.4152	18	0.52	17
4,4'-DDE	0.8	1.853	2.6225	18	0.28	17
4,4'-DDT	0.75	1.787	2.3057	18	0.17	17
Aroclor-1260	3.45	3.021	109.7573	18	1.01	17
Dieldrin	0.79	1.931	2.8142	18	0.37	17
Endrin Aldehyde	0.75	1.787	2.3057	18	0.17	17
Endrin Ketone	0.79	1.931	2.8072	18	0.37	17
Inorganics (mg/kg)						
Aluminum	9.33	2.362	21995.2976	18	0.71	17
Antimony	-0.61	3.021	2.5439	18	1.17	17
Arsenic	2.04	2.638	21.3615	18	0.93	17
Barium	3.39	2.021	40.4017	18	0.43	17
Beryllium	-0.94	2.362	0.8497	18	0.8	17
Cadmium	-1.54	3.867	4.6556	18	1.71	17
Calcium	7.11	3.867	22509.7219	18	1.65	17
Chromium	3.44	2.124	49.1413	18	0.57	17
Cobalt	1.55	2.021	6.4819	18	0.45	17
Copper	2.36	3.867	237.0233	18	1.73	17
Cyanide	-3.2	4.314	1.3275	18	1.79	17
Iron	10.2	2.124	39746.0248	18	0.51	17
Lead	2.68	2.496	33.5177	18	0.82	17
Magnesium	6.71	2.238	1397.2936	18	0.62	17
Manganese	4.29	2.124	109.3565	18	0.53	17
Mercury	-3.67	2.124	0.0411	18	0.59	17
Nickel	2.29	2.124	15.638	18	0.57	17
Potassium	6.77	2.124	1405.5374	18	0.59	17
Silver	1.91	2.496	16.179	18	0.85	17
Sodium	3.17	2.496	58.5553	18	0.87	17
Thallium	-0.56	2.238	1.0069	18	0.66	17
Vanadium	3.42	2.021	41.3948	18	0.43	17
Zinc	3.46	2.362	61.7917	18	0.71	17

SUMMARY OF TCLP AND RCRA CHARACTERIZATION
AREA OF CONCERN 2 - DEXTROSE DUMP
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Aqueous IDW	Respirator Cartridge	Composite of TP01-TP06
	A2-AQWT-01 11/23/1999	A2-CART-01 11/23/1999	A2-TPCOMP-01 11/14/1999
Volatiles (ug/L)			
1,1-Dichloroethene	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U
2-Butanone	10 U	1300 D	10 U
Benzene	5 U	370 D	5 U
Carbon Tetrachloride	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U
Chloroform	8	5 U	5 U
Tetrachloroethene	5 U	5 U	5 U
Trichloroethene	5 U	5 U	3 J
Vinyl Chloride	5 U	5 U	5 U
Semivolatiles (ug/L)			
1,4-Dichlorobenzene	40 U	40 U	40 U
2,4,5-Trichlorophenol	100 U	100 U	100 U
2,4,6-Trichlorophenol	40 U	40 U	40 U
2,4-Dinitrotoluene	40 U	40 U	40 U
2-Methylphenol	40 U	40 U	40 U
4-Methylphenol	40 U	40 U	40 U
Hexachlorobenzene	40 U	40 U	40 U
Hexachlorobutadiene	40 U	40 U	40 U
Hexachloroethane	40 U	40 U	40 U
Nitrobenzene	40 U	40 U	40 U
Pentachlorophenol	100 U	100 U	100 U
Pyridine	40 U	40 U	40 U

SUMMARY OF TCLP AND RCRA CHARACTERIZATION
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NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Aqueous IDW	Respirator Cartridge	Composite of TP01-TP06
	A2-AQWT-01 11/23/1999	A2-CART-01 11/23/1999	A2-TPCOMP-01 11/14/1999
Pesticides (ug/L)			
Chlordane	4 U	4 U	4 U
Endrin	0.4 U	0.4 U	0.4 U
Heptachlor	0.2 U	0.2 U	0.2 U
Heptachlor Epoxide	0.2 U	0.2 U	0.2 U
Methoxychlor	2 U	2 U	2 U
Toxaphene	20 U	20 U	20 U
gamma-BHC	0.2 U	0.2 U	0.2 U
Herbicides (ug/L)			
2,4,5-T	NA	0.4 U	0.4 U
2,4,5-TP (Silvex)	NA	0.4 U	0.4 U
2,4-D	NA	4 U	4 U
Dinoseb	NA	2 U	2 U
Inorganics (ug/L)			
Arsenic	5.8 B	90 U	3.6 U
Barium	222 B	398 B	484 B
Cadmium	1.1 B	2480	112
Chromium	9.3 B	235	63.2
Lead	24.5 B	8600	135 B
Mercury	0.11 U	0.11 U	0.2 U
Selenium	2.1 U	52.5 U	2.1 U
Silver	3.7 U	28.8	14.7
RCRA Characteristics			
pH (SU)	NA	NA	6.66
Flashpoint (ºF)	NA	NA	U
Reactive Cyanide (mg/kg)	NA	NA	0.6 U
Reactive Sulfide (mg/kg)	NA	NA	1.5 U

Notes:
(1) 40CFR261.20 Subpart C

AOC 6—Historical Data

Table C-5
AOC 6 - 1999 Soil Sampling Results
Cheatham Annex
Williamsburg, Virginia

Sample Location Area	**Residential RSLs-Soil**	Ammonia Settling Pits	TNT Graining House Sump	TNT Graining House Sump	TNT Catch Box Ruins	Metallic Slag Material	1918 Drum Storage Area	1918 Drum Storage Area
Sample ID		PEN1-SO-01[2]	PEN1-SO-03[2]	PEN1-SO-03A[1,2]	PEN1-SO-04[2]	PEN1-SO-07[2]	PEN1-SO-13[2]	PEN1-SO-14[2]
Sample Date		01/12/99	01/12/99	01/12/99	01/12/99	01/12/99	01/13/99	01/12/99
Chemical Name								
Volatile Organic Compounds (UG/KG)								
Chloroform	300.00	4 B	3 B	**10 J**	12 U	14 U	12 U	1 B
Styrene	6,500,000.00	12 U	**2.66666667 J**	20 UJ	12 U	14 U	12 U	11 U
Xylene (total)	600,000.00	**2 J**	20 U	20 UJ	12 U	14 U	12 U	11 U
Semi-volatile Organic Compounds (UG/KG)								
Naphthalene	3,900.00	410 U	660 U	670 U	400 U	**21.5 J**	380 U	380 U
2-Methylnaphthalene	310,000.00	410 U	660 U	670 U	400 U	**45 J**	380 U	380 U
Dibenzofuran	3,900,000.00	410 U	660 U	670 U	400 U	**9.1 J**	380 U	380 U
2,4-Dinitrotoluene	120,000.00	410 U	660 U	670 U	**111.76 J**	480 U	380 U	380 U
Diethyl phthalate	49,000,000.00	410 U	660 U	670 U	400 U	480 U	**3.26 J**	380 U
Phenanthrene	17,000,000.00	410 U	**42 J**	**34 J**	**2.8 J**	**24 J**	380 U	380 U
Di-n-butyl phthalate	6,100,000.00	410 U	660 U	670 U	400 U	480 U	**17 J**	380 U
Fluoranthene	2,300,000.00	410 U	**42 J**	**48 J**	**25 J**	**3 J**	380 U	380 U
Pyrene	1,700,000.00	410 U	**1300**	**1500**	**510**	**5.18 J**	380 U	380 U
Benzo(a)anthracene	150.00	410 U	**97.67 J**	**125.58 J**	**21.86 J**	**7.21 J**	380 U	380 U
Chrysene	15,000.00	410 U	**740**	**840 J**	**30.23 J**	**15.81 J**	380 U	380 U
Benzo(b)fluoranthene	150.00	410 U	**33 J**	**38 J**	**3.6 J**	**6.1 J**	380 U	380 U
Benzo(k)fluoranthene	1,500.00	410 U	**31 J**	**37 J**	**4.5 J**	**5.7 J**	380 U	380 U
Benzo(a)pyrene	15.00	410 U	**47 J**	**55 J**	400 U	480 U	380 U	380 U
Ideno(1,2,3-cd)pyrene	150.00	410 U	**22.47 J**	**22.47 J**	400 U	**7.64 J**	380 U	380 U
Dibenz(a,h)anthracene	15.00	410 U	**15.73 J**	**19.1 J**	400 U	480 U	380 U	380 U
Benzo(g,h,i)perylene	1,500.00	410 U	**26 J**	**35 J**	400 U	**9.6 J**	380 U	380 U
Nitroaromatics (MG/KG)								
2,4,6-Trinitrotoluene	16.00	0.25 U	**26**	**28**	**620**	0.25 U	0.25 U	0.25 U
2-Amino-4,6-dinitrotoluene	120.00	0.25 U	**1.8 J**	1.8 U	18 U	0.25 U	0.25 U	0.25 U
Pesticide/Polychlorinated Biphenyls (UG/KG)								
Endosulfan I	370,000.00	2.1 U	**16 J**	**14 J**	**11 J**	2.5 U	2 U	2 U
Dieldrin	30.00	4.1 U	66 U	**1.35 J**	80 U	4.8 U	3.8 U	3.8 U
4,4'-DDE	2,000.00	**0.066 J**	**0.9 J**	**1.2 J**	**0.48 J**	**0.12 J**	**0.02 J**	**0.017 J**
Endrin	1,800.00	4.1 U	**4 J**	67 U	80 U	**0.15 J**	3.8 U	3.8 U
Endosulfan II	370,000.00	4.1 U	**0.43 J**	67 U	80 U	4.8 U	3.8 U	3.8 U
4,4'-DDD	2,000.00	4.1 U	**0.72 J**	67 U	80 U	**0.45 J**	3.8 U	**0.046**
Endrin ketone	18,000.00	4.1 U	**1.2 J**	**1.8 J**	80 U	**0.16 J**	3.8 U	3.8 U
Endrin aldehyde	18,000.00	4.1 U	66 U	67 U	80 U	**0.3 J**	3.8 U	3.8 U
alpha-Chlordane	1,600.00	**0.18 J**	34 U	35 U	41 U	2.5 U	2 U	**0.033**
Inorganics (MG/KG)								
Aluminum	77,000.00	**9050**	**2150**	**2730**	**7760**	**3080**	**11600**	**9640**
Antimony	31.00	0.94 B	2.9 B	2.2 B	**UL**	**4.6 L**	UL	UL
Arsenic	0.39	**6**	**12.5**	**15.5**	**11**	**33.4**	**4.7**	**5.5**
Barium	15,000.00	**16.8**	**283**	**203**	**34.5**	**261**	**50.4**	**41.9**
Beryllium	160.00	**0.24**	**0.18**	**0.17**	**0.36**	**0.6**	**0.52**	**0.52**
Cadmium	70.00	U	**4**	**4**	UL	UL	UL	**0.22**
Calcium	--	**87.5 J**	**7983.33 J**	**7633.33 J**	**768.33 J**	**7241.67 J**	**2050 J**	**1925**
Chromium	230.00	**14.8**	**14.8**	**22.7**	**15.1**	**32.9**	**21**	**20.2**
Cobalt	--	**2**	**5.3**	**6.4**	**2.4**	**14.9**	**2.8**	**1.8**
Copper	3,100.00	**3.8**	**27.9**	**32.1**	**4.09 J**	**127.27 J**	**9.82**	**3.91**
Iron	55,000.00	**13900**	**70800**	**101000**	**20000**	**256000**	**18500**	**23300**
Lead	400.00	**15**	**7580**	**7750**	**813**	**2600**	**23.6**	**12.9**
Magnesium	--	**408.33 J**	**605 J**	**900 J**	**648**	**824**	**1090**	**977**
Manganese	1,800.00	**25.1**	**705**	**886**	**65.42 J**	**1725 J**	**100**	**29.92**
Mercury	6.70	**0.26**	**0.49**	**0.6**	**0.07**	**0.07**	U	U
Nickel	1,600.00	**4.3**	**15.6**	**17.4**	**5.4**	**34.1**	**5.9**	**3.7**
Potassium	--	**419**	**485**	**570**	**722**	**607**	**836**	**850**
Selenium	390.00	UL	**3.9**	**3.7 L**	U	**3.6**	U	1.1 K
Silver	390.00	**0.45**	**2.7**	**4**	**0.76**	**9.1**	**0.77**	**1**
Sodium	--	**57.4**	**147**	**168**	**74.7**	**356**	**94.5**	**75.2**
Vanadium	390.00	**25.1**	**28**	**31.8**	**22.5**	**18.4**	**25.7**	**26.3**
Zinc	23,000.00	**13.4**	**1010**	**1150**	**87.69 J**	**110.77 J**	**31.85 J**	**138.46 J**
Cyanide	1,600.00	UL	**0.57**	**1.2**	**0.07 L**	**0.64 L**	UL	UL

NOTES:
Detections of a chemical are indicated in bold font.
[1]Duplicate of PEN-SO-03
[2]Data as reported in the *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia* by Roy F. Weston, Inc., August 9, 1999.
U = Compound not detected.
J = Analyte present. Reported value may or may not be accurate or precise.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
UL = Not detected, quantitation limit is probably higher.
B = Not detected substantially above the level reported in laboratory or field blanks.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
UJ = Not detected, quantitation limit may be inaccurate or imprecise.

Table C-6
AOC 6 - 1999 Surface Water Sampling Results
Cheatham Annex
Williamsburg, Virginia

Sample Location Area	**Residential RSLs-Soil**	Penniman Lake
Sample ID		PEN1-SW-02[1]
Sample Date		01/12/99
Chemical Name		
Volatile Organic Compounds (UG/L)		
No Detections		
Semi-volatile Organic Compounds (UG/L)		
No detections		
Pesticide/Polychlorinated Biphenyls (UG/L)		
No Detections		
Inorganics (UG/L)		
Arsenic	0.39	**4**
Barium	15,000.00	**18.6**
Calcium	--	**50,400**
Iron	55,000.00	**145**
Magnesium	--	**2,100**
Manganese	1,800.00	**13.5**
Potassium	--	**2,900**
Sodium	--	**11,500**

NOTES:

[1]Data as reported in the *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia* by Roy F. Weston, Inc., August 9, 1999.

Detections of a chemical are indicated in bold font.

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

Table C-7
AOC 6 - 1999 Sediment Sampling Results
Cheatham Annex
Williamsburg, Virginia

Sample Location Area	**Residential RSLs-Soil**	Penniman Lake @ suspected point of discharge of runoff from Annomia Settling Pits	Penniman Lake @ suspected point of discharge of runoff from TNT Catch Basin	Penniman Lake @ suspected point of discharge of runoff from TNT Catch Basin
Sample ID		PEN1-SED-01[1]	PEN1-SED-02[1]	PEN1-SED-02A[1]
Sample Date		01/12/99	01/12/99	01/12/99
Chemical Name				
Volatile Organic Compounds (UG/KG)				
Xylene (total)	600,000.00	**0.002 J**	0.014 U	0.013 U
Semi-volatile Organic Compounds (UG/KG)				
Di-n-butylphthalate	6,100,000.00	**0.0047 J**	0.44 U	0.43 U
Nitroaromatics (MG/KG)				
2-Amino-4,6-dinitrotoluene	120.00	0.25 U	**1.8 J**	1.8 U
Pesticide/Polychlorinated Biphenyls (UG/KG)				
Endosulfan I	370,000.00	0.0022 U	**0.000086 J**	0.0022 U
Dieldrin	30.00	0.0042 U	**0.000140323 J**	0.0043 U
4,4'-DDE	2,000.00	0.0042 U	**0.000056 J**	0.0043 U
Endrin	1,800.00	0.0042 U	**0.000164706 J**	**0.00005 J**
Endosulfan sulfate	370,000.00	0.0042 U	0.0045 U	**0.000047 J**
4.4'-DDT	1,700.00	0.0042 U	**0.000135135 J**	**0.000121622 J**
Endrin aldehyde	18,000.00	0.0042 U	**0.000053 J**	**0.00006 J**
Inorganics (MG/KG)				
Aluminum	77,000.00	**9170**	**1270**	**1360**
Arsenic	0.39	**4.8**	**1.4**	**2**
Barium	15,000.00	**21.8**	**5.5**	**6.5**
Beryllium	160.00	**0.26**	**0.09**	**0.09**
Calcium	--	**795 J**	**698.33 J**	**728.33 J**
Chromium	230.00	**12.1**	**2.6**	**3**
Cobalt	--	**1.9**	U	**0.45**
Copper	3,100.00	**3.2**	1 B	1.3 B
Iron	55,000.00	**8320**	**1900**	**2170**
Lead	400.00	**8.1**	**4**	**4.9**
Magnesium	--	**495.83 J**	**100 J**	**114.17 J**
Manganese	1,800.00	**23**	**14.5**	**14.1**
Nickel	1,600.00	**4.2**	**0.84**	**1.4**
Potassium	--	**416**	**130**	**150**
Silver	390.00	**0.23**	U	U
Sodium	--	**71.8**	**30.2**	**60.7**
Vanadium	390.00	**20.2**	**3.6**	**4.2**
Zinc	23,000.00	**15.5**	3.9 B	4.4 B
Cyanide	1,600.00	UL	UL	**0.6 L**

NOTES:

[1]Data as reported in the *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia by Roy F. Weston, Inc., August 9, 1999.*

Detections of a chemical are indicated in bold font.

J = Analyte present. Reported value may or may not be accurate or precise.

B = Not detected substantially above the level reported in laboratory or field blanks.

UL = Not detected, quantitation limit is probably higher.

U = Not detected.

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

AOC 8—Historical Data

TABLE 4-1

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED - QA/QC SAMPLES
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02 11/12/1999	104-TB03 11/14/1999	104-TB05 03-FEB-2000	104-RS01 11/13/1999	104-RS03 11/13/1999	104-FB01 11/10/1999	104-FB02 11/10/1999
Volatiles (ug/L)							
1,1,2,2-Tetrachloroethane	10 U	1 J	10 U	10 U	10 U	10 U	10 U
2-Butanone	7 J	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	3 J	1 J	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	1 J	10 U	10 U	10 U	10 U	10 U
Acetone	8 J	7 J	10 U	6 J	10 U	5 J	6 J
Chloromethane	10 U	3 J	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	2 J	12 B	2 J	2 J	2 J	2 J	2 J
Semivolatiles (ug/L)							
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	2 J	10 U	2 J	10 U

TABLE 4-2

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED - QA/QC SAMPLES
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Rinsate Blanks		Field Blanks	
	104-RS01	104-RS03	104-FB01	104-FB02
	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Inorganics (ug/L)				
Aluminum	49.1 J	44 U	84.7 J	428
Barium	11.3 J	4.1 U	4.1 U	6.9 J
Calcium	85.4 U	85.4 U	85.4 U	87.7 J
Copper	5.4 U	5.4 U	5.4 U	7.3 J
Iron	37.5 J	27.4 J	65.4 J	151
Magnesium	143 J	117 U	117 U	117 U
Potassium	247 J	250 J	209 U	209 U
Silver	3.9 U	3.9 U	5.8 J	8.5 J
Sodium	86.5 J	42.3 U	236 J	194 J
Thallium	2.4 U	2.4 U	2.4 U	2.8 J
Zinc	9.8 J	9.8 J	40.7	64.3

TABLE 4-3

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS DETECTED IN SEDIMENT
SITE 7 - OLD DuPONT DISPOSAL AREA
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

Sample ID	Comparison to	7-SD01	
Sample Date	Residential RSLs	11/11/1999	
Semivolatiles (ug/kg)			
Di-n-Butylphthalate	6,100,000	69	J
Pesticides/PCBs (ug/kg)			
Aroclor-1260	220	540	L

Notes: Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

TABLE 4-4

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS DETECTED IN SEDIMENT
SITE 7 - OLD DuPONT DISPOSAL AREA
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

Sample ID	Comparison to	7-SD01	
Sample Date	Residential RSLs	11/11/1999	
Inorganics (mg/kg)			
Aluminum	77,000	10,200	L
Arsenic	0.39	5.9	
Barium	15,000	36.8	J
Calcium	--	1,970	
Chromium	230 (1)	22	
Cobalt	--	2.2	J
Iron	55,000	17,000	
Lead	400 (2)	21.2	
Magnesium	--	1,070	J
Manganese	1,800	59.5	
Mercury	23.00 (3)	0.11	J
Nickel	1,600	4.8	J
Potassium	--	1,450	
Vanadium	390	35.3	

Notes:
(1) Screening value for chromium VI used.
(2) Action level for lead
(3) Screening values for mercuric chloride

Shading indicates that the detected concentration exceeds the Regional Screening Level value for soil (beta version, 5/27/08).

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Volatiles (ug/L)							
1,1,1-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	10 U	1 J	10 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Butanone	7 J	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	3 J	1 J	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	1 J	10 U	10 U	10 U	10 U	10 U
Acetone	8 J	7 J	10 U	6 J	10 U	5 J	6 J
Benzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromoform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	11 B	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon Tetrachloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloromethane	10 U	3 J	10 U	10 U	10 U	10 U	10 U
Dibromochloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene Chloride	2 J	12 B	2 J	2 J	2 J	2 J	2 J
Styrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Toluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Xylene (Total)	10 U	10 U	10 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	10 U	10 U	10 U	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Semivolatiles (ug/L)							
1,2,4-Trichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
2,2'-oxybis(1-Chloropropane)	NA	NA	NA	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	NA	NA	NA	25 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	NA	NA	NA	25 U	25 U	25 U	25 U
2,4-Dinitrotoluene	NA	NA	NA	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Chloronaphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Chlorophenol	NA	NA	NA	10 U	10 U	10 U	10 U
2-Methylnaphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
2-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
2-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
2-Nitrophenol	NA	NA	NA	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	NA	NA	NA	10 U	10 U	10 U	10 U
3-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
4,6-Dinitro-2-Methylphenol	NA	NA	NA	25 U	25 U	25 U	25 U
4-Bromophenyl phenylether	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chloroaniline	NA	NA	NA	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	NA	NA	NA	10 U	10 U	10 U	10 U
4-Methylphenol	NA	NA	NA	10 U	10 U	10 U	10 U
4-Nitroaniline	NA	NA	NA	25 U	25 U	25 U	25 U
4-Nitrophenol	NA	NA	NA	25 U	25 U	25 U	25 U
Acenaphthene	NA	NA	NA	10 U	10 U	10 U	10 U
Acenaphthylene	NA	NA	NA	10 U	10 U	10 U	10 U
Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(a)Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
SITE 7 / AREA OF CONCERN 2
FIELD INVESTIGATION REPORT
NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA
CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Semivolatiles (ug/L) (Cont)							
Benzo(a)Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(b)Fluoranthene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(g,h,i)Perylene	NA	NA	NA	10 U	10 U	10 U	10 U
Benzo(k)Fluoanthene	NA	NA	NA	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl)Phthalate	NA	NA	NA	2 J	10 U	2 J	10 U
Bis(2-chloroethoxy)Methane	NA	NA	NA	10 U	10 U	10 U	10 U
Bis(2-chloroethyl)Ether	NA	NA	NA	10 U	10 U	10 U	10 U
Butylbenzylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Carbazole	NA	NA	NA	10 U	10 U	10 U	10 U
Chrysene	NA	NA	NA	10 U	10 U	10 U	10 U
Di-n-Butylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Di-n-Octyl Phthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Dibenz(a,h)Anthracene	NA	NA	NA	10 U	10 U	10 U	10 U
Dibenzofuran	NA	NA	NA	10 U	10 U	10 U	10 U
Diethylphthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Dimethyl Phthalate	NA	NA	NA	10 U	10 U	10 U	10 U
Fluoranthene	NA	NA	NA	10 U	10 U	10 U	10 U
Fluorene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorobutadiene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	NA	NA	NA	10 U	10 U	10 U	10 U
Hexachloroethane	NA	NA	NA	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U
Isophorone	NA	NA	NA	10 U	10 U	10 U	10 U
N-Nitroso-Di-n-Propylamine	NA	NA	NA	10 U	10 U	10 U	10 U
N-Nitrosodiphenylamine	NA	NA	NA	10 U	10 U	10 U	10 U
Naphthalene	NA	NA	NA	10 U	10 U	10 U	10 U
Nitrobenzene	NA	NA	NA	10 U	10 U	10 U	10 U
Pentachlorophenol	NA	NA	NA	25 U	25 U	25 U	25 U
Phenanthrene	NA	NA	NA	10 U	10 U	10 U	10 U
Phenol	NA	NA	NA	10 U	10 U	10 U	10 U
Pyrene	NA	NA	NA	10 U	10 U	10 U	10 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Pesticides/PCBs (ug/L)							
4,4'-DDD	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDE	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
4,4'-DDT	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Aldrin	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Aroclor-1016	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1221	NA	NA	NA	2 U	2 U	2 U	2 U
Aroclor-1232	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1242	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1248	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1254	NA	NA	NA	1 U	1 U	1 U	1 U
Aroclor-1260	NA	NA	NA	1 U	1 U	1 U	1 U
Dieldrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan I	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan II	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endosulfan Sulfate	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin Aldehyde	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Endrin Ketone	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U
Heptachlor	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor Epoxide	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Methoxychlor	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U
Toxaphene	NA	NA	NA	5 U	5 U	5 U	5 U
alpha-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
alpha-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
gamma-Chlordane	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U

ANALYTICAL SUMMARY OF ORGANIC COMPOUNDS - QAQC
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	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Explosives (ug/L)							
1,3,5-Trinitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
1,3-Dinitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
2,4,6-Trinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2,4-Dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2,6-Dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
2-Amino-4,6-dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
3-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
4-Nitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
4-Amino-2,6-dinitrotoluene	NA	NA	NA	1 U	1 U	1 U	1 U
HMX	NA	NA	NA	1 U	1 U	1 U	1 U
Nitrobenzene	NA	NA	NA	1 U	1 U	1 U	1 U
RDX	NA	NA	NA	1 U	1 U	1 U	1 U
Tetryl	NA	NA	NA	1 U	1 U	1 U	1 U

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS - QAQC
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CHEATHAM ANNEX SITE

	Trip Blanks			Rinsate Blanks		Field Blanks	
	104-TB02	104-TB03	104-TB05	104-RS01	104-RS03	104-FB01	104-FB02
	11/12/1999	11/14/1999	2/3/00	11/13/1999	11/13/1999	11/10/1999	11/10/1999
Inorganics (ug/L)							
Aluminum	NA	NA	NA	49.1 J	44 U	84.7 J	428
Antimony	NA	NA	NA	2.2 U	2.2 U	2.2 U	2.2 U
Arsenic	NA	NA	NA	3.4 U	3.4 U	3.4 U	3.4 U
Barium	NA	NA	NA	11.3 J	4.1 U	4.1 U	6.9 J
Beryllium	NA	NA	NA	0.66 U	0.66 U	0.66 U	0.66 U
Cadmium	NA	NA	NA	0.34 U	0.34 U	0.34 U	0.34 U
Calcium	NA	NA	NA	85.4 U	85.4 U	85.4 U	87.7 J
Chromium	NA	NA	NA	6.2 U	6.2 U	6.2 U	6.2 U
Cobalt	NA	NA	NA	6.2 U	6.2 U	6.2 U	6.2 U
Copper	NA	NA	NA	5.4 U	5.4 U	5.4 U	7.3 J
Cyanide	NA	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U
Iron	NA	NA	NA	37.5 J	27.4 J	65.4 J	151
Lead	NA	NA	NA	1.4 U	1.4 U	1.4 U	1.4 U
Magnesium	NA	NA	NA	143 J	117 U	117 U	117 U
Manganese	NA	NA	NA	3.9 U	3.9 U	3.9 U	3.9 U
Mercury	NA	NA	NA	0.06 U	0.06 U	0.07 U	0.06 U
Nickel	NA	NA	NA	6 U	6 U	6 U	6 U
Potassium	NA	NA	NA	247 J	250 J	209 U	209 U
Selenium	NA	NA	NA	3 U	3 U	3 U	3 U
Silver	NA	NA	NA	3.9 U	3.9 U	5.8 J	8.5 J
Sodium	NA	NA	NA	86.5 J	42.3 U	236 J	194 J
Thallium	NA	NA	NA	2.4 U	2.4 U	2.4 U	2.8 J
Vanadium	NA	NA	NA	5.7 U	5.7 U	5.7 U	5.7 U
Zinc	NA	NA	NA	9.8 J	9.8 J	40.7	64.3