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NRL CHESAPEAKE BEACH, MD
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# FINAL BASEWIDE EXPANDED SITE INSPECTION REPORT CHESAPEAKE BAY DETACHMENT NRL CHESAPEAKE BEACH MD

04/01/2020
CH2M HILL

Naval Facilities Engineering Command Washington
Washington, DC

**Final**

# Base-wide Expanded Site Inspection Report
# Naval Research Laboratory – Chesapeake Bay Detachment

Naval Research Laboratory
Chesapeake Beach, Maryland

April 2020

**Approved for public release: distribution unlimited**

Naval Facilities Engineering Command Washington
Washington, DC

Final

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# Naval Research Laboratory – Chesapeake Bay Detachment

Naval Research Laboratory
Chesapeake Beach, Maryland

April 2020

Prepared for NAVFAC Washington
by CH2M HILL, Inc.
Herndon, Virginia
Contract N62470-16-D-9000
CTO JU23

# Executive Summary

A Base-wide Expanded Site Inspection (ESI) was performed at the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) to:

- Further evaluate whether historical practices led to site-related releases to the environment that pose a potential unacceptable risk to human health and/or the environment at five environmental restoration sites and one area of concern (AOC).
- Further delineate buried waste disposed of at the three landfill sites (Sites 3, 4, and 5).

The areas included in the investigation were selected based on recommendations presented in the *Final Base-Wide Site Inspection Report* (CH2M, 2016) and are summarized in Table ES-1.

Table ES-1. Reasons for Inclusion in Base-wide ESI Investigation

| Investigation Area | Reason(s) for Inclusion in the Base-wide ESI Investigation |
|---|---|
| Site 3 – Landfill No. 1 | Further evaluation for human health and ecological risks in surface soil |
| Site 4 – Landfill No. 2 | Further evaluation for human health and ecological risks in surface soil |
| Site 5 – Landfill No. 3 | Further evaluation for human health and ecological risks in surface soil |
| Site 7 – Road Oil Application | Further evaluation for ecological risks in surface soil |
| Site 9 – Photo-processing Waste | Further evaluation for ecological risks in surface soil |
| AOC D – Water Tower | Further evaluation for human health and ecological risks in surface soil |

The purpose of this document is to report the findings of the Base-wide ESI based on the investigation objectives identified in the Uniform Federal Policy Sampling and Analysis Plan and to address the issues noted above. To support the Base-wide ESI, a field investigation consisting of test pitting, surface soil sampling, direct-push technology soil sampling, monitoring well installation, groundwater sampling, and x-ray fluorescence soil screening for lead was performed. Analytical data generated during this investigation were combined with data generated during the Site Inspection and evaluated in the human health risk screening and the ecological risk screening to determine potential risks associated with exposure to analytes in site media. The Base-wide ESI recommendations based on site characterization and potential site risks are summarized in Table ES-2.

Table ES-2. Base-wide ESI Recommendations

| Investigation Area | Recommendation |
|---|---|
| Site 3 – Landfill No. 1 | Further evaluation of surface soil |
| Site 4 – Landfill No. 2 | Further evaluation of surface soil |
| Site 5 – Landfill No. 3 | Further evaluation of surface soil |
| Site 7 – Road Oil Application | No further action |
| Site 9 – Photo-processing Waste | Further evaluation of hydroquinone in soil and groundwater |
| AOC D – Water Tower | Further evaluation of surface soil |

A historical records review of Building 76 and its surrounding area at NRL-CBD was performed to investigate the presence of solid waste and debris at the base of the hill near the building. A site visit and historical records search of available base documents were conducted in early 2019. The document review noted Building 76 historically supported multiple trade shops (carpentry, machine, plumbing, and electrical) and is currently used for storage. Based on observations during the site visit it was suggested that subsurface construction debris noted along the western hillside of Building 76 may be related to the timeframe when Building 76 was constructed. The Navy is evaluating this area to determine whether a new environmental restoration site should be created.

# Contents

**Appendixes**

## Tables

## Figures

# Acronyms and Abbreviations

| | |
|---|---|
| µg/dL | microgram per deciliter |
| µg/L | microgram per liter |
| ALM | Adult Lead Methodology |
| amsl | above mean sea level |
| AOC | area of concern |
| bgs | below ground surface |
| BTV | background threshold value |
| CH2M | CH2M HILL, Inc. |
| CLEAN | Comprehensive Long-term Environmental Action – Navy |
| CNO | Chief of Naval Operations |
| COPC | chemical of potential concern |
| CSM | conceptual site model |
| DGM | digital geophysical mapping |
| DO | dissolved oxygen |
| DOT | Department of Transportation |
| DPT | direct-push technology |
| EPC | exposure point concentration |
| ERA | ecological risk assessment |
| ERS | ecological risk screening |
| ESV | ecological screening value |
| $ft^2$ | square foot |
| HHRS | human health risk screening |
| HI | hazard index |
| HMW | high molecular weight |
| HQ | hazard quotient |
| IAS | Initial Assessment Study |
| IEUBK | Integrated Exposure Uptake Biokinetic |
| IDW | investigation-derived waste |
| LMW | low molecular weight |
| MDE | Maryland Department of the Environment |
| mg/kg | milligram per kilogram |
| N/A | not applicable |
| NAVFAC | Naval Facilities Engineering Command |
| Navy | Department of the Navy |
| NEESA | Naval Energy and Environmental Support Activity |
| NRL-CBD | Naval Research Laboratory – Chesapeake Bay Detachment |
| NRL-DC | Naval Research Laboratory – Washington, D.C. |
| OLEM | Office of Land and Emergency Management |
| ORP | oxidation-reduction potential |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PID | photoionization detector |

| | |
|---|---|
| PPRTV | Provisional Peer Reviewed Toxicity Value |
| QA | quality assurance |
| QC | quality control |
| RfD | reference dose |
| RSL | regional screening level |
| SAP | Sampling and Analysis Plan |
| SI | Site Inspection |
| SVOC | semivolatile organic compound |
| TCLP | toxicity characteristic leaching procedure |
| UCL | upper confidence limit |
| UFP | Uniform Federal Policy |
| USEPA | United States Environmental Protection Agency |
| USWFS | United States Fish and Wildlife Service |
| UTL | Upper Tolerance Limit |
| VOC | volatile organic compound |
| WOE | weight-of-evidence |
| XRF | x-ray fluorescence |

SECTION 1

# Introduction

This report was prepared under the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Washington, Comprehensive Long-term Environmental Action – Navy (CLEAN) 9000 Contract N62470-16-D-9000, Contract Task Order JU23 and in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorizations Act of 1986. This deliverable has been submitted to NAVFAC Washington and the Maryland Department of the Environment (MDE), which serves as the lead regulatory agency.

This report presents the results of the Base-wide Expanded Site Inspection (ESI) conducted at the Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD) located in Chesapeake Beach, Maryland (**Figure 1-1**). Six sites - Sites 3, 4, 5, 7, 9, and AOC D (**Figure 1-2**), were identified for investigation during the Base-wide Expanded Site Inspection (ESI) based on the recommendations from the Base-wide SI Report (CH2M HILL, 2016). **Table 1-1** lists the sites included in the Base-wide ESI based on the recommendations presented in the Final SI Report (CH2M, 2016).

Table 1-1. Summary of Investigation Areas

| Investigation Area | Reason(s) for Inclusion in the Base-wide ESI |
|---|---|
| Site 3 – Landfill No 1 | Further evaluation for human health and ecological risks in surface soil |
| Site 4 – Landfill No 2 | Further evaluation for human health and ecological risks in surface soil |
| Site 5 – Landfill No 3 | Further evaluation for human health and ecological risks in surface soil |
| Site 7 – Road Oil Application | Further evaluation for ecological risks in surface soil |
| Site 9 – Photo-processing Waste | Further evaluation for ecological risks in surface soil |
| AOC D – Water Tower | Further evaluation for human health and ecological risks in surface soil |

The objectives of the Base-wide ESI were to:

1) Further evaluate whether historical practices led to site-related releases to the environment that pose a potential unacceptable risk to human health and/or the environment at five sites and one AOC (Sites 3, 4, 5, 7, 9, and AOC D).
2) Further delineate buried waste disposed of at the three landfill sites (Sites 3, 4, and 5).

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**Legend**

— Road

🟥 Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

N

0 200 400 Feet

1 inch = 400 feet

Imagery: Calvert County, MD - 2017

**Figure 1-1**
**Base Location Map**
Base-Wide Expanded Site
Inspection Report
***NRL-CBD***
***Chesapeake Beach, Maryland***

ch2m

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**Legend**

🟨 IR Site Feature
🟧 IR Site and AOC Boundary
🟥 NRL-CBD Base Boundary

1 inch = 200 feet

Imagery: Calvert County, MD - 2017

**Figure 1-2**
**Site Location Map**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

SECTION 2

# Facility and Site Background

## 2.1 NRL-CBD Facility Background, Mission, and History

NRL-CBD is located south of Chesapeake Beach, Maryland and approximately 40 miles southeast of Washington, D.C. The installation occupies approximately 160 acres of land along the western shoreline of the Chesapeake Bay. The facility is separated into an eastern and western portion, separated by Bayside Road (Maryland State Route 261).[1] The facility is bounded by the Chesapeake Bay to the east and offsite residential housing areas to the north, south, and west.

The mission of NRL-CBD is to provide and maintain facilities for use by the research divisions of the Naval Research Laboratory – Washington, D.C. (NRL-DC), for the testing, development, and evaluation of radar, radio, optical, and fire control equipment, along with other research projects requiring a maritime environment or open skies, but with land-based support facilities (NEESA, 1984).

The original acquisition of land for NRL-CBD was made in 1941, and construction progressed rapidly during World War II. Major expansion occurred in 1953 and 1954 with construction of a large laboratory building, shop facilities, and complete utility systems (NEESA, 1984).

## 2.2 Facility Geology and Hydrogeology

NRL-CBD is in the Atlantic Coastal Plain physiographic province. The sediments of the Coastal Plain are a thick sequence of unconsolidated sands, clays, and gravels and, at times, indurated lime or iron-cemented sands (NEESA, 1984). The two primary formations that underlie NRL-CBD are the Choptank formation, which ranges from 75 to 100 feet thick, and the underlying Calvert formation, which is approximately 150 feet thick (NEESA, 1984). Based on information obtained from the soil borings collected during the SI (CH2M, 2016), the 2017 Background Groundwater investigation (CH2M, 2017a), and the per- and polyfluoroalkyl substances investigation (CH2M, 2017b) at the facility, the soils underlying NRL-CBD are consistent with the Atlantic Coastal Plain and the Choptank formation. Soil lithologic descriptions at NRL-CBD consist predominantly of clays from ground surface to approximately 120 feet below ground surface (bgs) and then transitioning into clayey sand (between 120 and 200 feet bgs) and ultimately to poorly-graded sand (below 200 feet bgs).

Shallow groundwater across the facility has been encountered from depths ranging from 10 to 27 feet bgs. Localized groundwater flow is influenced by surface topography, which causes the groundwater flow to radiate to the northeast and southeast from Navy Court Road (**Figure 2-1**). This shallow water table is underlain by a thick clay layer (i.e., Calvert confining unit) that is believed to be laterally continuous and fully confining to the deeper Piney Point aquifer.

## 2.3 Land Use

NRL-CBD consists of laboratory buildings, shop facilities, and other structures that support its mission (see Section 2.1). The six sites investigated during the Base-wide ESI are located on the western portion of the facility (**Figure 2-1**) and currently and for the foreseeable future, are expected to have an industrial land use.

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[1] In addition to the facility at 5813 Bayside Drive, NRL-CBD also operates a boat from a small dock area (referred to as the Navy Dock) located in downtown Chesapeake Beach, Maryland (approximate address 8050 Bayside Road; Latitude = 38°41’30.05” North, Longitude = 76°32’06.00” West). The Navy Dock is approximately 1.7 miles north of the main NRL-CBD facility.

## 2.4 Conceptual Site Model

**Figures 2-2a, 2-2b, and 2-2c** present the current understanding of the conceptual site model (CSM) for the six sites investigated in the Base-wide ESI. The CSM describes the relationship between potential contaminant sources and their impacts to the receptors and the environmental media of concern. Section 2.4.1 describes the potential contamination sources at each Base-wide ESI site and Section 2.4.2 describes the transport pathway between the potential contamination sources to the media of impact (i.e., soil and/or groundwater).

The areas being evaluated during the Base-wide ESI are composed of two distinctly different habitat types. Site 5 is composed of wooded habitat, while Sites 3, 4, 7, and 9 and AOC D are composed of primarily mowed mixed grass habitats that are bordered by wooded habitat on one or more sides. Despite the variability in habitats, soil (surface and subsurface) and groundwater are the media of concern at the six Base-wide ESI sites.

### 2.4.1 Potential Source Areas

This section summarizes the potential source areas for each of the sites investigated during the Base-wide ESI. The site history and suspected past disposal practices are discussed in the subsequent sections for each specific site.

- **Site 3** – From 1942 until 1950, Site 3 was used as a landfill for municipal, shop, and laboratory wastes. After the landfill closed the site was used for storage. Based on the history of the site, the likely potential source areas that may be associated with an environmental release are the disposal pits and undocumented releases during the time the site was used as a storage area.
- **Site 4** – From 1950 until 1958, Site 4 was used as a landfill for municipal, shop, and laboratory wastes. Based on the history of the site, the likely potential source areas that may be associated with an environmental release are the disposal pits.
- **Site 5** – From 1958 until 1968, Site 5 was used as a landfill for municipal, shop, and laboratory wastes. After the landfill was closed the site was used for storage. Based on the history of the site, the likely potential source areas that may be associated with an environmental release are the disposal area and burn pits. In addition, undocumented releases from the time when the site was used as open storage may serve as a source.
- **Site 7** – From 1940 until 1952, Site 7 consisted of unpaved roads located on the portion of NRL-CBD located west of Bayside Road. The unpaved roads were treated with waste oils for dust control. Based on the history of the site, the likely sources of site-related constituents are the former oiled roadways, which are documented to have potentially contained polychlorinated biphenyl (PCB)-contaminated oil.
- **Site 9** – From the late 1950s until 1975, Site 9 contained a photo-processing laboratory. Based on the history of the site, the likely source area that may be associated with an environmental release is the former drain pipe through which the photo processing wastes were reportedly disposed of. The building and drain pipes have been since demolished and removed from the site.
- **AOC D** – Lead-based paint associated with routine maintenance of the water tower conducted during the 1950s through 1970s is thought to serve as a potential source for lead that may be found in surface soils at the site.

### 2.4.2 Transport Pathways

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source area to exposure media where receptor exposures may occur. The primary mechanisms for constituent transport from the potential source areas are:

- Infiltration/leaching of constituents from the landfill waste material into surface and subsurface soils and/or groundwater (for Sites 3, 4, and 5)

- Discharge/leaking of oil or related petroleum constituents from oil/petroleum storage vehicles driving on the unpaved site road at Site 7
- Discharge of photo-processing wastes into the surface and subsurface soils at Site 9
- Infiltration/leaching of lead from the water tower paint chips into surface and subsurface soils at AOC D

Additional transport pathways may include:

- Overland flow/surficial runoff to downgradient terrestrial areas
- Suspension/deposition of particulates via wind to downgradient terrestrial areas
- Leaching of chemicals from surface soils into subsurface soil and groundwater via infiltrating precipitation
- Uptake by biota from soil (for example, vegetation and soil invertebrates) and trophic transfer to upper trophic level receptors (e.g., birds and mammals)

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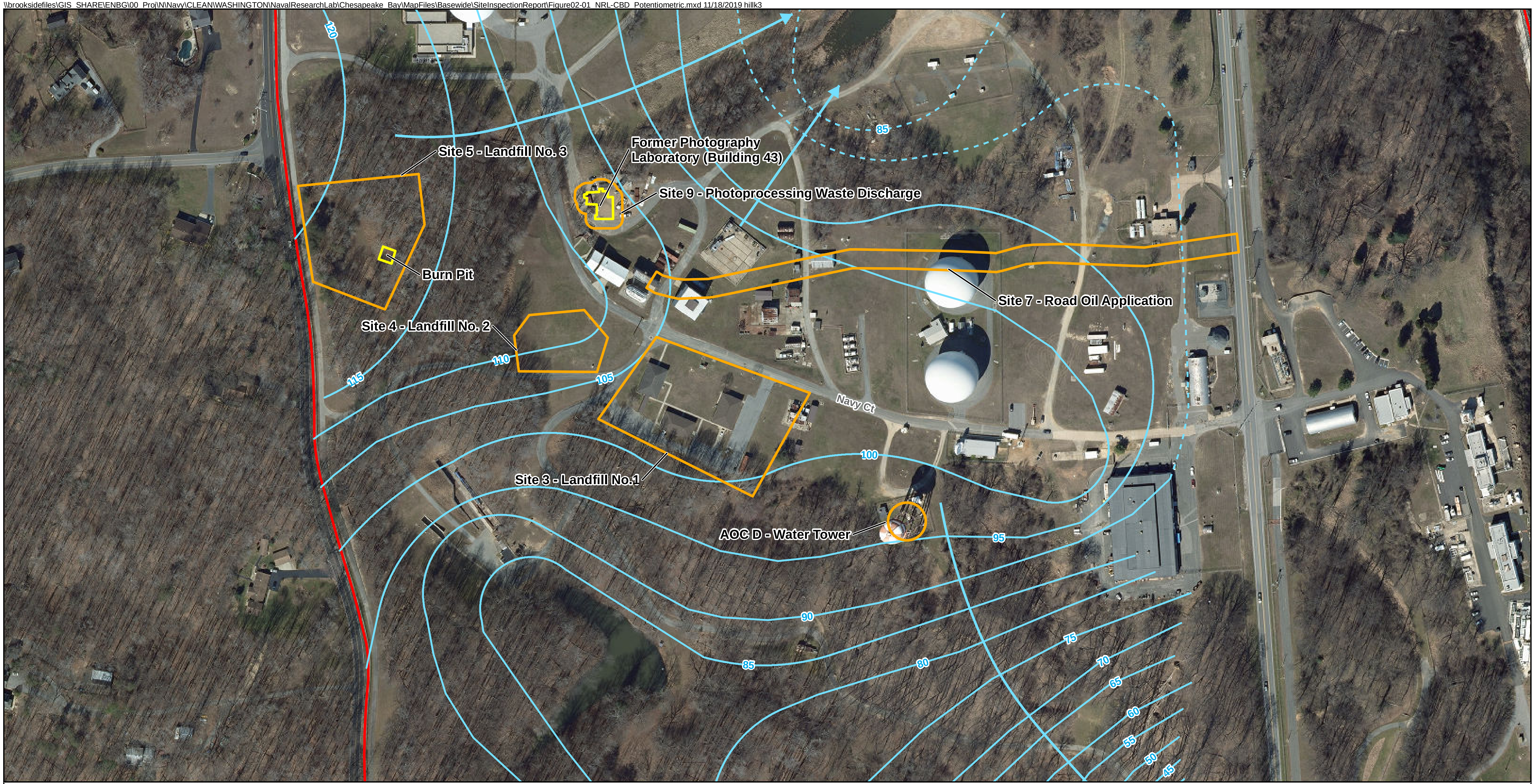


**Legend**

- 5-foot Contour Interval (dashed where inferred)
- Direction of Shallow Groundwater Flow
- 🟨 IR Site Feature
- 🟧 IR Site and AOC Boundary
- 🟥 NRL-CBD Base Boundary

N

0 100 200 Feet

1 inch = 200 feet

Imagery: Calvert County, MD - 2017

**Figure 2-1**
**Base-wide Potentiometric Map**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

**LEGEND**

▭ Site Boundary
▭ Base Boundary
- -▼- - Water Table

Site 3 – Landfill No. 1
Site 4 – Landfill No. 2
Site 5 – Landfill No. 3
Site 7 – Road Oil Application
Site 9 – Photo Processing Waste Discharge
AOC D – Water Tower

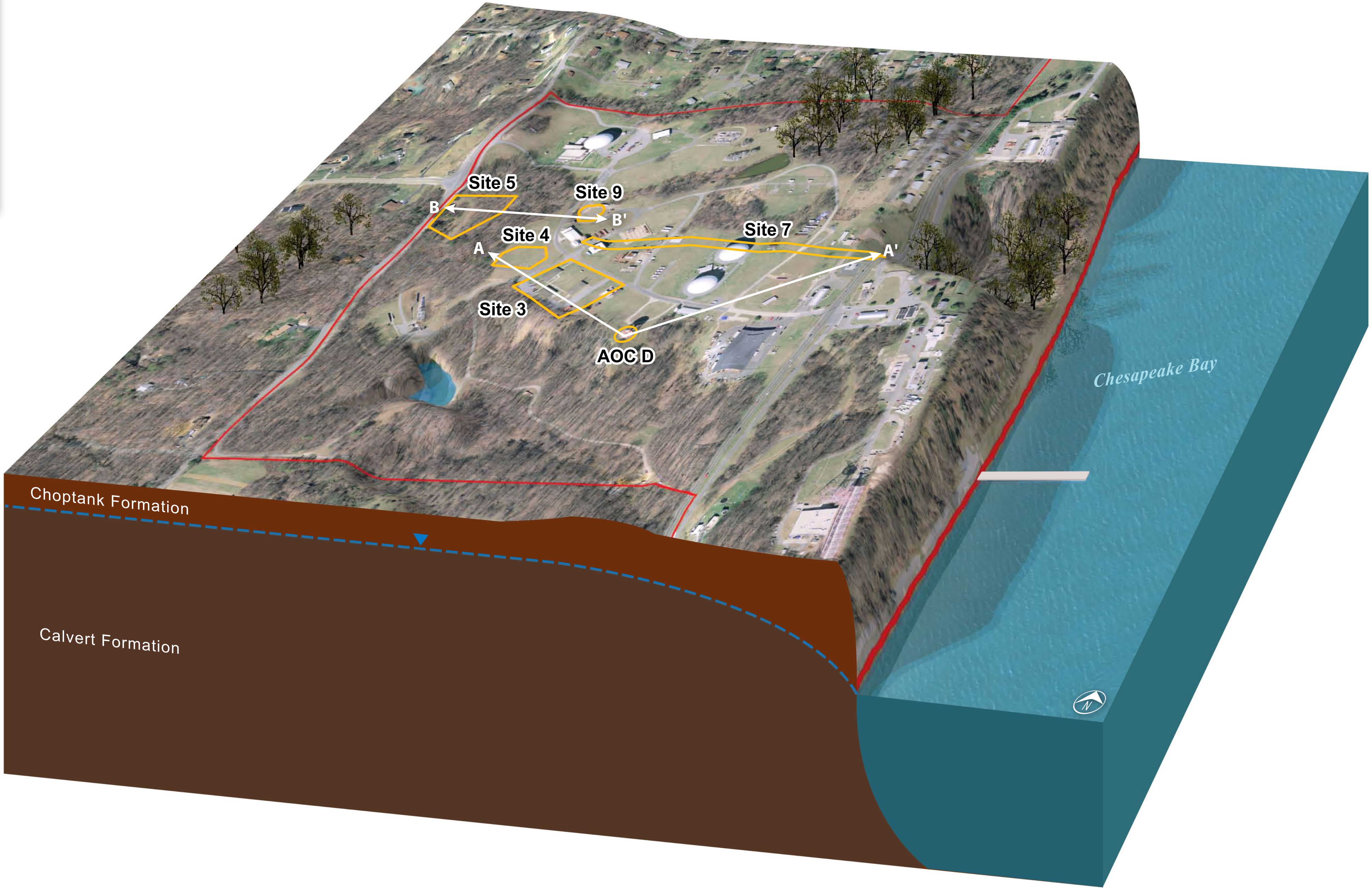


**FIGURE 2-2a**
Conceptual Site Model
Base-Wide Expanded Site Inspection Report
NRL-CBD
Chesapeake Beach, Maryland

### Human Health Exposures and Receptors

**Media –** Soil

- Current adult/adolescent trespassers and visitors, and adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions.
- Future adult/adolescent trespassers and visitors, adult industrial workers, construction workers, and if the site is redeveloped adult and child residents exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions.

**Media –** Groundwater

- Current and future adult industrial workers as well as future adult and child residents exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site.
- Future construction workers exposed to shallow groundwater through dermal contact and inhalation of volatile emissions in an open excavation, if shallow groundwater is within 15 feet of the ground surface.
- Future residents or industrial workers who use the water as a potable water supply. Future residents receptors could be exposed to the groundwater through ingestion, and dermal contact and inhalation of volatile emissions while showering. Future industrial workers could be exposed to the groundwater through ingestion.

### Additional Transport Pathways At Sites 3, 4, 7, and AOC D May Include:

- Overland flow/surficial runoff to downgradient terrestrial areas
- Suspension/deposition of particulates via wind to downgradient terrestrial areas
- Leaching of chemicals from surface soils into subsurface soil and groundwater via infiltrating precipitation
- Uptake by biota from soil (e.g., vegetation, soil invertebrates) and trophic transfer to upper trophic level receptors (e.g., birds and mammals)

### Legend

▼ Water Table

↓ Transport Pathway for infiltration/leaching of constituents from the landfill waste material into surface and subsurface soils and/or groundwater at Sites 3 and 4

↓ Transport Pathway for discharge/leaking of oil or related petroleum constituents from oil/petroleum storage vehicles driving on the unpaved site road at Site 7

↓ Transport Pathway for infiltration/leaching of lead from the water tower paint chips into surface and subsurface soils at AOC D

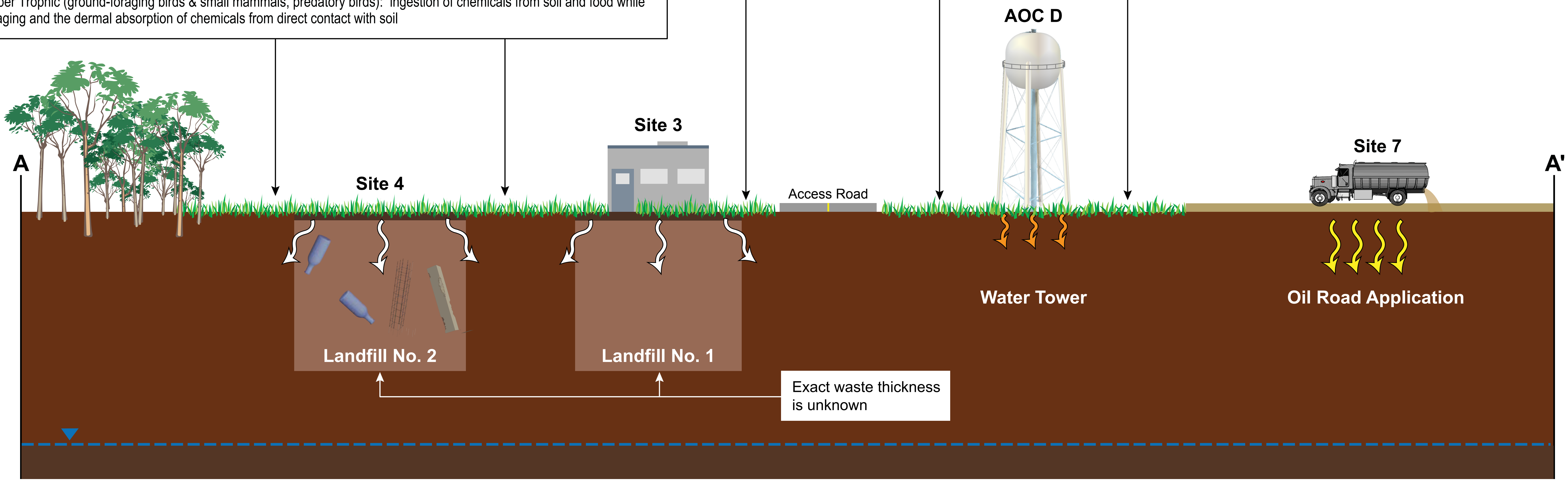
### Ecological Exposures and Receptors

**Media –** Surface Soil

**Habitat –** Mowed mixed grass habitat bordered by wooded habitat on one or more sides

**Receptors and Exposure Pathways –**

- Lower Trophic (plants and soil invertebrates): direct contact with contaminated soil (root uptake for plants)
- Upper Trophic (ground-foraging birds & small mammals, predatory birds): ingestion of chemicals from soil and food while foraging and the dermal absorption of chemicals from direct contact with soil



Not to Scale

**FIGURE 2-2b**
Conceptual Site Model A – A'
Basewide Expanded Site Inspection Report
NRL-CBD
Chesapeake Beach, Maryland

## Human Health Exposures and Receptors

**Media –** Soil

- Current adult/adolescent trespassers and visitors, and adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions.
- Future adult/adolescent trespassers and visitors, adult industrial workers, construction workers, and if the site is redeveloped adult and child residents exposed to surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions.

**Media –** Groundwater

- Current and future adult industrial workers as well as future adult and child residents exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site.
- Future construction workers exposed to shallow groundwater through dermal contact and inhalation of volatile emissions in an open excavation, if shallow groundwater is within 15 feet of the ground surface.
- Future residents or industrial workers who use the water as a potable water supply. Future residents receptors could be exposed to the groundwater through ingestion, and dermal contact and inhalation of volatile emissions while showering. Future industrial workers could be exposed to the groundwater through ingestion.

## Additional Transport Pathways At Sites 5 and 9 May Include:

- Overland flow/surficial runoff to downgradient terrestrial areas
- Suspension/deposition of particulates via wind to downgradient terrestrial areas
- Leaching of chemicals from surface soils into subsurface soil and groundwater via infiltrating precipitation
- Uptake by biota from soil (e.g., vegetation, soil invertebrates) and trophic transfer to upper trophic level receptors (e.g., birds and mammals)

## Legend

| | |
|---|---|
| ▼ | Water Table |
| ⇣ | Transport Pathway for infiltration/leaching of constituents from the landfill waste material into surface and subsurface soils and/or groundwater at Site 5 |
| ⇣ | Transport Pathway for discharge of photo-processing wastes into the surface and subsurface soils at Site 9 |

## Ecological Exposures and Receptors

**Media –** Surface Soil

**Habitat –** Mature upland forest (deciduous with scattered evergreen) and scrub shrub understory

**Receptors and Exposure Pathways –**

- Lower Trophic (plants and soil invertebrates): direct contact with contaminated soil (root uptake for plants)
- Upper Trophic (ground-foraging birds & small mammals, predatory birds): ingestion of chemicals from soil and food while foraging and the dermal absorption of chemicals from direct contact with soil

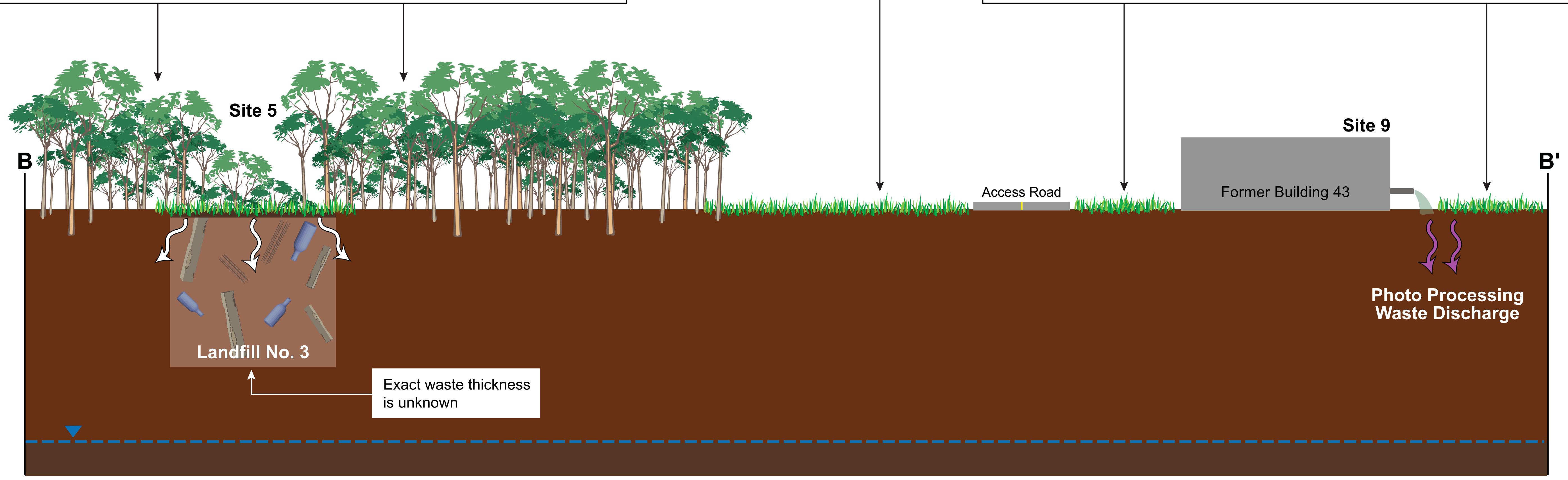
## Ecological Exposures and Receptors

**Media –** Surface Soil

**Habitat –** Mowed mixed grass habitat bordered by wooded habitat on one or more sides

**Receptors and Exposure Pathways –**

- Lower Trophic (plants and soil invertebrates): direct contact with contaminated soil (root uptake for plants)
- Upper Trophic (ground-foraging birds & small mammals, predatory birds): ingestion of chemicals from soil and food while foraging and the dermal absorption of chemicals from direct contact with soil



Not to Scale

**FIGURE 2-2c**
Conceptual Site Model B – B'
Basewide Expanded Site Inspection Report
NRL-CBD
Chesapeake Beach, Maryland

SECTION 3

# Investigation and Data Evaluation Methodology

This section provides descriptions of the field investigation activities and analytical methods and data evaluation along with descriptions of the risk screening approach, methods, and calculations. Site-specific descriptions of the field activities, presentation of analytical results and site characterization, and risk screenings evaluations are presented in Sections 4 through 9.

## 3.1 Investigation Methods

The Base-wide ESI investigation utilized a phased data evaluation approach. Digital geophysical mapping results from the SI (CH2M, 2016) were used to select test pits at the three landfill sites (Sites 3, 4, and 5). Since the SI test pit locations were selected using the highest digital geophysical mapping (DGM) responses, the Base-wide ESI test pit locations were selected using the next highest DGM responses available. If waste was found in the test pit, the proposed soil boring closest to the test pit was to be placed adjacent to the test pit. If waste was not found in the test pit, the proposed soil boring closest to the test pit was to be placed at a location within the site boundary where it can provide for wider spatial coverage to determine the presence or absence of contamination. For sites where, historical land-filling practices were not suspected, such as at Sites 7 and 9 and AOC D, pre-determined sampling locations were selected to provide wider spatial coverage to determine the presence or absence of contamination. Investigation activities during the Base-wide ESI were performed in accordance with the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) (CH2M, 2018) and described in the following sections, along with deviations encountered in the field.

### 3.1.1 Utility Clearance

Utility clearance was performed to identify subsurface utilities and metallic anomalies at proposed soil boring and monitoring well installation locations. Subsurface anomaly detection equipment, such as magnetometers and ground-penetrating radar, were used to find metallic features such as piping and wiring. Several proposed sampling locations at Sites 4, 5, and 7 were relocated because of the detection of subsurface utilities and anomalies during the clearance activities.

### 3.1.2 Test Pitting

Test pits were dug at the three landfill sites (Site 3, 4, and 5) during the Base-wide ESI to determine the presence of waste materials based on DGM results. As noted in Section 3.1, the SI test pit locations were selected based on highest DGM responses and the Base-wide ESI test pit locations were selected based on the next highest DGM responses. The dimension of each test pit was approximately 10 feet in length and 5 feet in width, and with a maximum depth of 10 feet bgs (see **Appendix A** for test pit logs). If waste was encountered prior to the depth of 10 feet bgs, the test pitting activities stopped at that depth. Groundwater was not encountered during the excavation of Base-wide ESI test pits.

The excavated material from each test pit was placed adjacent to the test pit and segregated into two stockpiles, a soil cover material pile and a waste material pile (if present). The CH2M HILL, Inc. (CH2M) onsite geologist recorded observations from each test pit, such as sidewalls and floor conditions and waste materials discovered (if present). The CH2M onsite geologist also prepared a sketch of the test pit findings. Once the test pit had been characterized, the test pit was backfilled first with excavated waste material (if present) and then followed with the excavated soil cover material. The surface of the test pits was restored to approximately the original grade and reseeded with grass and protected with straw cover. Additionally, as a Health and Safety precaution, radiological monitoring was performed during test pitting activities due to the potential for undocumented radiological items to have been disposed of in landfills.

### 3.1.3 Soil Sampling

For soil sampling locations at Sites 3, 4, 5, 7, and 9, a direct-push technology (DPT) drill rig was used to advance soil borings. Soil borings were advanced to 10 feet bgs at Sites 3, 4, 5, and 9; to 8 feet bgs at Site 7; and to 2 feet bgs at AOC D. Soil lithologic information was collected by the CH2M onsite geologist for each soil core. Soil descriptions, including grain size, color, moisture content, relative density, consistency, soil structure, minerology, and site-specific comments, were noted on the boring log form (**Appendix B**). Surface (0 to 0.5 foot bgs) and subsurface (depth ranges varied) soil samples were sampled from soil cores collected in 5-foot-long disposable acetate liners. Subsurface soil sampling depth intervals were selected based on elevated photoionization detector (PID) readings or distinct visual and odorous observations (i.e., soil staining, strong petroleum smells). If there were no elevated PID readings and/or no distinct visual and olfactory observations in the subsurface soil core, the sampling interval selected was between 8 to 10 feet bgs at Sites 3, 4, 5, and 9, and 5 to 8 feet bgs at Site 7. In addition to DPT soil collection, surface soil samples were collected using disposal plastic scoops at Site 5. Hand augering was used at AOC D for surface and subsurface soil samples because of the overhead and underground utility hazards and adjacent trees within the sampling area.

All soil samples were placed into laboratory-supplied jars and shipped in coolers to the laboratory according to temperature requirements noted in the UFP-SAP (CH2M, 2018). Surface and subsurface soil samples were analyzed for constituent groups shown in Worksheet #17 of the UFP-SAP and described in Section 3.2 below. Excess soil cuttings from each soil boring were containerized in 55-gallon Department of Transportation (DOT)-approved steel drums. The soil cuttings were analyzed for toxicity characteristic leaching procedure (TCLP) and the results showed non-hazardous characteristics. The soil drums were removed offsite by a waste subcontractor and disposed at an offsite facility.

### 3.1.4 XRF Field Screening

At AOC D, XRF field screening of lead in surface and subsurface soil samples was performed as detailed in the UFP-SAP (CH2M, 2018). A subset of the XRF screened samples (10 surface and 10 subsurface soil samples) were sent to the laboratory for lead analysis and to gauge the comparability of the XRF results to laboratory results. The XRF grid locations associated with the subset of the XRF screened samples were determined using a random number generator program prior to the Base-wide ESI mobilization.

A 100-foot by 100-foot area at AOC D was marked-out where the water tower sits at the center of this area. Twenty-five 20-foot by 20-foot square XRF grids were established inside this 100-foot by 100-foot area. A five-point composite soil sample (points were from the center and at each of the corners of the XRF grid) was collected for both the surface (0 to 0.5 foot bgs) and subsurface (1.5 to 2 feet bgs) soil intervals. As noted in Section 3.1.3, soil samples were collected using a hand auger rather than from the DPT because of safety hazards with nearby utility lines. Soil aliquots from each grid and for each sample interval (i.e., surface and subsurface) were placed in labeled 2-gallon resealable plastic bags for compositing.

Composited surface and subsurface soil samples were taken to the designated XRF sample preparation area and manually mixed thoroughly inside the 2-gallon resealable plastic bag to obtain a uniform consistency. After mixing, an aliquot of soil was transferred into a small resealable plastic bag. The aliquot was then carefully inspected to remove non-soil debris and noticeable lead fragments.

XRF field screening results for lead were statistically evaluated against lead analytical results to determine correlation between the two sets of data. Additional information regarding the statistical analysis of XRF results is discussed in Section 9.3

### 3.1.5 Monitoring Well Installation

Six monitoring wells were newly installed at Sites 3, 4, and 5 (one at Site 3, two at Site 4, and three at Site 5). The monitoring wells were installed using hollow-stem auger drilling methods and were constructed with 2-inch-diameter Schedule 40 polyvinyl chloride screen and riser. The depths of the newly installed monitoring wells at Sites 3, 4, and 5 range from 25 feet bgs to 40 feet bgs. The monitoring wells were constructed with 10 feet of

0.010-inch machine-slotted screen and the start of the well screen was placed 1-foot above the top of the water table. The annular space around each well screen was filled with silica sand to approximately 2 feet above the top of the screen interval and the remainder of the borehole annulus was filled with a minimum of 2 feet of hydrated bentonite directly above the sand filter pack, and overlain by a cement-bentonite grout seal to the ground surface. The newly installed monitoring wells were completed with an above-grade protective cover, concrete pad, and protective bollards. Well construction diagrams are provided in **Appendix B**.

### 3.1.6 Monitoring Well Development

The six newly installed monitoring wells at Sites 3, 4, and 5 were developed to remove sediments to the extent practicable using a surge block and whale pump. Development activities continued until at least three well volumes were purged (or until the monitoring well went dry). Water quality parameters, including turbidity, pH, specific conductivity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO), along with the volume of water removed, were recorded during well development. **Appendix C** contains the monitoring well development logs. Development water from each newly installed monitoring well was containerized in 55-gallon DOT-approved steel drums. The development water was analyzed for TCLP and the results showed non-hazardous characteristics. The aqueous drums were removed offsite by a waste subcontractor and disposed of at an offsite facility.

### 3.1.7 Groundwater Sampling

Groundwater samples were collected from existing and newly installed monitoring wells at Sites 3, 4, and 5. Groundwater samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and PCBs, and metals, as identified in the UFP-SAP (CH2M, 2018) and in Section 3.2 below.

Groundwater samples were collected using a submersible pump following low-flow sampling protocol. Static water-level measurements were gauged and recorded immediately prior to the purging and sampling of a well and recorded during purging to document low-flow procedures. All groundwater samples were collected by placing the sample tubing intake in the middle of the screen interval. Water quality parameters (turbidity, pH, specific conductivity, temperature, ORP, and DO) were measured during well purging toward stabilization conditions using a water quality meter (i.e., Horiba), which was calibrated at least once each day the instrument was used. The aquifer was considered stable after at least one well volume was purged, and water quality readings collected 3 to 5 minutes apart were stabilized as follows:

- pH within 0.1 pH standard unit
- Conductivity within 3 percent
- DO within 10 percent
- ORP within 10 millivolts
- Turbidity measurement within 10 percent or is minimized to the extent practical for the well (ideally below 10 nephelometric turbidity units)

Groundwater purging logs are shown in **Appendix C**. Purged groundwater from each newly installed monitoring well was containerized in 55-gallon DOT-approved steel drums. The groundwater was analyzed for TCLP and the results showed non-hazardous characteristics. The aqueous drums were removed offsite by a waste subcontractor and disposed of at an offsite facility.

### 3.1.8 Monitoring Well Land Survey

Newly installed monitoring wells at Sites 3, 4, and 5 were surveyed by a Maryland-licensed surveyor. The horizontal location of the monitoring well and the vertical height of the well casing were recorded. The monitoring wells survey report is shown in **Appendix D**.

## 3.2 Analytical Methods

Soil and groundwater samples were analyzed in accordance with the methods specified in the UFP-SAP (CH2M, 2018). Surface soil and subsurface soil samples were analyzed for the following:

- SVOCs by Method SW-846 8270C
- Pesticides and PCBs by Methods SW-846 8082A and SW-846 8081A, respectively
- Target analyte list (including mercury) metals and hexavalent chromium by Methods SW-846 6020A and SW-846 7199, respectively

Groundwater samples were analyzed for the following:

- VOCs by Method SW-846 8260C
- SVOCs (including SIM polycyclic aromatic hydrocarbons [PAHs] by Methods SW-846 8270C and SW-846 8270D SIM
- Pesticides and PCBs by Methods SW-846 8082A and SW-846 8081A, respectively
- Target analyte list (including mercury) metals and hexavalent chromium by Method SW-846 6020A
- Filtered metals including hexavalent chromium by Method SW-846 7199

All analyses were performed at Jupiter Environmental Laboratories with the exception of hexavalent chromium (ALS Laboratories) and SIM PAHs (TestAmerica). The validated analytical data is provided in **Appendix E**.

## 3.3 Data Validation Summary

All results underwent analytical data validation according to the procedures listed in the UFP-SAP. Guidance and qualifiers were taken from "USEPA National Functional Guidelines for Organic Superfund Methods Data Review" (USEPA; 2017d), and "USEPA National Functional Guidelines for Inorganic Superfund Data Review" (USEPA, 2017e).

### 3.3.1 Data Qualifiers

Data validation qualifier descriptions and results are summarized in **Table 3-1**. Only one result per analyte per sample is presented. If a sample was re-extracted, re-analyzed, or diluted, it was reported twice or more by the laboratory. The result with the best data quality was selected for reporting and any other results were excluded to prevent redundancy. Such exclusion does not negatively affect data quality.

Table 3-1. Descriptions of Data Validation Qualifiers

| Qualifier | Meaning | Description | Percent of Total | Number of Results |
|---|---|---|---|---|
| U | Nondetect or not detected at significantly greater than that in an associated blank | The analyte was not detected. Or, the analyte was detect, but the data validator determined that it was not detected at significantly greater than that in an associated blank. Therefore, it was U-qualified. These results are usable as nondetects at the reporting limit. | 65 | 6,052 |
| [none] | Detected | The analyte was detected. Qualification was not warranted. These results are usable as detects at the reported concentration. | 17 | 1,623 |
| UJ | Nondetect, estimated reporting limit | The analyte was not detected, but there was a QA/QC exceedance that warranted qualification. These results are usable as nondetects at the reporting limit. | 10 | 929 |
| J | Estimated | The analyte was detected, but there was a QA/QC exceedance that warranted qualification. Or, there may have been no QA/QC exceedance, but the analyte was detected at less than the limit of quantitation (i.e., the result is ‘low’). These results are usable as detects at the reported concentration. | 6.6 | 619 |

Table 3-1. Descriptions of Data Validation Qualifiers

| Qualifier | Meaning | Description | Percent of Total | Number of Results |
|---|---|---|---|---|
| R | Rejected | The analyte may or may not have been detected, but there was a severe QA/QC exceedance. These results are not usable as detects or as nondetects. These may represent data gaps, or the data user may work around them. | 0.45 | 42 |
| J+ | Potential high bias | The analyte was detected, but there was a QA/QC exceedance that may indicate a potential high bias. These results are usable as detects at the reported concentration. | 0.42 | 39 |
| J- | Potential low bias | The analyte was detected but there was a QA/QC exceedance that may indicate a potential low bias. These results are usable as detects at the reported concentration. | 0.27 | 25 |

QA = quality assurance
QC = quality control

### 3.3.2 Data Quality Assessment Summary

The samples were collected as specified in the UFP-SAP (CH2M, 2018). The laboratory analyzed the samples in accordance with the SW-846 methods as stated in the UFP-SAP. The data packages were reviewed by the data validator on the basis of the criteria outlined in the UFP-SAP and **Table 3-1**.

The laboratory U-qualified 63 percent of the results as nondetect and further qualification was not warranted. Another 17 percent was reported as detected and further qualification was not warranted. When this is considered, 81 percent of the data are acceptable as reported by the laboratory. Of the total results, 6.6 percent were J-qualified as "estimated." Many of these J-qualifiers (75 percent of the J-qualified data) are present simply because the result was detected at less than the limit of quantitation. Results J-qualified for this reason are also usable as reported. Therefore, a total of 86 percent of the data reported by the laboratory as detections, nondetects, and estimated detects were not further qualified by data validation and are considered usable as reported. The remaining J-qualifiers resulted from dual-column reproducibility (precision), equipment blank contamination, field duplicate precision, low recovery in the initial calibration, high recovery of internal standards, matrix duplicate precision, low matrix spike recovery, serial dilution (precision), and low spiked surrogate recovery.

In some cases, an analyte was detected by the laboratory, but the data validator determined that the analyte was not detected at significantly greater than that in an associated blank. When this occurred, the data validator U-qualified the result such that it would no longer be distinguishable from other nondetect. If necessary, the concentration was raised to the limit of detection (reporting limit). These U-qualifiers amounted to 1.5 percent and resulted from contamination in related equipment rinseate blanks and laboratory method blanks. These results are usable as nondetects at the reported concentration, but the data validator should take extra caution when results U-qualified due to blank contamination exceed screening levels.

UJ-qualifiers amounted to 10 percent and resulted from blank spike/blank spike duplicate (precision), low recovery in the blank spike, low recovery in a continuing calibration verification, field duplicate (precision), low recovery in the internal calibration, method blank contamination, low recovery in a matrix spike, and low spiked surrogate recovery. These results are usable as nondetects at the reported level as long as the data user recognizes that the reporting limit is estimated.

R-qualifiers amounted to 0.45 percent and resulted from extremely low spiked surrogate recovery (20 pesticide compounds in CBD-S03-SS08-000H and 19 pesticide compounds in CBD-S03-SS09-000H) and extremely low matrix spike recovery (total/filtered mercury in CBD-S04-GW01-0518 and 2,4-dinitrophenol in CBD-S09-SB07-0810. These may indicate an unacceptable extreme low bias, or an inability to detect the contaminant in the sample, if present. These rejected results are not usable for any purpose and may constitute a data gap. However, the data user is often able to exclude such minor data gaps because they are very small (0.45 percent of the results in this case), are limited to the affected samples/fractions/analytes, and do not affect other results which are not R-qualified. Although this affects the completeness of the data set, the completeness goal is still easily met (see below).

$J^+$-qualifiers amounted to 0.42 percent and resulted from equipment blank contamination, internal standard recovery, and equipment blank contamination. This may indicate a potential high bias. These results are usable as detects at their reported concentration as long as the data user recognizes that they are estimated and potentially biased high. Therefore, the data user should exercise caution when these results are slightly greater than screening levels.

$J^-$-qualifiers amounted to 0.27 percent and resulted from low recovery in the initial calibration, low matrix spike recovery, and low spiked surrogate recovery. This may indicate a potential low bias. These results are usable as detects at their reported concentration as long as the data user recognizes that they are estimated and potentially biased low. Therefore, the data user should exercise caution when these results are slightly less than screening levels.

Because all qualified results, with the exception of R-qualified results, are usable as qualified, greater than 99 percent of the data are complete and usable as qualified. A typical completeness goal of 95 percent is met. The overall conclusion is that the data set generated is acceptable and appropriate for its intended use.

## 3.4 Human Health Risk Screening Approach

A conservative human health risk screening (HHRS) was performed to determine the potential for unacceptable human health risks associated with exposure to site media (surface soil, subsurface soil, and groundwater) at Sites 3, 4, 5, 7, and 9 and AOC D. The results of the HHRS provide an initial indication of potential risks from exposure to COPCs identified for each site and are used to help determine whether the sites require further investigation (such as a baseline risk assessment or additional data collection) or future unrestricted (for example, residential) use of the site is acceptable based on human health risks. HHRS tables are shown in **Appendix F**.

### 3.4.1 Potentially Complete Exposure Pathways

The human health CSM presents an overview of site conditions, potential contaminant migration pathways, and exposure pathways to potential receptors. The CSM is presented in Section 2.4, while graphical representations of the CSM were presented in **Figures 2-2a through 2-2c**. The facility background and history are presented in Section 2.1 and land use is presented in Section 2.3. A description of each site and AOC is provided in Sections 4.1 through 9.1.

The potential source areas for each of the sites and AOCs are discussed in Section 2.4. The primary release and transport mechanism from the potential source areas for each site and AOC is infiltration and leaching of constituents from the potential source areas into surface and subsurface soils and/or groundwater. Additional release and transport pathways may include overland flow and surficial runoff, suspension and deposition of particulates via wind, and volatilization from soils and groundwater.

Access to NRL-CBD is restricted; however, once on the facility humans can be exposed to soil and groundwater at the individual sites. Current receptors may include adult and adolescent trespassers and visitors, as well as adult industrial workers exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions. Current receptors also could be exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site. However, for the sites where groundwater was collected (Sites 3, 4, 5, and 9), volatile constituents were not detected in groundwater or are insufficiently volatile and/or there are no occupied buildings onsite or 100 feet downgradient of the site (Site 9). Therefore, the vapor intrusion pathway is incomplete.

Future receptors include the current receptors. In addition, although there are no plans for redevelopment at NRL-CBD, the future receptors also include future residents and construction workers. Future receptors could be exposed to the surface and subsurface soil if future development activities occur at the site (for example, construction of residential housing or industrial buildings) or if utility or excavation work results in exposing subsurface soil. Exposure routes for future exposure to surface and subsurface soil are the same as those for current exposure to surface soil. Although shallow groundwater is not used as a water supply at the facility, as a conservative approach to evaluate potential future risks it is assumed that shallow groundwater beneath the sites could be used as a future water supply source. Potential future receptors for shallow groundwater could include future residents or industrial workers who might use the water as a potable water supply. Residents could be exposed to the groundwater through incidental ingestion, dermal contact, and inhalation of volatile emissions while showering. Industrial workers could be exposed to the groundwater through ingestion. Additionally, if shallow groundwater is within 15 feet of the ground surface, future construction workers could be exposed through dermal contact and inhalation of volatile emissions in an open excavation. Future receptors also could be exposed to shallow groundwater through vapor intrusion from the groundwater into indoor building air at any of the sites with buildings, or buildings downgradient of the site. However, as mentioned above, volatile constituents were not detected in groundwater or are insufficiently volatile, and therefore, the vapor intrusion pathway is incomplete.

### 3.4.2 Human Health Risk Screening Methodology

The HHRS was conducted in three steps using a risk-ratio technique (Navy, 2000). The three-step screening process is described in the following sections.

Soil and groundwater samples collected from Sites 3, 4, 5, 7, and 9 and AOC D in October 2012 and April and May 2018 were evaluated in the HHRS. Surface soil samples were collected 0 to 0.5 feet bgs. The depths of subsurface soil samples collected at the six sites ranged from 2 to 22 feet bgs. Although a human receptor would not be expected to contact soil from depths greater than about 12 feet bgs, these samples were included in the Base-wide SI and ESI HHRS because of limited subsurface soil data and the subsurface soil sampling approach. Table 1 in **Appendix F** lists the samples included in the HHRS. The analytical data for the samples evaluated in the risk screening are presented in **Appendix F**. The data included in the HHRS were validated as described in the previous section. The data were evaluated to determine their reliability for use in the HHRS. A review of the data identified the following criteria for data usability:

- Data qualified with an R (rejected) were not used in the HHRS.
- Data qualified with a B (blank contamination) were treated as nondetected concentrations.
- Values flagged with a J, J+, J-, L, or K were treated as detected concentrations.

For duplicate samples, the maximum concentration between the two samples was used as the sample concentration. If the analyte was only detected in one of the samples, the detected concentration was used as the sample concentration. If the analyte was not detected in either of the samples, the higher detection limit was used as the sample detection limit.

### 3.4.3 Step 1: Comparison to Screening Levels

The maximum detected constituent concentrations for surface soil, subsurface soil, and groundwater were compared to the United States Environmental Protection Agency (USEPA) human health regional screening levels (RSLs) (USEPA 2019). RSLs based on noncarcinogenic effects were based on a hazard quotient (HQ) of 0.1 to account for exposure to multiple constituents. RSLs based on carcinogenic endpoints were based on a carcinogenic risk of $1 \times 10^{-6}$.

Surface soil and subsurface soil data were compared to residential soil RSLs (USEPA, 2019). Although industrial workers are the most likely receptors at the sites, trespassers and visitors (adult and youth) are also potential receptors, in addition to hypothetical future residential receptors. Residential soil RSLs are more conservative (that is, lower) than industrial soil RSLs and are therefore protective of all potential receptors (such as trespassers, visitors, residents, industrial workers, and construction workers). If the maximum detected concentration was greater than the residential soil RSL the constituent was carried forward to Step 2.

Groundwater data were compared to tap water RSLs (USEPA, 2019). An RSL exceedance was used to identify the groundwater COPCs, which were then carried forward to Step 2. Filtered and unfiltered groundwater samples were collected for metals analysis. Following current USEPA risk assessment guidance (USEPA, 2014), the unfiltered groundwater samples were evaluated in the HHRS. The maximum contaminant levels (USEPA, 2018) also were presented in the comparison table. However, these values are provided for informational purposes and risk management, if applicable, and were not used to identify COPCs.

Lead is not evaluated in the same manner as the other COPCs. It is regulated by USEPA based on blood-lead uptake using a physiologically based pharmacokinetic model called the Integrated Exposure Uptake Biokinetic (IEUBK) Model. As a screening tool, lead is currently screened at 400 milligrams per kilogram (mg/kg) in soil based on residential exposure (the residential soil RSL, USEPA, 2019). If the maximum lead concentration is greater than 400 mg/kg, it is retained as a COPC for the site or AOC. For groundwater, lead is screened against the federal action level of 15 micrograms per liter (µg/L) (USEPA, 2018). If the maximum lead concentration is greater than the action level, it is retained as a COPC for the site or AOC. If lead was identified as a COPC it was further evaluated in the HHRS using the IEUBK Model (USEPA, 2010). If blood lead levels for a child resident identified by the IEUBK model are above current blood lead goals, the Adult Lead Model (ALM; USEPA, 2017a) was used to evaluate exposure to lead in soil by industrial workers. The average concentration of lead in either soil and/or groundwater were used as the lead concentration in the IEUBK (and ALM model if used). All the other default model input parameters were used in the model, except for the mother's blood lead concentration at childbirth (MatPb) variable, which was updated to 0.6 micrograms per deciliter (µg/dL) based on the recommendation in USEPA's Office of Land and Emergency Management (OLEM) Directive 9285.6-56 (USEPA, 2017b). Additionally, following current USEPA guidance (OLEM Directive 9200.2-177, USEPA, 2017c), the default age range of 0 to 84 months was modified to 12 to 72 months based on current science and the U.S. Centers for Disease Control and Prevention's recommendation.

If a chemical was 100 percent nondetected in a medium, it was not selected as a COPC. Although nondetected chemicals were not selected as COPCs, sample-specific detection limits (that is, adjusted method detection limits) were compared to screening levels to evaluate if the nondetected chemicals could be present at concentrations less than the detection limit but at concentrations greater than the screening levels and potentially contribute to site risk.

### 3.4.4 Step 2: Risk Ratio Evaluation using Maximum Detected Concentrations

For constituents identified as COPCs in Step 1, a risk level was calculated using the following equation:

$$\text{risk level} = \frac{\text{concentration} \times \text{acceptable risk level}}{\text{RSL}}$$

The concentration is the maximum detected concentration (the same concentration that was used in Step 1). The acceptable risk level is 1 for noncarcinogens and $1 \times 10^{-6}$ for carcinogens (as presented in the Navy human health risk screening guidance [Navy, 2000]). The RSL is the residential soil RSL or tap water RSL based on a HQ of 1 (USEPA, 2018a). All the risk levels for each constituent within a medium are summed to calculate the cumulative hazard index (HI) (for noncarcinogens) and cumulative carcinogenic risk (for carcinogens). A cumulative HI is also calculated for each target organ and effect. For Step 1 COPCs that elicit both noncarcinogenic and carcinogenic effects, a risk level is calculated for both noncarcinogenic and carcinogenic endpoints using the RSL based on noncarcinogenic effects and the RSL based on carcinogenic endpoints for that constituent.

Following the Navy risk ratio screening methodology (Navy, 2000), if the cumulative HI for a target organ or effect is greater than the risk-ratio screening benchmark of 0.5, or the cumulative carcinogenic risk is greater than $5 \times 10^{-5}$, the constituents contributing to these values are retained as COPCs and evaluated in Step 3.

MDE uses an acceptable carcinogenic risk range of 1 × $10^{-6}$ to 1 × $10^{-5}$, which is a smaller range of acceptable risk than specified by the National Oil and Hazardous Substances Pollution Contingency Plan (1 × $10^{-6}$ to 1 × $10^{-4}$) and is lower than the target risk ratio carcinogenic risk of 5 × $10^{-5}$ specified in the Navy guidance (Navy, 2000), and an acceptable cumulative noncarcinogenic hazard of 1. If the cumulative HI for a target organ or effect is greater than the MDE-acceptable HI of 1 or the cumulative carcinogenic risk is greater than the MDE-acceptable carcinogenic risk of 1 × $10^{-5}$, the constituent will be retained as an MDE COPC and further evaluated. Due to the differences in the acceptable risk levels used by the Navy versus MDE and USEPA, the HHRS results are presented in this report to reflect the acceptable risk levels used by the Navy, USEPA, and MDE

### 3.4.5 Step 3: Risk Ratio Evaluation using 95 percent Upper Confidence Limit on Mean

For constituents identified as COPCs in Step 2, a risk level was calculated, as previously discussed, for Step 2. However, the 95% UCL of the arithmetic mean was used in place of the maximum detected concentration to obtain a more site-specific risk ratio for data sets containing 10 or more samples. The 95% UCL of the arithmetic mean of the data set was calculated using USEPA's ProUCL statistical software program (USEPA, 2015; USEPA, 2016). If the cumulative HI by target organ/effect is greater than the risk-ratio screening benchmark of 0.5, or the cumulative carcinogenic risk is greater than the risk-ratio screening benchmark of 5 × $10^{-5}$ specified in the Navy risk ratio guidance document (Navy, 2000), the constituents contributing to these values are considered COPCs and there is a potential for unacceptable human health risks associated with exposure to the site. Additionally, if the cumulative HI by target organ and effect is greater than the MDE target HI of 1 or the cumulative carcinogenic risk is greater than the MDE target carcinogenic risk of 1 × $10^{-5}$, the constituents contributing to these values are considered MDE COPCs and there is a potential for unacceptable human health risks associated with exposure to the site based on MDE target risk levels. Constituents were considered USEPA COPCs when the HI by target organ and effect was greater than the USEPA target HI of 1 or the cumulative carcinogenic risk was greater than the upper end of USEPA target carcinogenic risk range of 1 × $10^{-4}$ to 1 × $10^{-6}$.

Step 3 was only performed for media with COPCs from Step 2 having ten or more samples. Ten or more samples are needed to perform the statistical calculations necessary to estimate the Step 3 exposure concentration. The most current version of the ProUCL software program (USEPA, 2016) was used to test the data distribution and calculate 95 percent UCL exposure point concentrations (EPCs) used for the Step 3 risk-ratio calculations. In cases where the recommended UCL exceeded the maximum detected concentration, the maximum concentration was used as the EPC. Step 3 of the risk screening evaluation was not performed for Site 4 groundwater because only five samples were available and a 95% UCL could not be calculated.

### 3.4.6 Comparison to Background

COPCs identified after Step 3 of the three-step risk ratio screening process were compared to background concentrations. Soil data were compared to site-specific background threshold values (BTVs; 95% Upper Tolerance Limits [UTLs] with 95% coverage) for surface soil and subsurface soil metals concentrations (Tetra Tech, 2015) and groundwater data were compared to the site-specific BTVs (95% UTLs with 95% coverage) for metals and SVOCs (CH2M, 2017).

### 3.4.7 General Uncertainties Associated with Human Health Risk Screening Evaluation

The uncertainty associated with the data analysis is minimal, as the data have been fully validated prior to use in the risk assessment.

The uncertainty related to the selection of COPCs has been addressed by using conservative assumptions when applicable. The general assumptions used in the COPC selection process were conservative to ensure that actual COPCs were not eliminated from the quantitative risk assessment and that the highest possible risk was estimated. RSLs based on residential assumptions were used to select the COPCs for all of the scenarios, including non-residential scenarios.

To conservatively evaluate unrestricted land use, it was assumed that the sites may be used for residential purposes in the future; however, this is not a likely scenario. It is also not likely that shallow groundwater from the sites and AOCs will be used as a future potable water supply.

## 3.5 Ecological Risk Assessment Approach

### 3.5.1 Introduction

This section summarizes the ecological risk assessment (ERA) component of the Base-wide ESI for the NRL-CBD. The Base-wide ESI was conducted in accordance with Navy policy for ERAs (CNO, 1999), with Navy guidance for implementing this ERA policy (NAVFAC, 2001), and with USEPA ERA Guidance for Superfund (USEPA, 1997).

The objectives of the ERA are to:

- Describe the environmental setting at the sites with an emphasis on ecological receptors
- Refine the ecological CSM for exposure pathways for ecological receptors
- Determine whether contaminants present in site media due to historical site operations could represent a potential risk to environmental receptors

Results of the ERA will be used to determine if further action or ecological evaluation is necessary.

An ERA was conducted in 2016 as part of the SI (CH2M, 2016). Six of the eight sites evaluated were retained for additional evaluation. Consequently, additional sampling was conducted at these 6 sites (Sites 3, 4, 5, 7, and 9 and AOC D) as part of this Base-wide ESI. This ERA was conducted with chemical analytical data collected during the SI conducted in October 2012 (CH2M, 2016) and with data collected to support this Base-wide ESI in 2018. The ERA focuses on the evaluation of chemical analytical data for surface soil because, as discussed in Section 3.5.2, this is the only medium to which potential ecological receptors are likely to have a significant exposure to chemicals at the sites.

The ecological risk assessment is comprised of the following sections:

- **Section 3.5.2 Screening-level Problem Formulation** provides an overview of the site activities, setting and habitats, further develops the CSM, and identifies receptor groups for screening in the Base-wide ESI.
- **Section 3.5.3 Screening-level Assessment.** establishes chemical exposure levels (ecological screening values [ESVs]) that are protective for the potential ecological receptors identified for screening**.** Identifies the analytical chemistry data evaluated in the ERA, data groupings, and exposure models used to estimate the potential exposure of ecological receptors to site-related chemicals.
- **Section 3.5.4 Screening-level Risk Calculation** compares estimated exposure concentrations with ESVs to derive screening-level risk estimates to identify COPCs. Evaluates the site-relatedness of chemicals, based on a comparison to background concentrations and discusses uncertainties associated with the risk calculation.

Results of the ERA screening are presented within each of the site-specific sections (Sections 4 through 9), with a final summary of the evaluation and recommendations presented in Section 10.

### 3.5.2 Screening-level Problem Formulation

The product of the screening-level problem formulation is the preliminary CSM. The purpose of the CSM is to describe how ecological receptors may be exposed to chemical constituents originating from sites. Development of the CSM requires identifying and describing major habitats and ecological receptors, media of potential concern, and potential contaminant sources. This information is used along with an understanding of how chemicals move through the environment (transport and exposure pathways) to build the CSM. Potentially complete exposure pathways and receptors are identified as part of the CSM.

Although the objective of the CSM is to discuss each potential exposure pathways to site receptors, the focus of the Base-wide ESI evaluation is on initially determining whether there are chemicals that are site-related that could represent a potential risk to ecological receptors. Accordingly, the CSM for the Base-wide ESI focuses on screening these chemicals against conservative ESVs that are protective to a wide range of potential ecological receptors, rather than focusing on specific species identified as representing complete exposure pathways in the CSM.

The screening-level problem formulation is organized into two sections. The Environmental Setting section presents information pertaining to the environmental setting and onsite habitats and biota being assessed. An overview of the facility, sites, and surrounding land use is described in Section 2. The Ecological Exposure Pathways and Receptors section expands upon the preliminary CSM presented in Section 2.4, discussing the pathways and routes by which ecological receptors could be exposed to chemicals.

### 3.5.2.1 Environmental Setting

The areas being evaluated in the Base-wide ESI are composed of two habitat types. Site 5 is composed of wooded habitat, while Sites 3, 4, 7, and 9 and AOC D are composed of primarily mowed mixed grass habitats that are bordered by wooded habitat on one or more sides. The wooded areas are covered by mostly mature upland trees with little scrub shrub understory. The trees in the wooded areas are primarily deciduous, with some scattered stands of evergreen trees.

Trees within Sites 3, 4, 9, and AOC D were removed as part of historical site activities. The seeded grasses at these Sites are regularly mowed as part of site maintenance activities. Site 7 encompasses the areas bordering the roadways, and habitats within these areas are also composed of mostly mowed mixed grass communities.

The wooded onsite habitats are expected to support a variety of both lower-trophic-level terrestrial invertebrate species (such as earthworms) and upper-trophic-level birds and mammals typical of eastern deciduous woodland habitats. The mowed mixed grass communities are also expected to support lower-trophic-level terrestrial invertebrates but are expected to support a more limited range of mostly urban-adapted wildlife species that typically use mowed lawn habitats, such as Eastern gray squirrels and American robin.

A literature-based search for federally listed endangered, threatened, or other species of special concern was conducted for Calvert County through the Chesapeake Bay Field Office of the United States Fish and Wildlife Service (USFWS, 2018). The Sensitive Joint Vetch (*Aeschynomene virginica*), which has a Federally Threatened status, was identified as potentially present in Calvert County. However, it is not known if this species is present on the facility. The Puritan Tiger Beetle (*Cicindela puritana*) and Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) were identified as a Federally Threatened species, but would be localized to the beach cliffs.

### 3.5.2.2 Ecological Exposure Pathways and Receptors

Based on the woodland and mowed mixed grass communities present at the areas being evaluated, there are potentially complete exposure pathways for lower-trophic-level terrestrial receptors (primarily terrestrial plants and soil invertebrate communities) and upper-trophic-level birds and mammals typical of eastern deciduous woodland and mowed lawn habitats. Potential exposure pathways for lower-trophic-level receptors primarily consist of direct exposure to chemicals in surface soil. Terrestrial plants also could be exposed to chemicals through roots during water and nutrient uptake. Upper-trophic-level receptors (birds and mammals) could be exposed to chemicals via the following potential exposure pathways:

- Incidental ingestion of chemicals from surface soil while foraging or grooming
- Ingestion of chemicals that have accumulated in prey
- Direct (dermal) contact with chemicals in surface soils
- Inhalation of gaseous chemicals or chemicals adhered to suspended particulate matter.

Lower-trophic-level species (such as plants and soil invertebrates) are likely to have their greatest exposure through direct contact with contaminated media. Terrestrial wildlife may be exposed to chemicals via the ingestion of chemicals from soil or food while foraging and the dermal absorption of chemicals from soil via direct contact. The relative importance of these exposure routes depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate, the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate, the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of the contaminated media, such as soil. Consistent with the scope of an Base-wide ESI, the ERA evaluation will focus only on the initial screening of chemicals based on the direct exposure of lower-trophic-level receptors (terrestrial plants and soil invertebrates). This screening provides a conservative indication of whether there are chemicals in surface soil that could represent a potential for adverse effect and warrant further evaluation for their potential to represent an ecological risk.

## 3.5.3 Screening-level Assessment

This section discusses the approach for conducting the Base-wide ESI ERA. The result of the evaluation are presented by site. If this ERA indicates no unacceptable potential for adverse effect to ecological receptors, the screening process can be terminated. Chemicals indicating a potential for ecological risk are summarized at the end of the ERA and recommendations are made concerning the need for additional evaluation.

### 3.5.3.1 Screening-level Effects Evaluation

The purpose of the screening-level effects evaluation is to establish chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. Screening levels are developed to be protective of selected ecological receptors from direct exposure to chemicals in environmental media, which in this case is surface soils.

Media-specific screening values for soil are designed to identify chemical concentrations that are protective of terrestrial plant and soil invertebrate communities. Media-specific screening values for soil were preferentially based upon the lowest of plant and invertebrate USEPA Soil Screening Levels (ecological soil screening levels). When media-specific screening values were not available from this preferred source, other available alternate toxicological values from the scientific literature were used for screening. The selected surface soil screening values (and their reference source) are provided in **Table 1 of Appendix G**.

### 3.5.3.2 Screening-level Exposure Estimates

The screening-level exposure estimate summarizes the analytical data to be considered for use in the ERA, the data groupings, and the exposure models and input parameters that are used to estimate the potential exposure of ecological receptors to chemicals at each site.

### 3.5.3.3 Available Analytical Data and Data Groupings

The ERA focused on the evaluation of surface soil (0 to 0.5 foot bgs) for each of the evaluated sites. Subsurface soils and soils under paved surfaces were not evaluated in the ERA. Subsurface soils were not evaluated because the exposure of most ecological receptors is expected to be significantly less in deeper soils. Soils beneath paved surfaces were not evaluated because they are considered inaccessible to ecological receptors. All other surface soil data were grouped by site for evaluation. Samples used in the risk evaluation for each site are presented in **Table 2 of Appendix G**.

PAHs were evaluated based on summing the detected concentrations of high molecular weight (HMW) PAHs PAHs) and low molecular weight (LMW) PAHs PAHs), by sample. LMW PAHs were assumed to include 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene. HMW PAHs were assumed to include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.

### 3.5.3.4 Exposure Estimation

The following guidelines were used in the Base-wide ESI to estimate the potential direct exposure of ecological receptors to chemicals in soils:

- For each data group, the maximum detected chemical concentrations in surface soil and a calculated EPC represented by an upper confidence limit of the mean (such as the 95% UCL) were used to conservatively estimate potential direct chemical exposures. The arithmetic mean was used instead of the 95% UCL when the 95% UCL could not be calculated or the 95% UCL was higher than the maximum detected concentration. EPCs were calculated using ProUCL V5.1 (USEPA, 2017).
- For chemicals not detected in any samples of a data grouping, the maximum method detection limit and an EPC represented by half of the maximum method detection limit were used to estimate the potential direct exposure.
- For samples with duplicate analyses, the higher of the two detected concentrations was used if both values were detects. In cases where one result was a detected concentration and the other a nondetect, the detected value was used for screening.

## 3.5.4 Screening-level Risk Calculation

The screening-level risk calculation is the final step of the ERA for the Base-wide ESI. In this step, maximum detected values (or maximum detection limits for nondetected analytes) and EPCs are compared to the corresponding screening values to derive screening risk estimates. For each site, the outcome of this step is a list of COPCs that warrant further consideration and a list of chemicals that can be eliminated from further consideration based on the conclusion that they are unlikely to adversely affect the ecological receptors of concern.

### 3.5.4.1 Selection of Chemicals of Potential Concern

COPCs were selected using the HQ method as well a weight-of-evidence (WOE) approach that considers the magnitude of the risks based on central tendency EPCs, toxicity information, frequency of detection, magnitude of exceedance, background (when available), and the distribution of detected concentrations. HQs were calculated by dividing the maximum detected chemical concentration in data grouping being evaluated by the corresponding screening value. Chemicals with HQs greater than or equal to 1.0 are considered to pose potential risk but are further evaluated using the WOE approach. HQs that are equal to or less than 1 indicate that risks are unlikely, enabling a conclusion of no unacceptable risk to be reached with a high level of confidence and negating the need for further evaluation of that chemical-pathway-receptor combination. In the Base-wide ESI ERA, detected chemicals without screening values were not retained as COPCs and are further discussed in the uncertainties.

In addition to comparing chemical concentrations to ESVs, the maximum detected concentrations of the inorganic chemicals detected in surface soil at each site were compared to background concentrations. The 95% UTL for inorganic constituents in Soil Groups 2 (Sites 4 and 5) and 3 (AOC D and Sites 3, 7, and 9) (Tetra Tech, 2015) were used for this comparison. The maximum concentration of inorganic constituents detected at a site was compared to a background 95% UTL to determine if chemicals are detected at concentrations exceeding background. Constituents that are not present at concentrations exceeding background 95% UTLs were considered to be present at naturally-occurring concentrations and were not recommended for further evaluation in the ERA process regardless of the estimated HQ.

The ERS results for the six sites are detailed in the ERA summary sections within each site-specific section.

### 3.5.4.2 Uncertainties

Uncertainties are present in all risk assessments because of the limitations in the available data and the need to make assumptions and extrapolations based on incomplete information. The following paragraphs summarize the primary uncertainties associated with this evaluation.

**Data Available for Evaluation** – Samples were in most cases collected from locations where the highest chemical concentrations would be expected to occur based on site observations or information available about historical site activities. In most cases, concentrations are expected to be much lower outside of the immediate and localized area of sampling. Based on the collected samples, however, only concentrations occurring within the areas where the highest concentrations are present were characterized. Based on the bias of collecting samples from locations where chemicals are likely to be present at their highest concentration, risks are likely in most cases to be overestimated by this screening.

**Non-detected Chemicals** – The current assessment focused on the evaluation of detected chemicals. There is some uncertainty associated with the possible occurrence of non-detected chemicals in soils if the reporting limits of those chemicals also exceed the ESV. Although it cannot be determined definitively that such chemicals do not occur onsite, based on the general bias of samples to potential source areas, it is considered unlikely that chemicals potentially posing a risk to ecological receptors would not have been detected in soil.

**Detected Chemicals Without ESVs** – Chemicals without ESVs were not identified for additional focused evaluation. There is uncertainty associated with these chemicals as it cannot be determined definitively if they represent a potential risk to ecological receptors. However, risk is unlikely. Volatile compounds are expected to be transient in surface soils and are considered unlikely to represent a long-term exposure to ecological receptors, unless there is an ongoing source of the compound at the site. Furthermore, most of these compounds were detected in only one or two of the samples and the highly localized presence of these compounds is not likely to represent a risk to ecological receptor populations, which is the focus of an ERA. ESVs are not available for aluminum and iron.

**Direct Exposure Screening –** Lower trophic level receptors (plants and terrestrial invertebrates) were considered to have the highest level of exposure and were chosen for evaluation in this ERA. Birds and mammals were not evaluated for exposures through the food chain. For some analytes that are known to bioaccumulate, this may underestimate risk. However, all sites, except for Site 5, consist of mowed habitat and would only support limited bird and mammal receptors such as squirrels and American robin. Higher quality habitat is located nearby and would be more attractive.

## 3.6 Historical Records Review of Building 76

A historical records review of Building 76 and its surrounding area at NRL-CBD was performed to investigate the presence of solid waste and debris at the base of the hill near the building. A site visit and historical records search of available base documents were conducted in early 2019. The document review noted Building 76 historically supported multiple trade shops (carpentry, machine, plumbing, and electrical) and is currently used for storage. Based on observations during the site visit it was suggested that subsurface construction debris noted along the western hillside of Building 76 may be related to the timeframe when Building 76 was constructed. The Navy is evaluating this area to determine whether a new environmental restoration site should be created. The findings of the review and site visit are presented in **Appendix H**.

SECTION 4

# Site 3 – Landfill No. 1

## 4.1 Site Description

Site 3, also known as Landfill No. 1 or "Old Junk Row," is located on the western portion of NRL-CBD, south and adjacent to the main access road (**Figure 4-1**). According to the Initial Assessment Study (IAS), the site consisted of four to six 25-foot by 25-foot by 20-foot-deep excavation pits occupying 3,750 square feet ($ft^2$) (NEESA, 1984). However, after landfilling operations ceased the site was used as open storage, during which time best management practices were followed and the potential for undocumented spills remained. A photograph from April 1958 shows the site during the time it was used as open storage. Based on use of the site as a storage area, the current site occupies an area of 81,411 $ft^2$. The site is relatively flat with an approximate elevation of 125 feet amsl. The area occupying the site is currently used as maintained office space consisting of three research buildings (Buildings 301, 307, and 314) and a parking lot.

Landfill No. 1 was operational from 1942 through 1950. As previously mentioned, the landfill consisted of four to six pits and accepted three types of waste: municipal waste such as household garbage and tree trimming refuse, shop wastes such as wooden boxes, cardboard cartons, oily rags, absorbent materials, empty oil cans, lubricant cans, and paint sludges, and non-toxic laboratory waste such as paper towels, cardboard boxes, and small quantities of waste solvents (NEESA, 1984). Once the landfill was filled with refuse to within 4 feet of ground surface, the remaining space was backfilled with excavated soil to ground surface (NEESA, 1984). After the landfill was closed, the area on top of the landfill was designated "Old Junk Row" and used as open storage for disabled heavy equipment, demolition debris, and out-of-service laboratory equipment used in radar, sonar, and optics research (NEESA, 1984). During a site visit while the IAS was being conducted, crusted and stained soils were observed in the area. In the late 1980s, research buildings were constructed at the site in association with development of the Fire Testing Area.

## 4.2 Investigation Summary

The Site 3 field activities were conducted in April and May 2018. The following sections describe the observations noted during test pitting activities and the soil and groundwater sampling details.

### 4.2.1 Test Pitting

Three new test pits were dug at Site 3  to further assess the presence or absence of waste material at the site (**Figure 4-1**). The complete test pit logs are provided in **Appendix A**. A summary of the results for each test pit is provided as follows:

- **Test Pit 3** – The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of silty sand to sandy silt. No waste materials or soil staining were found in this test pit.
- **Test Pit 4 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of silty sand to sandy silt. No waste materials or soil staining were found in this test pit.
- **Test Pit 5 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of silty sand. No waste materials or soil staining were found in this test pit.

### 4.2.2 Soil Sampling

Ten soil borings were advanced during the Base-wide ESI at Site 3 to further assess whether historical activities at the site contributed to the presence of contamination in soil (**Figure 4-1**). The soil borings were advanced to a depth of 10 feet bgs using a DPT rig. No signs of contamination (soil staining or odors) were observed in any of the soil borings. At each boring, surface soil samples were collected from 0 to 0.5 foot bgs and subsurface soil samples were collected from 8 to 10 feet bgs. All 10 soil borings were analyzed for pesticides in the surface and subsurface intervals; while 5 of 10 borings were analyzed for SVOCs, PCBs, and metals in the surface and subsurface intervals.

### 4.2.3 Groundwater Sampling

One permanent monitoring well (CBD-S03-MW03) was newly installed during the Base-wide ESI at Site 3 (**Figure 4-1**). Groundwater samples from the newly installed monitoring well and two existing monitoring wells at Site 3 were collected during the Base-wide ESI and analyzed for VOCs, SVOCs, PCBs, pesticides, total and dissolved metals, and total and dissolved mercury.

## 4.3 Analytical Results

A summary of the constituents detected in surface soil, subsurface soil, and groundwater during the Base-wide ESI at Site 3 are presented in **Tables 4-1, 4-2**, and **4-3** respectively, and discussed as follows. The complete analytical results for both the SI and ESI data are presented in **Appendix E**.

### 4.3.1 Surface Soil Analytical Results

A total of 10 surface soil samples were collected at Site 3 during the 2018 Base-Wide ESI field activities. The results of the surface soil sampling are summarized as follows:

- **SVOCs** – Fifteen SVOCs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) were detected in surface soil. The majority of the SVOC detections was associated with the soil samples collected from two locations (CBD-S03-DP11 and CBD-S03-DP14).
- **Pesticides and PCBs** – One pesticide (4,4’-DDE) was detected in surface soil at three locations (CBD-S03-DP06, CBD-S03-DP09, and CBD-S03-DP15). One PCB (Aroclor-1260) was detected in surface soil at five locations (CBD-S03-DP11, CBD-S03-DP12, CBD-S03-DP13, CBD-S03-DP14, and CBD-S03-DP15).
- **Metals** – Twenty-two metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in surface soil. Detections of metals were found in all surface soil samples.

### 4.3.2 Subsurface Soil Analytical Results

A total of 10 subsurface soil samples were collected at Site 3 during the 2018 Base-wide ESI field activities. The results of the subsurface soil sampling are summarized as follows:

- **SVOCs** – Twelve SVOCs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) were detected in subsurface soil. The SVOC detections were only present at one sample location (CBD-S03-DP12).
- **Pesticides and PCBs** – One PCB (Aroclor-1260) was detected in subsurface soil at two locations (CBD-S03-DP14 and CBD-S03-DP15).
- **Metals** – Twenty-one metals (aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in subsurface soil. Detections of metals were found in all subsurface soil samples.

### 4.3.3 Groundwater Analytical Results

Three groundwater samples were collected at Site 3 during the 2018 Base-wide ESI field activities. The results of the groundwater sampling are summarized as follows:

- **VOCs** – One VOC (toluene) was detected in CBD-S03-MW03.

- **SVOCs** – Twelve SVOCs (2-methylnaphthalene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benze[g,h,i]perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene) were detected in the groundwater samples. Monitoring well CBD-S03-MW03 had more SVOC detections than the other two monitoring wells at the site.
- **Pesticides and PCBs** – No pesticides or PCBs were detected in the groundwater samples.
- **Metals** – Twenty total metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc) and 20 dissolved metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, thallium, vanadium, and zinc) were detected in the groundwater samples. In general, the magnitude of the dissolved metals concentrations did not decrease significantly when compared against their total metals counterparts.

## 4.4 Human Health Risk Screening

The HHRS for Site 3 was conducted in three steps using the risk-ratio technique (Navy, 2000) described in Section 3.4. Results were reported for the Navy, USEPA, and MDE target risk levels. Table 1 in **Appendix F** lists the samples that were included in the Site 3 HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.1**.

### 4.4.1.1 Surface Soil

The risk-based screening and risk-ratio evaluation for surface soil at Site 3 are provided in **Appendix F.1, Tables 2.1 through 2.1c**.

Step 1: Aroclor-1260, aluminum, arsenic, cobalt, iron, and thallium were identified as COPCs (**Appendix F.1, Table 2.1**).

Step 2: The cumulative cancer risk was calculated to be 4 × $10^{-5}$; this value does not exceed the 5 × $10^{-5}$ Navy risk-ratio screening benchmark or the upper limit of the USEPA target risk range (1 × $10^{-4}$); however, it does exceed the MDE target risk level of 1 × $10^{-5}$. Target organ HIs are 0.1 to 0.7; which is less than the USEPA and MDE cumulative target organ HI of 1. However, the dermal target organ HI of 0.7 is greater than the the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5. No constituents were identified as COPCs compared to the USEPA target risk levels; however, Aroclor-1260 and arsenic are COPCs based on the MDE target risk level and arsenic and thallium were retained as COPCs compared to Navy target levels (**Appendix F.1, Table 2.1a**).

Step 3 (for MDE and Navy target level only): Cumulative cancer risk of 2 × $10^{-5}$ was calculated; this value is greater than the MDE 1 × $10^{-5}$ target risk level. The cumulative target organ HIs are 0.2 and 0.4 which is less than than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5. and the USEPA and MDE cumulative target organ HI of 1. Constituents contributing to the cumulative cancer risk were identified as COPCs under MDE target risk levels and include Aroclor-1260 and arsenic. The ProUCL output file that includes the 95% UCLs used for Site 3 surface soil is included in **Appendix F.1**. Additionally, the maximum detected arsenic concentration exceeds the site-specific surface soil BTV. (**Appendix F.1**, **Table 2.1c**).

Of the constituents that were 100 percent nondetected, the maximum detection limit for PCBs (Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, and Aroclor-1254) in surface soil slightly exceed their respective RSL (within 10 times the RSL). Because of the low level of exceedances, it is unlikely that if these PCBs are present in surface soil at concentrations below the detection limits they would contribute significantly to site risks. Screening criteria were not available for several constituents.

Exposure to surface soil at Site 3 would not be expected to result in unacceptable human health risks based on the Navy or USEPA target risk levels. However, based on the MDE target risk levels, exposure to surface soil may result in unacceptable human health risks associated with Aroclor-1260 and arsenic. The concentrations of Aroclor-1260 and arsenic detected in only one of the surface soil samples (CBD-S03-SS03-1012) exceed a screening level based on a 1 × $10^{-5}$ carcinogenic risk. Therefore, the potential unacceptable risk is primarily associated with the concentration detected in sample CBD-S03-SS03-1012.

#### 4.4.1.2 Subsurface Soil

The risk-based screening and risk-ratio evaluation for subsurface soil at Site 3 are provided in **Appendix F.1**, **Tables 2.2 and 2.2b**.

Step 1: Arsenic, chromium (hexavalent), cobalt, iron, manganese, and thallium were identified as COPCs (**Appendix F.1, Table 2.2**).

Step 2: The cumulative cancer risk was calculated to be 1 × $10^{-5}$; this value is less than the 5 × $10^{-5}$ Navy risk-ratio screening benchmark, less than the USEPA target risk level of 1 × $10^{-4}$ and does not exceed the MDE target risk level of 1 × $10^{-5}$. Target organ HIs are 0.1 to 0.6; which is less than the USEPA and MDE cumulative target organ HI of 1. However, the dermal target organ HI of 0.6 is greater than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5. Arsenic and thallium were identified as COPCs for subsurface soil based on Navy target organ HI(**Appendix F1, Table 2.2a**).

Step 3 (for Navy target level only): The dermal target organ HI of 0.3 was calculated; this value is less than the Navy cumulative target organ HI risk ratio screening benchmark of 0.5. The ProUCL output file that includes the 95% UCLs used for Site 3 subsurface soil is included in **Appendix F.1**. Based on Step 3, arsenic and thallium were not identified as Navy COPCs since the cumulative target organ HI risk ratio is less than 0.5 (**Appendix F.1**, **Table 2.2b**).

Of the constituents that were 100 percent nondetected, none exceeded the screening criteria. However, screening criteria were not available for several constituents.

Exposure to subsurface soil at Site 3 would not be expected to result in any unacceptable human health risks.

#### 4.4.1.3 Groundwater

The risk-based screening and risk-ratio evaluation for groundwater at Site 3 are provided in **Appendix F.1**, **Tables 2.3 and 2.3b**.

Step 1: Aluminum, arsenic, cadmium, chromium, cobalt, iron, manganese, and thallium were identified as COPCs (**Appendix F.1, Table 2.3**).

Step 2: The cumulative cancer risk was calculated to be 1 × $10^{-5}$; this value is less than the 5 × $10^{-5}$ Navy risk-ratio screening benchmark, less than the USEPA target risk level of 1 × $10^{-4}$ and does not exceed the MDE target risk level of 1 × $10^{-5}$. The dermal, thyroid, respiratory, and gastrointestinal target organ HIs are greater than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but do not exceed the USEPA and MDE cumulative target organ HI of 1. Arsenic, cobalt, iron, and thallium were identified as COPCs based on exceedances of the Navy target organ HI risk ratio screening benchmark. Although arsenic, cobalt, iron and thallium were identified as COPCs when compared to the Navy target organ HI risk ratio, the maximum detected concentrations of these constituents were less than concentrations detected in unimpacted groundwater (**Appendix F.1, Table 2.3b**). No COPCs were identified based on comparisons to USEPA and MDE target risk levels.

Of the constituents that were 100 percent nondetected, the maximum detection limit for PCBs (Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260) and one pesticide (aldrin) slightly exceed their respective RSL (within ten times the RSLs). Because of the low level of exceedances, it is unlikely that if they are present at concentrations below the detection limits they would contribute significantly to site risks. Screening criteria were not available for several constituents.

Exposure to groundwater at Site 3 would not be expected to result in any unacceptable site-related human health risks because the constituents identified as potential COPCs are present at concentrations that are consistent with concentrations in unimpacted groundwater.

## 4.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

Of the detected analytes, Aroclor-1260 was retained as a COPC (**Appendix G, Table 3**) and had an EPC-based HQ of 20. All other analytes either were not detected, had EPC-based HQs less than 1, were consistent with background, or were macronutrients. Consequently, exposure to surface soil at Site 3 may result in unacceptable ecological risk associated with Aroclor-1260 and further evaluation of risk or consideration of remediation is recommended.

## 4.6 Site Characterization

The potential for waste disposal at Site 3 was characterized through the installation of five test pits located across the site based on the results of the DGM survey performed in 2012. Based on the results of the test pitting activities conducted, no observations of waste were encountered in any of the test pits and no other indications of waste placement such as soil staining or elevated PID readings were noted.

The Base-wide SI and ESI soil and groundwater analytical data for Site 3 were evaluated for site characterization based on the human health and ecological risk screening results noted in Sections 4.4 and 4.5. Aroclor-1260 and arsenic were determined to be human health COPCs in surface soil, while Aroclor-1260 was also determined to be an ecological COPC in surface soil. **Figure 4-2** shows the analytical results of Aroclor-1260 and arsenic in surface soil at Site 3.

Aroclor-1260 concentrations are several orders of magnitude higher in eastern portion of the site when compared to the western portion of the site. The location with the maximum detection of Aroclor-1260 (5,500 µg/kg) is located at CBD-S03-DP03 (**Figure 4-2**). Spatially, concentrations of Arclor-1260 drop off by one to two orders of magnitude with distance from the maximum detected location. However, concentrations to the north/northeast remain above the residential soil RSL (240 µg/kg) while the area to the south/southwest has not been delineated. The maximum detected concentration of arsenic was also located at CBD-S03-DP03 and is an order of magnitude higher than arsenic levels at all other sample locations. This location appears to be a singular exceedance of the background concentration (6.4 mg/kg).

Groundwater at Site 3 has been characterized through the installation of monitoring wells and the collection representative groundwater samples. Groundwater elevation were observed between approximately 14 and 17 ft bgs with the overall groundwater flow to the southeast. No human health COPCs were identified through the risk screening.

## 4.7 Findings and Recommendations

### 4.7.1 Findings

Based on the results of the test pitting activities conducted, no observations of waste were encountered in any of the test pits and no other indications of waste placement such as soil staining or elevated PID readings were noted. SVOCs, PCBs, pesticides, and metals were detected in surface and subsurface soils at Site 3 during the Base-wide ESI. In addition, one VOC, SVOCs, and metals were detected in groundwater at Site 3. Based on the HHRS and ERS, the constituents presented in **Table 4-4** may present potentially unacceptable site-related risk and were retained as COPCs for Site 3.

Table 4-4. Human Health and Ecological Risk COPCs for Site 3

| **Media** | **COPCs** | |
|---|---|---|
| | **Human Health** | **Ecological** |
| Surface Soil | Aroclor-1260[1] and Arsenic[1.] | Aroclor-1260 |
| Subsurface Soil | None | N/A |
| Groundwater | None | N/A |

Note:

[1.] Only considered a COPC under MDE target risk levels.

## 4.7.2 Recommendations

Site 3 is recommended for further evaluation based upon potentially unacceptable human health risks with Aroclor-1260 and arsenic in surface soil and ecological risks associated with Aroclor-1260 in surface soil.

Table 4-1. Site 3 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S03-DP06 | CBD-S03-DP07 | CBD-S03-DP08 | CBD-S03-DP09 | CBD-S03-DP10 | CBD-S03-DP11 | | CBD-S03-DP12 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S03-SS06-000H | CBD-S03-SS07-000H | CBD-S03-SS08-000H | CBD-S03-SS09-000H | CBD-S03-SS10-000H | CBD-S03-SS11-000H | CBD-S03-SS11P-000H | CBD-S03-SS12-000H |
| **Sample Date** | | | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| Acenaphthene | -- | 360,000 | NA | NA | NA | NA | NA | 1.3 U | 0.76 J | 1.6 U |
| Acenaphthylene | -- | -- | NA | NA | NA | NA | NA | 0.49 J | 1.8 J | 1.6 U |
| Anthracene | -- | 1,800,000 | NA | NA | NA | NA | NA | 5.1 U | 2.6 J | 6.5 U |
| Benzo(a)anthracene | -- | 1,100 | NA | NA | NA | NA | NA | 5.1 U | 15 | 6.5 U |
| Benzo(a)pyrene | -- | 110 | NA | NA | NA | NA | NA | 4 J | 20 J | 2.9 J |
| Benzo(b)fluoranthene | -- | 1,100 | NA | NA | NA | NA | NA | 9.8 UJ | 40 J | 10 U |
| Benzo(g,h,i)perylene | -- | -- | NA | NA | NA | NA | NA | 4.5 J | 19 J | 10 U |
| Benzo(k)fluoranthene | -- | 11,000 | NA | NA | NA | NA | NA | 5.1 U | 13 | 6.5 U |
| Chrysene | -- | 110,000 | NA | NA | NA | NA | NA | 5.1 UJ | 24 J | 6.5 U |
| Dibenz(a,h)anthracene | -- | 110 | NA | NA | NA | NA | NA | 7.8 U | 3.7 J | 10 U |
| Fluoranthene | -- | 240,000 | NA | NA | NA | NA | NA | 5.1 UJ | 29 J | 6.6 U |
| Fluorene | -- | 240,000 | NA | NA | NA | NA | NA | 3.1 U | 1.2 J | 4 U |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | NA | NA | NA | NA | NA | 5 J | 22 J | 10 U |
| Phenanthrene | -- | -- | NA | NA | NA | NA | NA | 7.8 U | 14 | 6.6 J |
| Pyrene | -- | 180,000 | NA | NA | NA | NA | NA | 4.5 J | 25 J | 3.4 J |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDE | 100 | 2,000 | 2.73 | 0.13 U | 0.134 R | 7.94 J- | 0.132 U | 0.299 U | 0.142 U | 0.252 UJ |
| Aroclor-1260 | 160 | 240 | NA | NA | NA | NA | NA | 36 J | 70 J | 51 J |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | -- | 7,700 | NA | NA | NA | NA | NA | 6,800 | 5,200 | 7,000 |
| Antimony | 5 | 3.1 | NA | NA | NA | NA | NA | 0.15 J | 0.13 J | 0.13 J |
| Arsenic | 6.8 | 0.68 | NA | NA | NA | NA | NA | **3.2** | **2.5** | **2.9** |
| Barium | 110 | 1,500 | NA | NA | NA | NA | NA | 37 | 29 | 37 |
| Beryllium | 2.5 | 16 | NA | NA | NA | NA | NA | 0.36 J | 0.31 J | 0.52 J |
| Cadmium | 32 | 7.1 | NA | NA | NA | NA | NA | 0.25 J | 0.18 J | 0.2 J |
| Calcium | -- | -- | NA | NA | NA | NA | NA | 780,000 | 666,000 | 258 |
| Chromium | 10 | 0.3 | NA | NA | NA | NA | NA | ***12*** | **8.9** | ***11*** |
| Cobalt | 13 | 2.3 | NA | NA | NA | NA | NA | **2.4** | 1.8 | **3.5** |
| Copper | 70 | 310 | NA | NA | NA | NA | NA | 6.1 | 6.6 | 6.8 |
| Iron | -- | 5,500 | NA | NA | NA | NA | NA | **9,800** | **7,600** | **9,800** |
| Lead | 120 | 400 | NA | NA | NA | NA | NA | 15 | 12 | 11 |
| Magnesium | -- | -- | NA | NA | NA | NA | NA | 797,000 | 625,000 | 735 |
| Manganese | 220 | 180 | NA | NA | NA | NA | NA | 97 | 83 | 110 |
| Nickel | 38 | 150 | NA | NA | NA | NA | NA | 8.1 | 6.1 | 8.7 |
| Potassium | -- | -- | NA | NA | NA | NA | NA | 577,000 | 514,000 | 399 |
| Selenium | 0.52 | 39 | NA | NA | NA | NA | NA | *0.87* | *0.95* | *1.3* |
| Silver | 560 | 39 | NA | NA | NA | NA | NA | 0.18 U | 0.15 U | 0.11 J |
| Sodium | -- | -- | NA | NA | NA | NA | NA | 215,000 J | 379,000 J | 12.9 U |
| Thallium | 0.05 | 0.078 | NA | NA | NA | NA | NA | ***0.2 J*** | ***0.16 J*** | ***0.24 J*** |
| Vanadium | 60 | 39 | NA | NA | NA | NA | NA | 16 | 12 | 14 |
| Zinc | 120 | 2,300 | NA | NA | NA | NA | NA | 48 | 41 | 43 |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 4-1. Site 3 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S03-DP06 | CBD-S03-DP13 | CBD-S03-DP14 | CBD-S03-DP15 |
|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S03-SS06-000 | CBD-S03-SS13-000H | CBD-S03-SS14-000H | CBD-S03-SS15-000H |
| **Sample Date** | | | 04/03/18 | 04/03/18 | 04/04/18 | 04/03/18 |
| **Chemical Name** | | | | | | |
| | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | |
| Acenaphthene | -- | 360,000 | NA | 1.2 U | 0.81 J | 1.1 U |
| Acenaphthylene | -- | -- | NA | 0.69 J | 12 | 1.1 U |
| Anthracene | -- | 1,800,000 | NA | 5 U | 13 | 4.6 U |
| Benzo(a)anthracene | -- | 1,100 | NA | 7.5 U | 29 | 4.6 U |
| Benzo(a)pyrene | -- | 110 | NA | 7.6 J | 41 | 4.6 U |
| Benzo(b)fluoranthene | -- | 1,100 | NA | 15 | 97 | 7.1 U |
| Benzo(g,h,i)perylene | -- | -- | NA | 9.1 J | 42 | 7.1 U |
| Benzo(k)fluoranthene | -- | 11,000 | NA | 8.9 U | 30 | 4.6 U |
| Chrysene | -- | 110,000 | NA | 10 U | 47 | 4.6 U |
| Dibenz(a,h)anthracene | -- | 110 | NA | 5.2 J | 10 J | 7.1 U |
| Fluoranthene | -- | 240,000 | NA | 6.7 U | 52 | 4.6 U |
| Fluorene | -- | 240,000 | NA | 3.1 U | 2.1 J | 2.8 U |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | NA | 10 J | 51 | 7.1 U |
| Phenanthrene | -- | -- | NA | 7.7 U | 13 | 7.1 U |
| Pyrene | -- | 180,000 | NA | 5.9 J | 48 | 7.1 U |
| | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | |
| 4,4'-DDE | 100 | 2,000 | 2.73 | 0.146 U | 0.131 UJ | 13.5 |
| Aroclor-1260 | 160 | 240 | NA | ***1,200*** | ***1,600*** | ***350*** |
| | | | | | | |
| **Total Metals (MG/KG)** | | | | | | |
| Aluminum | -- | 7,700 | NA | 5,600 | 7,200 | 4,800 |
| Antimony | 5 | 3.1 | NA | 0.11 J | 0.076 J | 0.2 J |
| Arsenic | 6.8 | 0.68 | NA | **3.3** | **2.5** | **3.8** |
| Barium | 110 | 1,500 | NA | 25 | 42 | 27 |
| Beryllium | 2.5 | 16 | NA | 0.37 J | 0.57 J | 0.24 J |
| Cadmium | 32 | 7.1 | NA | 0.37 | 0.24 J | 1.7 |
| Calcium | -- | -- | NA | 543 | 360 | 935 |
| Chromium | 10 | 0.3 | NA | ***16*** | ***14*** | ***11*** |
| Cobalt | 13 | 2.3 | NA | 1.8 | **3.9** | 1.9 |
| Copper | 70 | 310 | NA | 5.1 | 5.8 | 16 |
| Iron | -- | 5,500 | NA | **10,000** | **9,800** | **9,200** |
| Lead | 120 | 400 | NA | 17 | 17 | 95 |
| Magnesium | -- | -- | NA | 789 | 662 | 607 |
| Manganese | 220 | 180 | NA | 81 | 130 | 100 |
| Nickel | 38 | 150 | NA | 5.1 | 8.8 | 7.4 |
| Potassium | -- | -- | NA | 958 | 344 | 414 |
| Selenium | 0.52 | 39 | NA | *0.75* | *1.1* | *0.76* |
| Silver | 560 | 39 | NA | 0.14 J | 0.16 U | 0.12 J |
| Sodium | -- | -- | NA | 6.3 U | 14.1 J+ | 22.4 J+ |
| Thallium | 0.05 | 0.078 | NA | ***0.17 J*** | ***0.19 J*** | ***0.12 J*** |
| Vanadium | 60 | 39 | NA | 16 | 13 | 13 |
| Zinc | 120 | 2,300 | NA | 29 | 43 | 70 |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 4-2. Site 3 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S03-DP06 | CBD-S03-DP07 | CBD-S03-DP08 | CBD-S03-DP09 | CBD-S03-DP10 | CBD-S03-DP11 | CBD-S03-DP12 | CBD-S03-DP13 |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-S03-SB06-0810 | CBD-S03-SB07-0810 | CBD-S03-SB08-0810 | CBD-S03-SB09-0810 | CBD-S03-SB10-0810 | CBD-S03-SB11-0810 | CBD-S03-SB12-0810 | CBD-S03-SB13-0810 |
| **Sample Date** | | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| Acenaphthene | 360,000 | NA | NA | NA | NA | NA | 1.1 U | 0.58 J | 1.2 U |
| Anthracene | 1,800,000 | NA | NA | NA | NA | NA | 4.3 U | 1.7 J | 4.8 U |
| Benzo(a)anthracene | 1,100 | NA | NA | NA | NA | NA | 4.3 U | 11 | 4.8 U |
| Benzo(a)pyrene | 110 | NA | NA | NA | NA | NA | 4.3 U | 14 | 4.8 U |
| Benzo(b)fluoranthene | 1,100 | NA | NA | NA | NA | NA | 6.7 U | 26 | 7.4 U |
| Benzo(g,h,i)perylene | -- | NA | NA | NA | NA | NA | 6.7 U | 12 | 7.4 U |
| Chrysene | 110,000 | NA | NA | NA | NA | NA | 4.3 U | 16 | 4.8 U |
| Dibenz(a,h)anthracene | 110 | NA | NA | NA | NA | NA | 6.7 U | 3.2 J | 7.4 U |
| Fluoranthene | 240,000 | NA | NA | NA | NA | NA | 4.3 U | 16 | 4.8 U |
| Indeno(1,2,3-cd)pyrene | 1,100 | NA | NA | NA | NA | NA | 6.7 U | 15 | 7.4 U |
| Phenanthrene | -- | NA | NA | NA | NA | NA | 6.7 U | 8.6 J | 7.4 U |
| Pyrene | 180,000 | NA | NA | NA | NA | NA | 6.7 U | 13 | 7.4 U |
| | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | |
| Aroclor-1260 | 240 | NA | NA | NA | NA | NA | 6.4 U | 6.6 U | 6.6 U |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 7,700 | NA | NA | NA | NA | NA | 2,000 | 4,100 | 2,100 |
| Antimony | 3.1 | NA | NA | NA | NA | NA | 0.14 U | 0.11 J | 0.1 J |
| Arsenic | 0.68 | NA | NA | NA | NA | NA | 0.61 | **4.2** | 0.28 |
| Barium | 1,500 | NA | NA | NA | NA | NA | 5.4 | 7.3 | 3.5 |
| Beryllium | 16 | NA | NA | NA | NA | NA | 0.28 U | 0.19 J | 0.27 U |
| Calcium | -- | NA | NA | NA | NA | NA | 343 | 363 | 322 |
| Chromium | 0.3 | NA | NA | NA | NA | NA | **7.6** | **14** | **8.8** |
| Cobalt | 2.3 | NA | NA | NA | NA | NA | 0.54 | 0.72 | 0.28 |
| Copper | 310 | NA | NA | NA | NA | NA | 1.1 | 3.3 | 1.2 |
| Iron | 5,500 | NA | NA | NA | NA | NA | 1,800 | **7,300** | 1,900 |
| Lead | 400 | NA | NA | NA | NA | NA | 1.6 | 2.6 | 1.7 |
| Magnesium | -- | NA | NA | NA | NA | NA | 435 | 655 | 437 |
| Manganese | 180 | NA | NA | NA | NA | NA | 3 | 6.5 | 2.5 |
| Nickel | 150 | NA | NA | NA | NA | NA | 0.87 | 1.2 | 0.59 |
| Potassium | -- | NA | NA | NA | NA | NA | 300 | 417 | 307 |
| Selenium | 39 | NA | NA | NA | NA | NA | 0.3 J | 0.5 J | 0.27 U |
| Silver | 39 | NA | NA | NA | NA | NA | 0.14 U | 0.076 J | 0.077 J |
| Sodium | -- | NA | NA | NA | NA | NA | 4.8 U | 6.6 U | 5.3 U |
| Thallium | 0.078 | NA | NA | NA | NA | NA | 0.066 J | **0.12 J** | **0.13 J** |
| Vanadium | 39 | NA | NA | NA | NA | NA | 3.2 | 10 | 3.6 |
| Zinc | 2,300 | NA | NA | NA | NA | NA | 6 | 9.9 | 3.3 |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

## Table 4-2. Site 3 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S03-DP14 | CBD-S03-DP15 | |
|---|---|---|---|---|
| **Sample ID** | | CBD-S03-SB14-0810 | CBD-S03-SB15-0810 | CBD-S03-SB15P-0810 |
| **Sample Date** | | 04/04/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | |
| | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | |
| Acenaphthene | 360,000 | 1.2 U | 1.1 U | 1.3 U |
| Anthracene | 1,800,000 | 5 U | 4.4 U | 5.4 U |
| Benzo(a)anthracene | 1,100 | 5 U | 4.4 U | 5.4 U |
| Benzo(a)pyrene | 110 | 5 U | 4.4 U | 5.4 U |
| Benzo(b)fluoranthene | 1,100 | 7.7 U | 6.8 U | 8.3 U |
| Benzo(g,h,i)perylene | -- | 7.7 U | 6.8 U | 8.3 U |
| Chrysene | 110,000 | 5 U | 4.4 U | 5.4 U |
| Dibenz(a,h)anthracene | 110 | 7.7 U | 6.8 U | 8.3 U |
| Fluoranthene | 240,000 | 5 U | 4.4 U | 5.4 U |
| Indeno(1,2,3-cd)pyrene | 1,100 | 7.7 U | 6.8 U | 8.3 U |
| Phenanthrene | -- | 7.7 U | 6.8 U | 8.3 U |
| Pyrene | 180,000 | 7.7 U | 6.8 U | 8.3 U |
| | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | |
| Aroclor-1260 | 240 | 4.9 J | 23 J | 6.5 UJ |
| | | | | |
| **Total Metals (MG/KG)** | | | | |
| Aluminum | 7,700 | 2,200 | 3,500 | 4,300 |
| Antimony | 3.1 | 0.099 J | 0.17 U | 0.17 U |
| Arsenic | 0.68 | 0.59 | **1.9 J** | **3.4 J** |
| Barium | 1,500 | 3.1 | 4.8 | 6.7 |
| Beryllium | 16 | 0.27 U | 0.33 U | 0.33 U |
| Calcium | -- | 47.4 | 453 | 491 |
| Chromium | 0.3 | **3.5** | **15** | **15** |
| Cobalt | 2.3 | 0.24 J | 0.32 J | 0.55 |
| Copper | 310 | 1.4 | 1.5 | 1.8 |
| Iron | 5,500 | 2,300 | 4,900 | **6,200** |
| Lead | 400 | 2.1 | 2.2 | 2.4 |
| Magnesium | -- | 180 | 521 | 579 |
| Manganese | 180 | 3.9 | 2.3 J | 6.9 J |
| Nickel | 150 | 0.62 | 0.65 J | 1.2 |
| Potassium | -- | 217 | 401 | 424 |
| Selenium | 39 | 0.27 U | 0.33 U | 0.34 J |
| Silver | 39 | 0.064 J | 0.17 U | 0.17 U |
| Sodium | -- | 6 U | 21 J+ | 18.3 J+ |
| Thallium | 0.078 | 0.14 U | 0.17 U | 0.17 U |
| Vanadium | 39 | 5.1 | 6 | 8.5 |
| Zinc | 2,300 | 2.6 | 6.8 | 6.4 |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

# Table 4-3. Site 3 Analytical Results – Detected Constituents in Groundwater

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Tapwater (HQ=0.1) 0519** | CBD-S03-MW01 | CBD-S03-MW02 | CBD-S03-MW03 |
|---|---|---|---|---|
| **Sample ID** | | CBD-S03-GW01-0418 | CBD-S03-GW02-0518 | CBD-S03-GW03-0418 |
| **Sample Date** | | 04/25/18 | 05/03/18 | 04/25/18 |
| **Chemical Name** | | | | |
| | | | | |
| **Volatile Organic Compounds (UG/L)** | | | | |
| Toluene | 110 | 0.4 U | 0.4 U | 1.34 J |
| | | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | | |
| 2-Methylnaphthalene | 3.6 | 0.014 U | 0.01 J | 0.012 U |
| Benzo(a)anthracene | 0.03 | 0.014 U | 0.0059 J | 0.026 J |
| Benzo(a)pyrene | 0.025 | 0.014 U | 0.013 U | 0.015 J |
| Benzo(b)fluoranthene | 0.25 | 0.014 U | 0.013 U | 0.03 J |
| Benzo(g,h,i)perylene | -- | 0.014 U | 0.013 U | 0.019 J |
| Benzo(k)fluoranthene | 2.5 | 0.014 U | 0.013 U | 0.037 J |
| Chrysene | 25 | 0.0075 J | 0.0042 J | 0.035 J |
| Fluoranthene | 80 | 0.0052 J | 0.0076 J | 0.023 J |
| Indeno(1,2,3-cd)pyrene | 0.25 | 0.023 U | 0.021 U | 0.022 J |
| Naphthalene | 0.17 | 0.014 U | 0.018 J | 0.012 U |
| Phenanthrene | -- | 0.023 U | 0.03 J | 0.013 J |
| Pyrene | 12 | 0.023 U | 0.021 U | 0.023 J |
| | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | | |
| No Detections | | | | |
| | | | | |
| **Total Metals (UG/L)** | | | | |
| Aluminum | 2,000 | **5,400** | 160 | 270 |
| Arsenic | 0.052 | **0.23 J** | **0.59** | **0.51** |
| Barium | 380 | 16 | 16 | 34 |
| Beryllium | 2.5 | 0.45 J | 0.13 U | 0.96 |
| Cadmium | 0.92 | **3.2** | 0.15 J | **1** |
| Calcium | -- | 6,000 | 50,900 | 9,420 |
| Chromium | 0.035 | **3.4** | **0.63** | 0.15 U |
| Cobalt | 0.6 | **1.8** | 0.49 J | **6.8** |
| Copper | 80 | 1.5 | 0.29 U | 0.07 J |
| Iron | 1,400 | 770 | 260 | **7,700** |
| Lead | 15 | 2.4 | 0.13 U | 0.1 J |
| Magnesium | -- | 3,380 | 25,500 | 4,670 |
| Manganese | 43 | 20 | **48** | **90** |
| Nickel | 39 | 5.7 | 3.2 | 21 |
| Potassium | -- | 2,100 | 1,800 | 3,140 |
| Selenium | 10 | 1.1 | 0.5 U | 0.5 U |
| Sodium | -- | 21,100 | 5,520 | 9,860 |
| Thallium | 0.02 | **0.28 J** | 0.5 U | 0.5 U |
| Vanadium | 8.6 | 2.1 | 1.5 | 0.25 J |
| Zinc | 600 | 31 | 3.1 J+ | 280 |
| | | | | |
| **Dissolved Metals (UG/L)** | | | | |
| Aluminum, Dissolved | 2,000 | 53 | 9.9 | 240 |
| Arsenic, Dissolved | 0.052 | 0.13 U | **0.52** | **0.56** |
| Barium, Dissolved | 380 | 11 | 15 | 34 |
| Beryllium, Dissolved | 2.5 | 0.35 J | 0.13 U | 2.2 |
| Cadmium, Dissolved | 0.92 | **2.9** | 0.14 J | **1.1** |
| Calcium, Dissolved | -- | 6,050 | 49,400 | 9,960 |
| Chromium, Dissolved | 0.035 | **0.43 J** | 0.13 U | **0.11 J** |
| Cobalt, Dissolved | 0.6 | **1.5** | 0.41 J | **6.9** |
| Copper, Dissolved | 80 | 1.3 | 0.51 | 1.3 |
| Iron, Dissolved | 1,400 | 13 | 22 | **7,400** |
| Lead, Dissolved | 15 | 0.37 J | 0.13 U | 0.11 J |
| Magnesium, Dissolved | -- | 2,820 | 25,200 | 4,510 |
| Manganese, Dissolved | 43 | 14 | **44** | **88** |
| Mercury, Dissolved | 0.57 | 0.11 J | 0.13 U | 0.16 J |
| Nickel, Dissolved | 39 | 4.5 | 3.7 | 21 |
| Potassium, Dissolved | -- | 1,740 | 1,710 | 3,030 |
| Sodium, Dissolved | -- | 20,200 | 5,370 | 9,600 |
| Thallium, Dissolved | 0.02 | **0.23 J** | 0.5 U | 0.5 U |
| Vanadium, Dissolved | 8.6 | 0.13 U | 1.1 | 0.15 J |
| Zinc, Dissolved | 600 | 26 | 3.1 | 280 |

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Tapwater (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UG/L - Micrograms per liter

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure04-01_NRL-CBD_Site3Landfill1.mxd 2/19/2019 jcarr3

⊕ Existing Monitoring Well Location

⊕ ESI Monitoring Well Location

● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals

● ESI SS/SB Location for Pesticides Only

○ SI SS/SB Location

▬ ESI Test Pit Location

▬ SI Test Pit Location

▭ Site Boundary

Imagery: Calvert County, MD - 2017

Notes:
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

N

0 37.5 75
Feet

1 inch = 75 feet

**Figure 4-1**
**Site 3 Landfill No. 1**
**Sample Locations**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

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| | | |
|---|---|---|
| Station ID | CBD-S03-DP12 | |
| Sample ID | CBD-S03-SS12-000H | |
| Sample Date | 04/04/18 | |
| Aroclor-1260 (UG/KG) | 51 | J |
| Arsenic (MG/KG) | 2.9 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP13 | |
| Sample ID | CBD-S03-SS13-000H | |
| Sample Date | 04/03/18 | |
| Aroclor-1260 (UG/KG) | 1,200 | |
| Arsenic (MG/KG) | 3.3 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP04 | |
| Sample ID | CBD-S03-SS04-1012 | |
| Sample Date | 10/17/12 | |
| Aroclor-1260 (UG/KG) | 2,100 | |
| Arsenic (MG/KG) | 2.2 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP01 | |
| Sample ID | CBD-S03-SS01-1012 | |
| Sample Date | 10/17/12 | |
| Aroclor-1260 (UG/KG) | 120 | |
| Arsenic (MG/KG) | 1.6 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP14 | |
| Sample ID | CBD-S03-SS14-000H | |
| Sample Date | 04/04/18 | |
| Aroclor-1260 (UG/KG) | 1,600 | |
| Arsenic (MG/KG) | 2.5 | |

| | | | | |
|---|---|---|---|---|
| Station ID | CBD-S03-DP11 | | | |
| Sample ID | CBD-S03-SS11-000H | | CBD-S03-SS11P-000H | |
| Sample Date | 04/03/18 | | 04/03/18 | |
| Aroclor-1260 (UG/KG) | 36 | J | 70 | J |
| Arsenic (MG/KG) | 3.2 | | 2.5 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP05 | |
| Sample ID | CBD-S03-SS05-1012 | |
| Sample Date | 10/17/12 | |
| Aroclor-1260 (UG/KG) | 150 | |
| Arsenic (MG/KG) | 1.2 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP15 | |
| Sample ID | CBD-S03-SS15-000H | |
| Sample Date | 04/03/18 | |
| Aroclor-1260 (UG/KG) | 350 | |
| Arsenic (MG/KG) | 3.8 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP03 | |
| Sample ID | CBD-S03-SS03-1012 | |
| Sample Date | 10/17/12 | |
| Aroclor-1260 (UG/KG) | 5,500 | |
| Arsenic (MG/KG) | 14 | |

| | | |
|---|---|---|
| Station ID | CBD-S03-DP02 | |
| Sample ID | CBD-S03-SS02-1012 | |
| Sample Date | 10/17/12 | |
| Aroclor-1260 (UG/KG) | 41 | |
| Arsenic (MG/KG) | 2.1 | |

- ⊕ Existing Monitoring Well Location
- ⊕ ESI Monitoring Well Location
- ● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS/SB Location for Pesticides Only
- ○ SI SS/SB Location
- ━ ESI Test Pit Location
- ━ SI Test Pit Location
- ▭ Site Boundary

Imagery: Calvert County, MD - 2017

Notes:
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

N

0 37.5 75
Feet

1 inch = 75 feet

**Figure 4-2**
**Site 3 Landfill No. 1**
**Human Health and Ecological Risk**
**COPCs in Surface Soil**
Base-Wide Expanded Site
Inspection Report
***NRL-CBD***
***Chesapeake Beach, Maryland***

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SECTION 5

# Site 4 – Landfill No. 2

## 5.1 Site Description

Site 4, also known as Landfill No. 2, is located on the western portion of NRL-CBD and is located west and adjacent to Site 3 (**Figure 5-1**). Landfill No. 2 was operational from 1950 through 1958. The IAS presented a similar site description for Site 4 as that presented for Site 3 (that is, four to six pits that were 25 feet by 25 feet by 20 feet deep), with the exception that no open storage was conducted on the site after the landfill was closed. Based on ground disturbance observed in historical photographs dated March 1955 and April 1958, the site boundary encompasses an area of 21,637 $ft^2$. Currently, the site is a relatively flat, large, open mowed grassy area with an approximate elevation of 135 feet amsl. During a recent site visit several small depressions were observed on the ground surface within the area of Site 4.

## 5.2 Investigation Summary

The Site 4 Base-wide ESI field activities were conducted in April and May 2018. The following sections describe the observations noted during test pitting activities and the soil and groundwater sampling details.

### 5.2.1 Test Pitting

Five new test pits were dug at Site 4 to further assess the presence or absence of waste material at the site (**Figure 5-1**). The complete test pit logs are shown in **Appendix A**. A summary of the results for each test pit is provided as follows:

- **Test Pit 6 –** The test pit was dug to a depth of 9.5 feet bgs. Fiberglass and corroded metal debris were encountered at 6.5 feet bgs and cans, bottles, and other litter items persisted deeper into the test pit. Soils encountered consisted of clayey sand to silty sand at 3 feet bgs and litter fragments were observed to be tied with silty sand throughout the test pit. A radiological object was encountered at 8.5 feet bgs and additional information is provided below and fully described in **Appendix I**.
- **Test Pit 7 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of clayey sand to silty sand at 4 feet bgs. No waste materials or soil staining were found in this test pit.
- **Test Pit 8** – The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of clayey sand to silty sand at 5 feet bgs. No waste materials or soil staining were found in this test pit.
- **Test Pit 9 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of silty sand with some cobbles. A few nails, glass shards, and a piece of rebar were encountered at the top 2 feet of the test pit. Otherwise, no waste materials or soil staining were found in the rest of the test pit.
- **Test Pit 10 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of silty sand. No waste materials or soil staining were found in this test pit.

**Radiological Object** - On April 3, 2018, a heavy metallic object was found in Test Pit 6 at Site 4. This metallic object was frisked with radiological instruments to determine its potential as a radiological source item. After characterization by the onsite radiological technician, the object was determined to be radioactive and subsequently double-bagged and taped for security. Field activities were temporarily suspended and NAVFAC Washington and NRL were notified of the discovery. The soil surrounding the item was frisked to evaluate whether the subsurface soil had been potentially exposed to radiological energy. No readings were noted, indicating that the radioactivity was limited to the item and not the surrounding subsurface soil. The radiological item was securely placed back at the bottom of the test pit and backfilled with the procedure noted above.

### 5.2.2 Soil Sampling

Ten soil borings were advanced during the Base-wide ESI at Site 4 to further assess whether historical activities at the site contributed to the presence of contamination in soil (**Figure 5-1**). The soil borings were advanced to a depth of 10 feet bgs using a DPT. Because of the discovery of the radiological object, proposed soil boring CBD-S04-DP12 was relocated adjacent to Test Pit 6. No signs of contamination (soil staining or odors) were observed in any of the soil borings. At each boring, surface soil samples were collected from 0 to 0.5 foot bgs and subsurface soil samples were collected from 8 to 10 feet bgs. All 10 soil borings were analyzed for pesticides in the surface and subsurface intervals; while 5 of 10 borings were analyzed for SVOCs, PCBs, and metals in the surface and subsurface intervals. In addition, hexavalent chromium was additionally analyzed in three soil borings (three surface and three subsurface soil samples).

### 5.2.3 Groundwater Sampling

Two permanent monitoring wells (CBD-S04-MW02 and CBD-S04-MW03) were newly installed during the Base-wide ESI at Site 4. Groundwater samples from two newly installed monitoring wells and one existing monitoring well (CBD-S04-MW01) at Site 4 were collected during the Base-wide ESI and analyzed for VOCs, SVOCs, PCBs, pesticides, total and dissolved metals, total and dissolved mercury, and dissolved hexavalent chromium.

## 5.3 Analytical Results

A summary of the constituents detected in soil and groundwater during the Base-wide ESI at Site 4 are presented in **Tables 5-1, 5-2**, and **5-3** respectively, and discussed as follows. The complete analytical results for both the SI and ESI data are presented in **Appendix E**.

### 5.3.1 Surface Soil Analytical Results

A total of 10 surface soil samples were collected at Site 4 during the 2018 Base-wide ESI field activities. The results of the surface soil sampling are summarized as follows:

- **SVOCs** – Fifteen SVOCs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) were detected in surface soil. The majority of the SVOC detections was associated with the soil samples collected from four locations (CBD-S04-DP12, CBD-S04-DP14, CBD-S04-DP15, and CBD-S04-DP16).
- **Pesticides and PCBs** –One Pesticide (4,4'-DDE) was detected in surface soil at two locations (CBD-S04-DP10 and CBD-S04-DP14). No PCBs were detected in surface soil.
- **Metals** – Twenty-four metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (hexavalent), chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in surface soil. Detections of metals were found in all surface soil samples.

### 5.3.2 Subsurface Soil Analytical Results

A total of 10 subsurface soil samples were collected at Site 4 during the 2018 Base-wide ESI field activities. The results of the subsurface soil sampling are summarized as follows:

- **SVOCs** – Sixteen SVOCs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene) were detected in subsurface soil. The detections were present at only one sample location (CBD-S04-DP16).

- **Pesticides and PCBs** – Five pesticides (4,4’-DDD, 4,4’-DDE, 4-4’-DDT, alpha-chlordane, and dieldrin) were detected in subsurface soil at two locations (CBD-S04-DP12 and CBD-S04-DP16). One PCB (Aroclor-1260) was detected in subsurface soil only at one location (CBD-S04-DP16).
- **Metals** – Twenty-four metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (hexavalent), chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in subsurface soil. Detections of metals were found in all subsurface soil samples.

### 5.3.3 Groundwater Analytical Results

Three groundwater samples were collected at Site 4 during the 2018 Base-wide ESI field activities. The results of the groundwater sampling are summarized as follows:

- **VOCs** – No VOCs were detected in the groundwater samples.
- **SVOCs** – Seven SVOCs (2-methylnaphthalene, benzo[a]anthracene, benzo[k]fluoranthene, chrysene, fluoranthene, naphthalene, and phenanthrene) were detected in the groundwater samples.
- **Pesticides and PCBs** – No pesticides or PCBs were detected in the groundwater samples.
- **Metals** – Nineteen total metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, thallium, vanadium, and zinc) and 19 dissolved metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc) were detected in the groundwater samples. In general, the magnitude of the dissolved metals concentrations did not decrease significantly when compared against their total metals counterparts.

## 5.4 Human Health Risk Screening

The HHRS evaluation for Site 4 was conducted in three steps using the risk-ratio technique (Navy, 2000) described in detail in Section 3.4. Results were reported for the Navy, USEPA, and MDE target risk levels. Table 1 in **Appendix F** lists the samples that were included in the Site 4 HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.2**.

#### 5.4.1.1 Surface Soil

The risk-based screening and risk-ratio evaluation for surface soil at Site 4 are provided in **Appendix F.2**, **Tables 2.1 through 2.1c**.

Step 1: Seven constituents were identified as COPCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, Aroclor-1260, aluminum, and arsenic (**Appendix F.2, Table 2.1**).

Step 2: The cumulative cancer risk was calculated as $5 \times 10^{-5}$; this value does not exceed the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$ or the upper limit of the USEPA target risk range of $1 \times 10^{-4}$; however, it does exceed the $1 \times 10^{-5}$ MDE target risk level. The cumulative HI is 0.7; however, the cumulative target organ HIs range from 0.2 to 0.3. Although the cumulative HI exceeds an HI of 0.5, no target organ HIs exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 or the USEPA or MDE target HI of 1. No COPCs were identified compared to the Navy or USEPA target HI levels. However, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, Aroclor-1260, and arsenic are COPCs based on the MDE target risk level (**Appendix F.2, Table 2.1a**).

Step 3 (for MDE target level only): Cumulative cancer risk of $5 \times 10^{-5}$; this value does not exceed the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$ or the upper limit of the USEPA target risk range of $1 \times 10^{-4}$; however, it does exceed the MDE target risk level of $1 \times 10^{-5}$. Constituents contributing to the cumulative cancer risk were identified as COPCs under MDE target risk levels and include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and arsenic (**Appendix F.2, Table 2.1b**). Additionally, the arsenic maximum detected concentration exceeds the site-specific surface soil BTV. (**Appendix F.2, Table 2.1c**).The contribution from Aroclor-1260 to the carcinogenic risk ($9 \times 10^{-7}$) is minimal, and therefore Aroclor-1260 was not identified as a COPC based on cumulative carcinogenic risk. The ProUCL output file that includes the 95% UCLs used for Site 4 surface soil is included in **Appendix F.2**.

No screening criteria were available for carbazole and dimethyl phthalate. Therefore, potential risks could not be evaluated for these constituents.

Of the constituents that were 100 percent nondetected, none exceeded the RSL. However, screening criteria were not available for several constituents.

Exposure to surface soil at Site 4 would not be expected to result in unacceptable human health risks based on the Navy or USEPA target risk levels; however, based on the MDE target risk levels exposure to surface soil may result in unacceptable human health risks associated with PAHs and arsenic. The contribution from Aroclor-1260 to the carcinogenic risk ($9 \times 10^{-7}$) is minimal, and therefore, Aroclor-1260 was not identified as a COPC based on cumulative carcinogenic risk. Aroclor-1260 was only detected in 4 of the 11 surface soil samples and only the maximum detected concentration (in sample CBD-S04-SS03-1012) exceeds the RSL. This is the same sample where the maximum concentrations of the PAHs were detected. All arsenic concentrations exceed the screening level based on a carcinogenic risk of $1 \times 10^{-6}$; however, only 2 of the 11 locations (CBD-S04-SS13-000H and CBD-S04-SS15-000H) had detected concentrations exceeding a screening level based on carcinogenic risk of $1 \times 10^{-5}$. Location CBD-S04-SS13-000H is on the western side of the site, and location CBD-S04-SS15-000H is on the eastern side.

### 5.4.1.2 Subsurface Soil

The risk-based screening and risk-ratio evaluation for subsurface soil at Site 4 are provided in **Appendix F.2**, **Tables 2.2 through 2.2c**.

Step 1: Eleven constituents were identified as COPCs: benzo(a)pyrene, aluminum, arsenic, cadmium, hexavalent chromium, cobalt, copper, iron, lead, manganese and thallium (**Appendix F.2, Table 2.2**).

Step 2: The cumulative cancer risk was calculated as $2 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$ and the USEPA target risk level but greater than the MDE target risk level. Benzo(a)pyrene, arsenic, and hexavalent chromium are identified as COPCs based on the MDE target risk level. The cumulative target organ HI for three organs (respiratory, thyroid, and gastrointestinal) exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but are less than the USEPA and MDE cumulative target organ target HI of 1. Hexavalent chromium, cobalt, copper, and iron are identified as COPCs based on the Navy benchmark value (**Appendix F.2, Table 2.2a**).

Step 3: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$ and the USEPA and MDE target risk levels. The cumulative target organ HI for three target organs (respiratory, thyroid, and gastrointestinal) exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but are less than the USEPA and MDE cumulative target organ target HI of 1. Hexavalent chromium and cobalt, are identified as COPCs based on the Navy benchmark value (**Appendix F.2, Table 2.2b**). The maximum detected concentrations of hexavalent chromium and cobalt exceed their respective site-specific subsurface soil BTV. (**Appendix F.1, Table 2.2c**). However, because hexavalent chromium and cobalt were not identified as COPCs based on MDE target level, they are not retained as COPCs for Site 4 subsurface soil. The ProUCL output file that includes the 95% UCLs used for Site 4 subsurface soil is included in **Appendix F.2**.

The maximum detected concentration of lead in the subsurface soil exceeds the screening level and background BTV. As discussed in Section 3.4, potential risks associated with exposure to lead are not evaluated in the same manner as the other COPCs; therefore, lead is not included in the Step 2 or 3 evaluations. Exposure to lead in subsurface soil by a potential future child resident was evaluated using the IEUBK model. The IEUBK model was run using the average lead subsurface soil concentration (70.7 mg/kg) and average (of the detected values, lead was detected in three of the five groundwater samples) lead groundwater concentration (6.85 μg/L). The output from the IEUBK model is provided in **Appendix F.2, Table 2.2d**, **Figure Lead.1**, and the RAGS D IEUBK Lead Worksheet identified as **Table Lead.1**. The predicted geometric mean blood lead level for a young child exposed to Site 4 subsurface soil and groundwater is 1.8 μg/L with 0.02 percent of the population potentially experiencing concentrations exceeding 10 μg/L. This is less than the current blood lead goal as described in the 1994 Office of Solid Waste and Emergency Response (OSWER) directive (USEPA, 1994) of no more than 5 percent of children exceeding 10 μg/dL blood lead. Because the IEUBK model determined that exposure to lead in subsurface soil by a child resident, the most conservative potential receptor, would not result in a blood lead level exceeding the current blood lead goal, exposure to lead in subsurface soil by future industrial workers was not evaluated.

No screening criteria were available for dimethyl phthalate. Therefore, potential risks could not be evaluated for this constituent.

Of the constituents that were 100 percent nondetected, none exceeded the RSL. Screening criteria were not available for several constituents.

Exposure to subsurface soil at Site 4 would not be expected to result in any unacceptable site-related human health risks based on the MDE target risk levels.

### 5.4.1.3 Groundwater

The risk-based screening and risk-ratio evaluation for groundwater at Site 4 are provided in **Appendix F.2**. Total metals concentrations were used for the HHRS.

Step 1: Aluminum, arsenic, cadmium, chromium, cobalt, iron, manganese, and thallium were identified as COPCs (**Appendix F.2, Table 2.3**).

Step 2: Cumulative cancer risk of $2 \times 10^{-4}$; this value is greater than the Navy, USEPA, and MDE risk-ratio screening benchmark levels of $5 \times 10^{-5}$, $1 \times 10^{-4}$, and $1 \times 10^{-5}$, respectively. The cumulative hazard index is 6. The dermal, thyroid and respiratory target organ HIs are greater than 1 which is greater than the Navy, USEPA, and MDE cumulative target organ HIs. The neurological target organ HI is 0.9 which is greater than the Navy target organ HI. Arsenic and chromium contribute to the cumulative cancer risk that exceeds Navy, USEPA, and MDE risk ratio screening levels. Arsenic, chromium, cobalt, and thallium contribute to target organ HIs above the Navy risk ratio screening benchmark of 0.5, and the USEPA and MDE target HI. Aluminum and manganese contribute to a target organ HI that only exceeds the Navy benchmark level.

The maximum detected concentrations of arsenic, chromium, cobalt, manganese, and thallium are below the site-specific BTV. Although the maximum detected concentration of aluminum is greater than it's site-specific BTV (**Appendix F.2, Table 2.3b**), aluminum was not identified as a COPC for Site 4 groundwater because the cumulative target organ HI is less than both the USEPA and MDE target level (**Appendix F.2, Table 2.3a**).

Step 3 was not performed because fewer than 10 samples were available for groundwater.

Of the constituents that were 100 percent nondetected, some of the VOCs, SVOCs, and PCBs exceeded their respective RSLs. However, the detection limits were generally within an order of magnitude of the screening levels, and it is unlikely that if these constituents are present in groundwater at concentrations less than the detection limits they would contribute significantly to site risks. Screening criteria were not available for several constituents.

Exposure to groundwater at Site 4 would not be expected to result in unacceptable human health risks based on the MDE target levels.

## 5.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

No surface soil COPCs were identified for Site 4 (**Appendix G**, **Table 4**). While HMW PAHs had an EPC-based HQ of 3, this was driven by one sample location (CBD-S04-DP03). Concentrations from other samples collected across the site were an order of magnitude lower. Therefore, HMW PAHs are not considered to pose a significant risk to ecological receptor populations on a sitewide basis. Additionally, habitat consists of mowed grass and more desirable habitat is located nearby.

All other analytes either were not detected, had EPC-based HQs less than 1, were consistent with background, or were macronutrients. Additionally, four detected analytes lacked screening values. As discussed in Section 3.4.6, these analytes were not identified as COPCs. Consequently, no unacceptable risk was identified, and no further ecological investigation or evaluation is recommended for surface soils at Site 4.

## 5.6 Site Characterization

The potential for waste disposal at Site 4 was characterized through the installation of 10 test pits located across the site based on the results of the DGM survey performed in 2012. Based on the results of the test pitting activities conducted, multiple observations of waste were encountered in test pits.  Waste material was described as consisting of primarily glass, brick, and metal (wires, pipes and fencing) as well as a metallic radiological item. Overall waste was observed in the subsurface with starting depths ranging from 1 to 6.5 feet bgs and extending to depths of 8.5 feet bgs however the testpits were terminated before the full thickness of the waste could be confirmed.  In two test pits (Test pits 5 and 9) waste was observed at a much shallower depth ranging from 0-2.5 feet bgs with the bottom of waste confirmed.  The location of these two test pits on the periphery of the site boundary in conjunction with the location of the deeper waste placement within the interior of the site boundary indicates that the lateral extent maybe bounded to the north and south.

The Base-wide SI and ESI soil and groundwater analytical data for Site 4 were evaluated for site characterization based on the human health and ecological risk screening results noted in Sections 5.4 and 5.5. PAHs and arsenic were determined to be human health COPCs in surface soil. **Figure 5-2** shows the analytical results of PAHs and arsenic in surface soil at Site 4. PAH concentrations increase by several orders of magnitude from the western portion of the site to the eastern portion of the site. The maximum concentrations of PAHs were detected at CBD-S04-DP03 and the maximum concentration of arsenic was detected at CBD-S04-DP15. No COPCs were identified in the subsurface soil.

Groundwater at Site 4 has been characterized through the installation of monitoring wells and the collection representative groundwater samples.  Groundwater elevations were observed between approximately 15 and 20 ft bgs with the overall groundwater flow to the south.  No human health COPCs were identified through the risk screening.

## 5.7 Findings and Recommendations

### 5.7.1 Findings

Based on the results of the test pitting activities conducted, observations of waste were encountered in several testpits. Waste material was described as consisting of primarily glass, brick, and metal (wires, pipes and fencing) as well as a metallic radiological item. Overall waste was observed in the subsurface with starting depths ranging from 1 to 6.5 feet bgs and extending to depths of 8.5 feet bgs however the testpits were terminated before the full thickness of the waste could be confirmed.

SVOCs, a pesticide, and metals were detected during the ESI in surface soil at Site 4. SVOCs, pesticides, a PCB, and metals were detected during the ESI in subsurface soil at Site 4. In addition, SVOCs and metals were detected during the ESI in groundwater at Site 4. Based on the HHRS and ERA, the constituents presented in **Table 5-4** may present potentially unacceptable risk and were retained as COPCs for Site 4.

Table 5-4. Human Health and Ecological Risk COPCs for Site 4

| Media | COPCs | |
|---|---|---|
| | **Human Health** | **Ecological** |
| Surface Soil | Benzo(a)anthracene[1], benzo(a)pyrene[1], benzo(b)fluoranthene[1], dibenz(a,h)anthracene[1], arsenic[1] | None |
| Subsurface Soil | None | N/A |
| Groundwater | None | N/A |

Note:

[1] Only considered a COPC under MDE target risk levels.

## 5.7.2 Recommendations

Site 4 is recommended for further evaluation based upon potential unacceptable human health risks associated with benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and arsenic in surface soil. Although there are unacceptable risks based on Navy target levels, no further evaluation is recommended for subsurface soil because there are no unacceptable risks when compared to USEPA or MDE target levels.

Table 5-1. Site 4 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S04-DP07 | CBD-S04-DP08 | CBD-S04-DP09 | CBD-S04-DP10 | CBD-S04-DP11 | CBD-S04-DP12 | CBD-S04-DP13 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S04-SS07-000H | CBD-S04-SS08-000H | CBD-S04-SS09-000H | CBD-S04-SS10-000H | CBD-S04-SS11-000H | CBD-S04-SS12-000H | CBD-S04-SS13-000H | CBD-S04-SS13P-000H |
| **Sample Date** | | | 04/05/18 | 04/05/18 | 04/04/18 | 04/04/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| Acenaphthene | -- | 360,000 | NA | NA | NA | NA | NA | 1.1 U | 1.2 U | 1.2 U |
| Acenaphthylene | -- | -- | NA | NA | NA | NA | NA | 1.6 J | 1.2 U | 1.2 U |
| Anthracene | -- | 1,800,000 | NA | NA | NA | NA | NA | 1.6 J | 5.1 U | 5 U |
| Benzo(a)anthracene | -- | 1,100 | NA | NA | NA | NA | NA | 8.2 J | 5.1 U | 5 U |
| Benzo(a)pyrene | -- | 110 | NA | NA | NA | NA | NA | 8 J | 5.1 U | 5 U |
| Benzo(b)fluoranthene | -- | 1,100 | NA | NA | NA | NA | NA | 15 | 7.8 U | 7.7 U |
| Benzo(g,h,i)perylene | -- | -- | NA | NA | NA | NA | NA | 5.3 J | 7.8 U | 7.7 U |
| Benzo(k)fluoranthene | -- | 11,000 | NA | NA | NA | NA | NA | 5.3 J | 5.1 U | 5 U |
| Chrysene | -- | 110,000 | NA | NA | NA | NA | NA | 11 | 5.1 U | 5 U |
| Dibenz(a,h)anthracene | -- | 110 | NA | NA | NA | NA | NA | 7.2 U | 7.8 U | 7.7 U |
| Fluoranthene | -- | 240,000 | NA | NA | NA | NA | NA | 17 | 5.1 U | 5 U |
| Fluorene | -- | 240,000 | NA | NA | NA | NA | NA | 2.9 U | 3.1 U | 3.1 U |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | NA | NA | NA | NA | NA | 6.7 J | 7.8 U | 7.7 U |
| Phenanthrene | -- | -- | NA | NA | NA | NA | NA | 6.2 J | 7.8 U | 7.7 U |
| Pyrene | -- | 180,000 | NA | NA | NA | NA | NA | 14 | 7.8 U | 7.7 U |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDE | 100 | 2,000 | 0.229 U | 0.134 U | 0.131 U | 0.519 | 0.223 U | 0.136 U | 0.236 U | 0.156 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | -- | 7,700 | NA | NA | NA | NA | NA | **8,500 J-** | 7,700 J | **21,000 J** |
| Antimony | 5 | 3.1 | NA | NA | NA | NA | NA | 0.14 U | 0.17 U | 0.17 U |
| Arsenic | 6.8 | 0.68 | NA | NA | NA | NA | NA | **5.8** | **1.9 J** | ***7.7 J*** |
| Barium | 110 | 1,500 | NA | NA | NA | NA | NA | 6.3 | 8.5 J | 13 J |
| Beryllium | 2.5 | 16 | NA | NA | NA | NA | NA | 0.23 J | 0.31 J | 0.8 |
| Cadmium | 32 | 7.1 | NA | NA | NA | NA | NA | 0.14 U | 0.17 U | 0.17 U |
| Calcium | -- | -- | NA | NA | NA | NA | NA | 229 | 405 J | 893 J |
| Chromium (hexavalent) | 0.4 | 0.3 | NA | NA | NA | NA | NA | 0.11 J | NA | NA |
| Chromium | 10 | 0.3 | NA | NA | NA | NA | NA | ***15*** | ***11 J*** | ***32 J*** |
| Cobalt | 13 | 2.3 | NA | NA | NA | NA | NA | 0.55 | 0.68 J | 1.2 J |
| Copper | 70 | 310 | NA | NA | NA | NA | NA | 3.1 | 2.5 J | 6.1 J |
| Iron | -- | 5,500 | NA | NA | NA | NA | NA | **22,000** | **12,000 J** | **37,000 J** |
| Lead | 120 | 400 | NA | NA | NA | NA | NA | 4.9 | 5 J | 9.9 J |
| Magnesium | -- | -- | NA | NA | NA | NA | NA | 796 | 621 J | 1,670 J |
| Manganese | 220 | 180 | NA | NA | NA | NA | NA | 6.4 | 10 | 8.3 |
| Mercury | 0.05 | 2.3 | NA | NA | NA | NA | NA | 0.14 U | 0.17 U | 0.17 U |
| Nickel | 38 | 150 | NA | NA | NA | NA | NA | 0.99 | 1.3 J | 2.1 J |
| Potassium | -- | -- | NA | NA | NA | NA | NA | 693 | 560 J | 1,180 J |
| Selenium | 0.52 | 39 | NA | NA | NA | NA | NA | *1.3 J-* | 0.48 J- | *1.1 J-* |
| Silver | 560 | 39 | NA | NA | NA | NA | NA | 0.14 U | 0.17 U | 0.17 U |
| Sodium | -- | -- | NA | NA | NA | NA | NA | 8.5 U | 7.2 U | 18.9 J+ |
| Thallium | 0.05 | 0.078 | NA | NA | NA | NA | NA | *0.065 J* | 0.17 U | ***0.099 J*** |
| Vanadium | 60 | 39 | NA | NA | NA | NA | NA | 19 | 14 J | 32 J |
| Zinc | 120 | 2,300 | NA | NA | NA | NA | NA | 25 | 7.8 J | 20 J |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

## Table 5-1. Site 4 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S04-DP14 | CBD-S04-DP15 | CBD-S04-DP16 |
|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S04-SS14-000H | CBD-S04-SS15-000H | CBD-S04-SS16-000H |
| **Sample Date** | | | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | |
| | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | |
| Acenaphthene | -- | 360,000 | 0.85 J | 3.9 J | 0.58 J |
| Acenaphthylene | -- | -- | 1.1 J | 4.5 J | 0.56 J |
| Anthracene | -- | 1,800,000 | 2.9 J | 13 | 2.4 J |
| Benzo(a)anthracene | -- | 1,100 | 19 | 150 J | 20 |
| Benzo(a)pyrene | -- | 110 | 21 | **180 J** | 23 |
| Benzo(b)fluoranthene | -- | 1,100 | 42 | 270 J | 38 |
| Benzo(g,h,i)perylene | -- | -- | 17 | 130 J | 21 |
| Benzo(k)fluoranthene | -- | 11,000 | 14 | 94 J | 13 |
| Chrysene | -- | 110,000 | 28 | 170 J | 25 |
| Dibenz(a,h)anthracene | -- | 110 | 3.8 J | 34 J | 5.1 J |
| Fluoranthene | -- | 240,000 | 43 | 210 J | 25 |
| Fluorene | -- | 240,000 | 2.8 U | 3.2 J | 3.1 U |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | 20 | 160 J | 24 |
| Phenanthrene | -- | -- | 14 | 49 J | 12 |
| Pyrene | -- | 180,000 | 36 | 190 J | 20 |
| | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | |
| 4,4'-DDE | 100 | 2,000 | 0.188 J | 0.138 U | 0.13 U |
| | | | | | |
| **Total Metals (MG/KG)** | | | | | |
| Aluminum | -- | 7,700 | **8,100 J-** | 6,400 | 7,100 J- |
| Antimony | 5 | 3.1 | 0.14 U | 0.084 J | 0.29 |
| Arsenic | 6.8 | 0.68 | **2.7 J** | ***8.3*** | **3.5 J** |
| Barium | 110 | 1,500 | 27 | 14 | 85 |
| Beryllium | 2.5 | 16 | 0.47 J | 0.29 J | 0.64 |
| Cadmium | 32 | 7.1 | 0.14 U | 0.14 U | 0.32 |
| Calcium | -- | -- | 389 | 314 | 477 |
| Chromium (hexavalent) | 0.4 | 0.3 | 0.11 J | NA | 0.05 J |
| Chromium | 10 | 0.3 | ***11*** | ***14*** | ***15*** |
| Cobalt | 13 | 2.3 | 2.2 | 0.93 | **2.7** |
| Copper | 70 | 310 | 2.9 | 2.8 | 46 |
| Iron | -- | 5,500 | **11,000** | **8,600** | **10,000** |
| Lead | 120 | 400 | 6 | 3.2 | *160* |
| Magnesium | -- | -- | 677 | 987 | 670 |
| Manganese | 220 | 180 | 61 | 14 | 84 |
| Mercury | 0.05 | 2.3 | 0.14 U | 0.14 U | *0.18 J* |
| Nickel | 38 | 150 | 3.9 | 2.1 | 11 |
| Potassium | -- | -- | 432 | 444 | 474 |
| Selenium | 0.52 | 39 | *1.2 J* | *1.2* | *1.1 J+* |
| Silver | 560 | 39 | 0.14 U | 0.081 J | 1.6 |
| Sodium | -- | -- | 10.4 U | 6.7 U | 9.8 U |
| Thallium | 0.05 | 0.078 | ***0.12 J*** | ***0.18 J*** | ***0.15 J*** |
| Vanadium | 60 | 39 | 15 | 20 | 16 |
| Zinc | 120 | 2,300 | 17 J | 15 | *170 J* |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 5-2. Site 4 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S04-DP07 | CBD-S04-DP08 | CBD-S04-DP09 | CBD-S04-DP10 | CBD-S04-DP11 | CBD-S04-DP12 | | CBD-S04-DP13 | CBD-S04-DP14 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-S04-SB07-0810 | CBD-S04-SB08-0810 | CBD-S04-SB09-0810 | CBD-S04-SB10-0810 | CBD-S04-SB11-0810 | CBD-S04-SB12-0810 | CBD-S04-SB12P-0810 | CBD-S04-SB13-0810 | CBD-S04-SB14-0810 |
| **Sample Date** | | 04/05/18 | 04/05/18 | 04/04/18 | 04/04/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| Acenaphthene | 360,000 | NA | NA | NA | NA | NA | 1.1 U | 1.1 U | 1.1 U | 1.2 U |
| Acenaphthylene | -- | NA | NA | NA | NA | NA | 1.1 U | 1.1 U | 1.1 U | 1.2 U |
| Anthracene | 1,800,000 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Benzo(a)anthracene | 1,100 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Benzo(a)pyrene | 110 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Benzo(b)fluoranthene | 1,100 | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| Benzo(g,h,i)perylene | -- | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| Benzo(k)fluoranthene | 11,000 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Chrysene | 110,000 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Dibenz(a,h)anthracene | 110 | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| Fluoranthene | 240,000 | NA | NA | NA | NA | NA | 4.4 U | 4.3 U | 4.5 U | 5 U |
| Fluorene | 240,000 | NA | NA | NA | NA | NA | 2.7 U | 2.6 U | 2.7 U | 3.1 U |
| Indeno(1,2,3-cd)pyrene | 1,100 | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| Naphthalene | 3,800 | NA | NA | NA | NA | NA | 2 U | 4.2 U | 2.1 U | 2.3 U |
| Phenanthrene | -- | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| Pyrene | 180,000 | NA | NA | NA | NA | NA | 6.7 U | 6.6 U | 6.9 U | 7.6 U |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 190 | 0.124 U | 0.123 U | 0.14 UJ | 0.13 U | 0.127 U | 0.346 J | 0.245 U | 0.125 U | 0.128 U |
| 4,4'-DDE | 2,000 | 0.124 U | 0.123 U | 0.14 UJ | 0.13 U | 0.127 U | 0.512 | 0.245 U | 0.125 U | 0.128 U |
| 4,4'-DDT | 1,900 | 0.248 U | 0.245 U | 0.28 UJ | 0.261 U | 0.255 U | 7.53 J | 0.491 UJ | 0.249 U | 0.257 U |
| alpha-Chlordane | 1,700 | 0.124 U | 0.123 U | 0.14 UJ | 0.13 U | 0.127 U | 0.283 J | 0.245 U | 0.125 U | 0.128 U |
| Aroclor-1260 | 240 | NA | NA | NA | NA | NA | 12 U | 12 U | 6.2 U | 6.4 U |
| Dieldrin | 34 | 0.124 U | 0.123 U | 0.14 UJ | 0.13 U | 0.127 U | 6.29 J | 0.245 UJ | 0.125 U | 0.128 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | 7,700 | NA | NA | NA | NA | NA | 3,200 | 3,100 | 2,200 J- | 2,900 |
| Antimony | 3.1 | NA | NA | NA | NA | NA | 0.23 J | 0.18 J | 0.054 J | 0.078 J |
| Arsenic | 0.68 | NA | NA | NA | NA | NA | **3.2** | **2.5** | **2.2** | **2 J** |
| Barium | 1,500 | NA | NA | NA | NA | NA | 12 J | 5.7 J | 6.9 | 5.3 |
| Beryllium | 16 | NA | NA | NA | NA | NA | 0.74 | 0.33 J | 0.56 | 0.86 |
| Cadmium | 7.1 | NA | NA | NA | NA | NA | 0.48 | 0.18 U | 0.32 | 0.14 U |
| Calcium | -- | NA | NA | NA | NA | NA | 31.3 | 19 | 22.7 | 40.8 |
| Chromium (hexavalent) | 0.3 | NA | NA | NA | NA | NA | 0.18 J | 0.24 J | NA | 0.1 J |
| Chromium | 0.3 | NA | NA | NA | NA | NA | **8.6** | **6.7** | **7.4** | **10** |
| Cobalt | 2.3 | NA | NA | NA | NA | NA | **13 J** | **6.1 J** | **10** | 2.1 |
| Copper | 310 | NA | NA | NA | NA | NA | 3.2 J | 1.9 J | 2.4 | 1.7 |
| Iron | 5,500 | NA | NA | NA | NA | NA | **16,000 J** | **8,200 J** | **8,200** | 5,100 |
| Lead | 400 | NA | NA | NA | NA | NA | 1.5 J | 0.9 J | 1.3 | 2.3 |
| Magnesium | -- | NA | NA | NA | NA | NA | 498 | 476 | 438 | 542 |
| Manganese | 180 | NA | NA | NA | NA | NA | **350 J** | 64 J | 140 | 11 |
| Mercury | 2.3 | NA | NA | NA | NA | NA | 0.17 U | 0.18 U | 0.13 U | 0.14 U |
| Nickel | 150 | NA | NA | NA | NA | NA | 30 J | 11 J | 18 | 3.6 |
| Potassium | -- | NA | NA | NA | NA | NA | 390 | 330 | 291 | 345 |
| Selenium | 39 | NA | NA | NA | NA | NA | 0.59 J | 0.47 J | 0.83 J- | 0.79 J |
| Silver | 39 | NA | NA | NA | NA | NA | 0.078 J | 0.18 U | 0.13 U | 0.088 J |
| Sodium | -- | NA | NA | NA | NA | NA | 4.8 U | 4.2 U | 2.6 U | 5.5 U |
| Thallium | 0.078 | NA | NA | NA | NA | NA | **0.17 J** | 0.18 U | 0.074 J | 0.14 U |
| Vanadium | 39 | NA | NA | NA | NA | NA | 9.9 | 9.7 | 12 | 6.7 |
| Zinc | 2,300 | NA | NA | NA | NA | NA | 23 J | 12 J | 21 | 18 J |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

# Table 5-2. Site 4 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S04-DP15 | CBD-S04-DP16 | EXCEED? |
|---|---|---|---|---|
| **Sample ID** | | CBD-S04-SB15-0810 | CBD-S04-SB16-0810 | YES |
| **Sample Date** | | 04/05/18 | 04/05/18 | YES |
| **Chemical Name** | | | | |
| | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | YES |
| Acenaphthene | 360,000 | 1.2 U | 56 | YES |
| Acenaphthylene | -- | 1.2 U | 5 J | YES |
| Anthracene | 1,800,000 | 4.8 U | 170 | YES |
| Benzo(a)anthracene | 1,100 | 4.8 U | 490 | YES |
| Benzo(a)pyrene | 110 | 4.8 U | **470** | YES |
| Benzo(b)fluoranthene | 1,100 | 7.4 U | 620 | YES |
| Benzo(g,h,i)perylene | -- | 7.4 U | 340 | YES |
| Benzo(k)fluoranthene | 11,000 | 4.8 U | 230 | YES |
| Chrysene | 110,000 | 4.8 U | 470 | YES |
| Dibenz(a,h)anthracene | 110 | 7.4 U | 89 | YES |
| Fluoranthene | 240,000 | 4.8 U | 850 | YES |
| Fluorene | 240,000 | 2.9 U | 48 | YES |
| Indeno(1,2,3-cd)pyrene | 1,100 | 7.4 U | 420 | YES |
| Naphthalene | 3,800 | 2.2 U | 19 | YES |
| Phenanthrene | -- | 7.4 U | 630 | YES |
| Pyrene | 180,000 | 7.4 U | 670 | YES |
| | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | YES |
| 4,4'-DDD | 190 | 0.131 U | 0.13 U | YES |
| 4,4'-DDE | 2,000 | 0.131 U | 8.31 | YES |
| 4,4'-DDT | 1,900 | 0.262 U | 0.26 U | YES |
| alpha-Chlordane | 1,700 | 0.131 U | 0.13 U | YES |
| Aroclor-1260 | 240 | 6.6 U | 160 | YES |
| Dieldrin | 34 | 0.131 U | 0.13 U | YES |
| | | | | |
| **Total Metals (MG/KG)** | | | | YES |
| Aluminum | 7,700 | 2,700 J- | **8,300 J-** | YES |
| Antimony | 3.1 | 0.14 U | 0.79 | YES |
| Arsenic | 0.68 | **5.7** | **4.1** | YES |
| Barium | 1,500 | 5.7 | 150 | YES |
| Beryllium | 16 | 0.35 J | 0.83 | YES |
| Cadmium | 7.1 | 0.14 U | **15** | YES |
| Calcium | -- | 305 | 3,700 | YES |
| Chromium (hexavalent) | 0.3 | NA | **0.31 J** | YES |
| Chromium | 0.3 | **11** | **33** | YES |
| Cobalt | 2.3 | 0.92 | **18** | YES |
| Copper | 310 | 2.2 | **480** | YES |
| Iron | 5,500 | **6,600** | **46,000** | YES |
| Lead | 400 | 1.5 | **690** | YES |
| Magnesium | -- | 661 | 1,420 | YES |
| Manganese | 180 | 2.3 | **570** | YES |
| Mercury | 2.3 | 0.14 U | 1.2 | YES |
| Nickel | 150 | 1.8 | 48 | YES |
| Potassium | -- | 319 | 303 | YES |
| Selenium | 39 | 0.37 J- | 0.79 J- | YES |
| Silver | 39 | 0.14 U | 0.86 | YES |
| Sodium | -- | 4 U | 131 | YES |
| Thallium | 0.078 | **0.083 J** | 0.07 J | YES |
| Vanadium | 39 | 7.9 | 12 | YES |
| Zinc | 2,300 | 19 | 2,000 | YES |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 5-3. Site 4 Analytical Results – Detected Constituents in Groundwater

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Tapwater (HQ=0.1) 0519** | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|
| **Sample ID** | | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | |
| | | | | | |
| **Volatile Organic Compounds (UG/L)** | | | | | |
| *No Detections* | | | | | |
| | | | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | | | |
| 2-Methylnaphthalene | 3.6 | 0.014 U | 0.0054 J | 0.012 U | 0.013 U |
| Benzo(a)anthracene | 0.03 | 0.014 UJ | 0.012 U | 0.0032 J | 0.013 U |
| Benzo(k)fluoranthene | 2.5 | 0.021 J | 0.012 U | 0.012 U | 0.013 U |
| Chrysene | 25 | 0.004 J | 0.0061 J | 0.004 J | 0.013 U |
| Fluoranthene | 80 | 0.0062 J | 0.0054 J | 0.0045 J | 0.013 U |
| Naphthalene | 0.17 | 0.01 J | 0.0075 J | 0.0058 J | 0.0077 J |
| Phenanthrene | -- | 0.023 U | 0.014 J | 0.012 J | 0.021 U |
| | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | | | |
| *No Detections* | | | | | |
| | | | | | |
| **Total Metals (UG/L)** | | | | | |
| Aluminum | 2,000 | **13,000** | 30 | 31 | 44 |
| Arsenic | 0.052 | **1.5** | 0.13 U | 0.13 U | **0.21 J** |
| Barium | 380 | 41 | 34 | 34 | 40 |
| Beryllium | 2.5 | 0.79 J- | 0.43 J | 0.42 J | 0.13 U |
| Cadmium | 0.92 | **2.9** | 0.62 | 0.62 | 0.51 |
| Calcium | -- | 4,250 | 8,780 | 8,770 | 22,300 |
| Chromium | 0.035 | **5.7** | **0.85** | **0.87** | **0.24 J** |
| Cobalt | 0.6 | **9.8** | **2.2** | **2.2** | **5** |
| Copper | 80 | 6.9 | 0.42 U | 0.42 U | 0.72 |
| Iron | 1,400 | **2,800** | 9 U | 7.8 U | 260 |
| Lead | 15 | 1.8 J- | 0.13 U | 0.13 U | 0.13 U |
| Magnesium | -- | 3,560 | 2,570 | 2,560 | 10,400 |
| Manganese | 43 | **74** | 13 | 13 | **120** |
| Nickel | 39 | 13 | 7.9 | 8 | 8.8 |
| Potassium | -- | 2,840 | 2,240 | 2,260 | 2,840 |
| Sodium | -- | 5,490 | 7,910 | 7,890 | 13,000 |
| Thallium | 0.02 | **0.54 J** | 0.5 U | 0.5 U | **0.2 J** |
| Vanadium | 8.6 | 4.6 | 0.059 J | 0.061 J | 0.17 J |
| Zinc | 600 | 120 | 25 | 25 | 23 |
| | | | | | |
| **Dissolved Metals (UG/L)** | | | | | |
| Aluminum, Dissolved | 2,000 | 100 | 21 | 19 | 35 |
| Arsenic, Dissolved | 0.052 | **1.1** | 0.13 U | 0.13 U | **0.2 J** |
| Barium, Dissolved | 380 | 12 | 33 | 32 | 37 |
| Beryllium, Dissolved | 2.5 | 0.35 J | 0.56 | 0.5 | 0.14 J |
| Cadmium, Dissolved | 0.92 | **1.1** | 0.63 | 0.61 | 0.78 |
| Calcium, Dissolved | -- | 6,750 | 8,420 | 8,520 | 24,500 |
| Chromium, Dissolved | 0.035 | 0.13 U | **0.83** | **0.84** | **0.12 J** |
| Cobalt, Dissolved | 0.6 | **5.9** | **2.2** | **2.2** | **5.9** |
| Copper, Dissolved | 80 | 0.13 U | 0.89 | 1.3 | 0.13 U |

## Table 5-3. Site 4 Analytical Results – Detected Constituents in Groundwater

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Tapwater (HQ=0.1) 0519** | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|
| **Sample ID** | | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | |
| Iron, Dissolved | 1,400 | 960 | 5 U | 4.8 J | 190 |
| Magnesium, Dissolved | -- | 3,360 | 2,450 | 2,420 | 8,120 |
| Manganese, Dissolved | 43 | **61** | 13 | 14 | **100** |
| Nickel, Dissolved | 39 | 8.6 | 8.1 | 9.5 | 9.9 |
| Potassium, Dissolved | -- | 1,870 | 2,110 | 2,120 | 2,790 |
| Selenium, Dissolved | 10 | 0.5 U | 0.29 J | 0.4 J | 0.72 J |
| Sodium, Dissolved | -- | 6,690 | 7,640 | 7,660 | 15,200 |
| Thallium, Dissolved | 0.02 | **0.22 J** | 0.5 U | 0.5 U | **0.37 J** |
| Vanadium, Dissolved | 8.6 | 0.12 J | 0.053 J | 0.13 U | 0.081 J |
| Zinc, Dissolved | 600 | 42 | 26 | 26 | 31 |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Tapwater (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UG/L - Micrograms per liter

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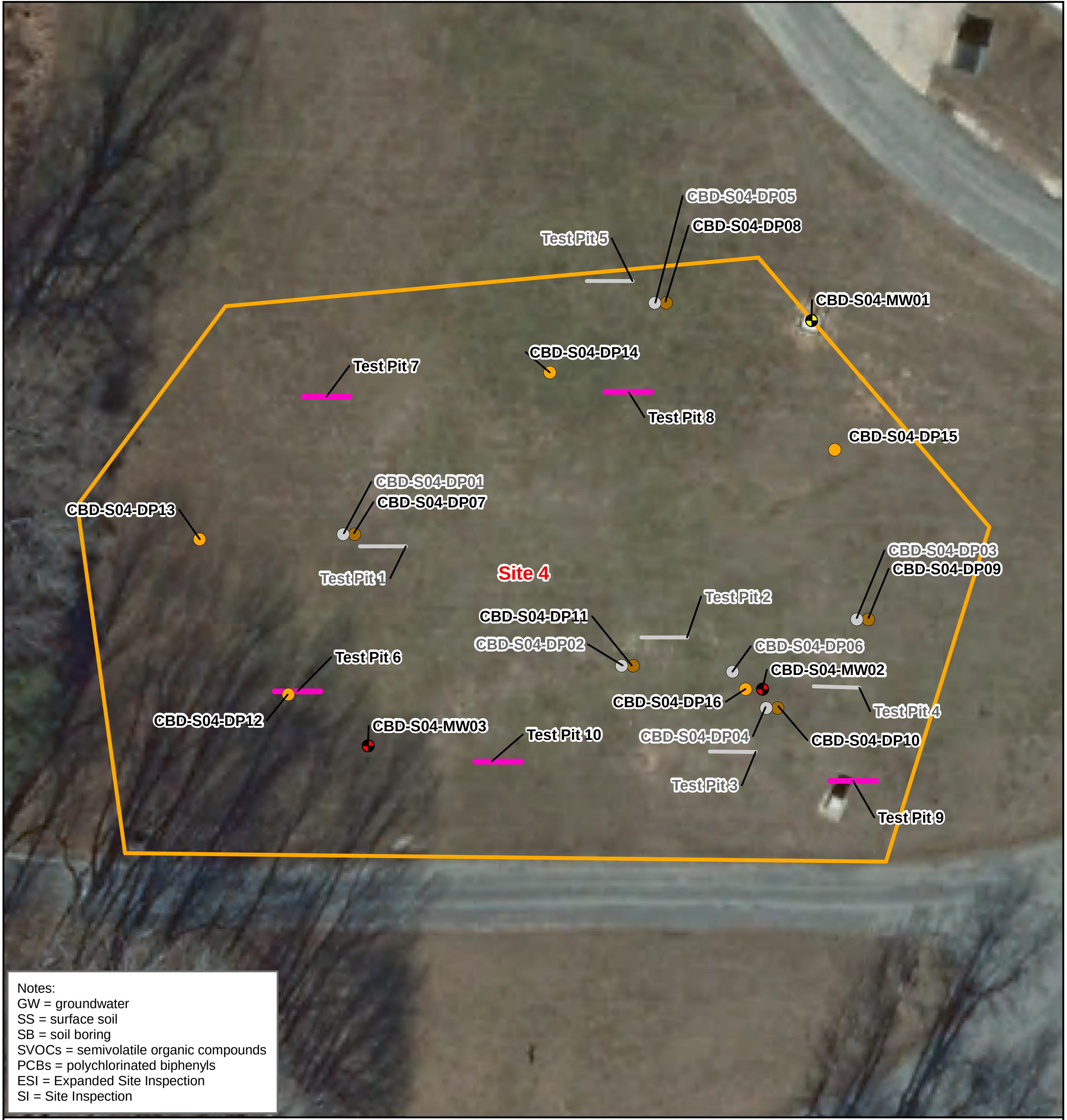

Notes:
GW = groundwater
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

- ⊕ Existing Monitoring Well Location
- ⊕ ESI Monitoring Well Location
- ● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals (and Hexavalent Chromium at 3 locations)
- ● ESI SS/SB Location for Pesticides Only
- ○ SI SS/SB/GW Location (for DP01 - DP03)<br>SI SS/SB Location (for DP04 - DP05)<br>SI SS Location (for DP06)
- ▬ ESI Test Pit Location
- ▬ SI Test Pit Location
- ▭ Site Boundary

Imagery: Calvert County, MD - 2017 1 inch = 30 feet

**Figure 5-1**
**Site 4 Landfill No. 2**
**Sample Locations**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

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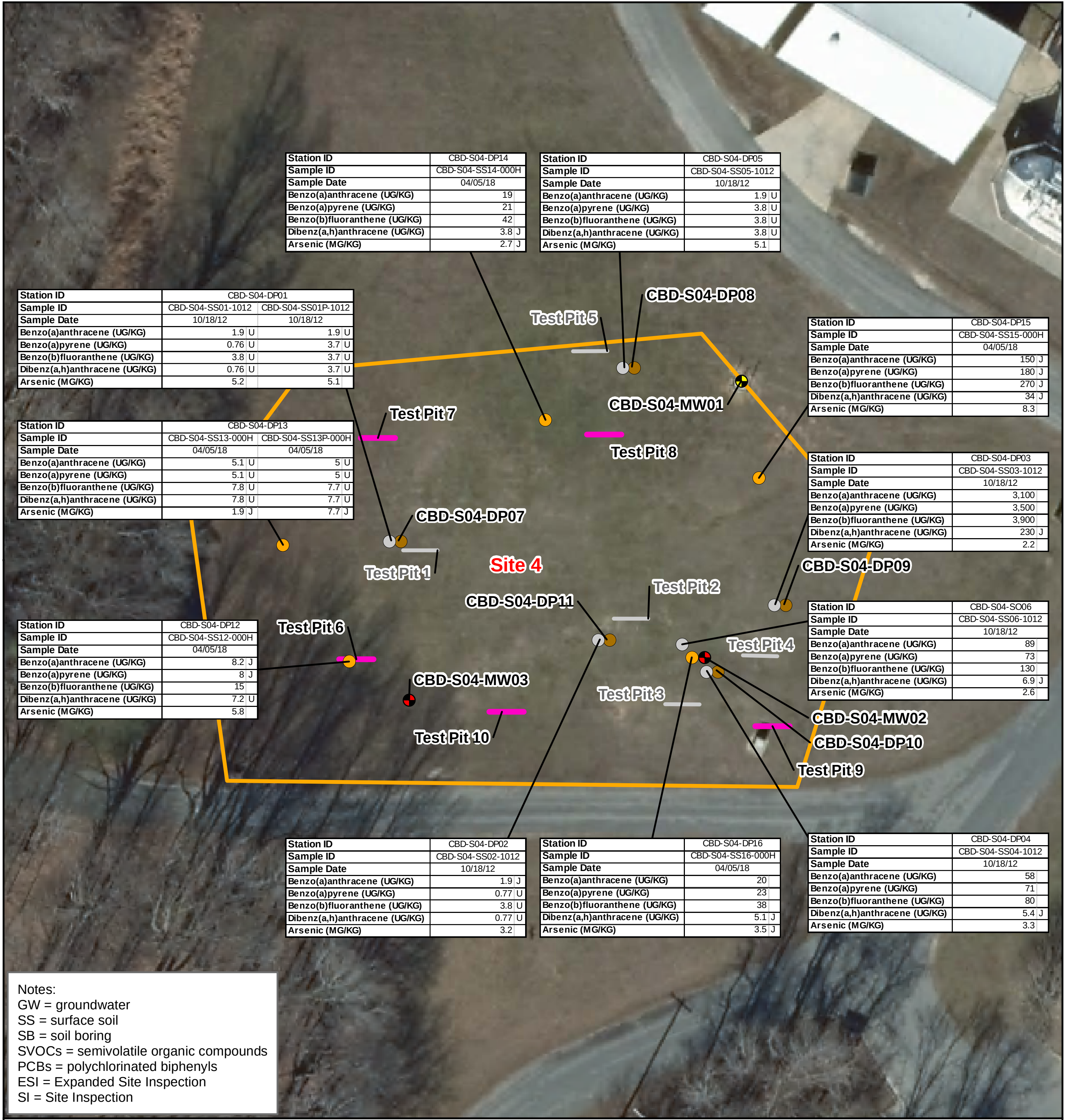


| Station ID | CBD-S04-DP14 | |
|---|---|---|
| Sample ID | CBD-S04-SS14-000H | |
| Sample Date | 04/05/18 | |
| Benzo(a)anthracene (UG/KG) | 19 | |
| Benzo(a)pyrene (UG/KG) | 21 | |
| Benzo(b)fluoranthene (UG/KG) | 42 | |
| Dibenz(a,h)anthracene (UG/KG) | 3.8 | J |
| Arsenic (MG/KG) | 2.7 | J |

| Station ID | CBD-S04-DP05 | |
|---|---|---|
| Sample ID | CBD-S04-SS05-1012 | |
| Sample Date | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 1.9 | U |
| Benzo(a)pyrene (UG/KG) | 3.8 | U |
| Benzo(b)fluoranthene (UG/KG) | 3.8 | U |
| Dibenz(a,h)anthracene (UG/KG) | 3.8 | U |
| Arsenic (MG/KG) | 5.1 | |

| Station ID | CBD-S04-DP01 | | | |
|---|---|---|---|---|
| Sample ID | CBD-S04-SS01-1012 | | CBD-S04-SS01P-1012 | |
| Sample Date | 10/18/12 | | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 1.9 | U | 1.9 | U |
| Benzo(a)pyrene (UG/KG) | 0.76 | U | 3.7 | U |
| Benzo(b)fluoranthene (UG/KG) | 3.8 | U | 3.7 | U |
| Dibenz(a,h)anthracene (UG/KG) | 0.76 | U | 3.7 | U |
| Arsenic (MG/KG) | 5.2 | | 5.1 | |

| Station ID | CBD-S04-DP15 | |
|---|---|---|
| Sample ID | CBD-S04-SS15-000H | |
| Sample Date | 04/05/18 | |
| Benzo(a)anthracene (UG/KG) | 150 | J |
| Benzo(a)pyrene (UG/KG) | 180 | J |
| Benzo(b)fluoranthene (UG/KG) | 270 | J |
| Dibenz(a,h)anthracene (UG/KG) | 34 | J |
| Arsenic (MG/KG) | 8.3 | |

| Station ID | CBD-S04-DP13 | | | |
|---|---|---|---|---|
| Sample ID | CBD-S04-SS13-000H | | CBD-S04-SS13P-000H | |
| Sample Date | 04/05/18 | | 04/05/18 | |
| Benzo(a)anthracene (UG/KG) | 5.1 | U | 5 | U |
| Benzo(a)pyrene (UG/KG) | 5.1 | U | 5 | U |
| Benzo(b)fluoranthene (UG/KG) | 7.8 | U | 7.7 | U |
| Dibenz(a,h)anthracene (UG/KG) | 7.8 | U | 7.7 | U |
| Arsenic (MG/KG) | 1.9 | J | 7.7 | J |

| Station ID | CBD-S04-DP03 | |
|---|---|---|
| Sample ID | CBD-S04-SS03-1012 | |
| Sample Date | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 3,100 | |
| Benzo(a)pyrene (UG/KG) | 3,500 | |
| Benzo(b)fluoranthene (UG/KG) | 3,900 | |
| Dibenz(a,h)anthracene (UG/KG) | 230 | J |
| Arsenic (MG/KG) | 2.2 | |

| Station ID | CBD-S04-SO06 | |
|---|---|---|
| Sample ID | CBD-S04-SS06-1012 | |
| Sample Date | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 89 | |
| Benzo(a)pyrene (UG/KG) | 73 | |
| Benzo(b)fluoranthene (UG/KG) | 130 | |
| Dibenz(a,h)anthracene (UG/KG) | 6.9 | J |
| Arsenic (MG/KG) | 2.6 | |

| Station ID | CBD-S04-DP12 | |
|---|---|---|
| Sample ID | CBD-S04-SS12-000H | |
| Sample Date | 04/05/18 | |
| Benzo(a)anthracene (UG/KG) | 8.2 | J |
| Benzo(a)pyrene (UG/KG) | 8 | J |
| Benzo(b)fluoranthene (UG/KG) | 15 | |
| Dibenz(a,h)anthracene (UG/KG) | 7.2 | U |
| Arsenic (MG/KG) | 5.8 | |

| Station ID | CBD-S04-DP02 | |
|---|---|---|
| Sample ID | CBD-S04-SS02-1012 | |
| Sample Date | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 1.9 | J |
| Benzo(a)pyrene (UG/KG) | 0.77 | U |
| Benzo(b)fluoranthene (UG/KG) | 3.8 | U |
| Dibenz(a,h)anthracene (UG/KG) | 0.77 | U |
| Arsenic (MG/KG) | 3.2 | |

| Station ID | CBD-S04-DP16 | |
|---|---|---|
| Sample ID | CBD-S04-SS16-000H | |
| Sample Date | 04/05/18 | |
| Benzo(a)anthracene (UG/KG) | 20 | |
| Benzo(a)pyrene (UG/KG) | 23 | |
| Benzo(b)fluoranthene (UG/KG) | 38 | |
| Dibenz(a,h)anthracene (UG/KG) | 5.1 | J |
| Arsenic (MG/KG) | 3.5 | J |

| Station ID | CBD-S04-DP04 | |
|---|---|---|
| Sample ID | CBD-S04-SS04-1012 | |
| Sample Date | 10/18/12 | |
| Benzo(a)anthracene (UG/KG) | 58 | |
| Benzo(a)pyrene (UG/KG) | 71 | |
| Benzo(b)fluoranthene (UG/KG) | 80 | |
| Dibenz(a,h)anthracene (UG/KG) | 5.4 | J |
| Arsenic (MG/KG) | 3.3 | |

Notes:
GW = groundwater
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

| | |
|---|---|
| ⊕ | Existing Monitoring Well Location |
| ⊕ | ESI Monitoring Well Location |
| ● | ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals |
| ● | ESI SS/SB Location for Pesticides Only |
| ○ | SI SS/SB/GW Location (for DP01 - DP03)<br>SI SS/SB Location (for DP04 - DP05)<br>SI SS Location (for DP06) |
| ▬ | ESI Test Pit Location |
| ▬ | SI Test Pit Location |
| ▭ | Site Boundary |

N

0 15 30
Feet

Imagery: Calvert County, MD - 2017

1 inch = 40 feet

**Figure 5-2**
**Site 4 Landfill No. 2**
**Human Health Risk**
**COPCs in Surface Soil**
Base-Wide Expanded Site
Inspection Report
***NRL-CBD***
***Chesapeake Beach, Maryland***

SECTION 6

# Site 5 – Landfill No. 3

## 6.1 Site Description

Site 5, also known as Landfill No. 3 or “New Junk Row,” is located on the western portion of NRL-CBD (**Figure 6-1**). Landfill No. 3 was operational from 1958 through 1968. Similar to Sites 3 and 4, the IAS stated that the site consisted of four to six pits (25 feet by 25 feet by 20 feet deep) and occupied an area of 3,750 $ft^2$. However, an aerial photograph dated May 1964 shows ground disturbance in an area that is 56,114 $ft^2$ in size. In addition to the landfill pits, the IAS states that two burn pits were located onsite as well. After the land-filling operations were complete, the site was designated as “New Junk Row” and used for the open storage of assorted debris consisting of rusted laboratory equipment, heavy equipment, and missile packing crates. During a site visit conducted during the IAS, two empty drums with no labels were observed and areas where open burning took place were noted to have oil-stained soil patches and were devoid of grass cover (NEESA, 1984). Currently, the site is largely wooded with a grass clearing where the former access road used to be located and is relatively flat with an approximate maximum elevation of 155 feet amsl.

## 6.2 Investigation Summary

The Site 5 Base-wide ESI field activities were conducted in April and May 2018. The following sections describe the observations noted during test pitting activities and the soil and groundwater sampling details.

### 6.2.1 Test Pitting

Three new test pits were dug at Site 5 to further assess the presence or absence of waste material at the site (**Figure 6-1**). The complete test pit logs are provided in **Appendix A**. A summary of the results for each test pit is provided as follows:

- **Test Pit 7** – The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of clayey sand and silty sand. No waste materials or soil staining were found in this test pit.
- **Test Pit 8 –** The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of clayey sand to sandy clay at 4 feet bgs. No waste materials or soil staining were found in this test pit.
- **Test Pit 9** – The test pit was dug to a depth of 10 feet bgs. Soils encountered consisted of clayey sand to sand with some clay at 6 feet bgs. Scrap metal and wiring were encountered at 2 to 3 feet bgs. Additional wiring and degraded metal also were encountered at 9 to 10 ft bgs. Wastes encountered consisted primarily of a few individual items, and no clear layers of waste were determined. No signs of soil staining were found in this test pit.

### 6.2.2 Soil Sampling

Ten soil borings were advanced during the Base-wide ESI at Site 5 to further assess whether historical activities at the site contributed to the presence of contamination in soil (**Figure 6-1**). The soil borings were advanced to a depth of 10 feet bgs using a DPT rig. No signs of contamination (soil staining or odors) were observed in any of the soil borings. At each boring, surface soil samples were collected from 0 to 0.5 feet bgs and subsurface soil samples were collected from 8 to 10 feet bgs. All 10 soil borings were analyzed for pesticides in the surface and subsurface intervals; while five of ten borings were analyzed for SVOCs, PCBs, and metals in the surface and subsurface intervals. In addition, seven surface soil samples were additionally sampled across Site 5 and analyzed for SVOCs, pesticides, PCBs, and metals.

### 6.2.3 Groundwater Sampling

Three permanent monitoring wells (CBD-S05-MW01, CBD-S05-MW02, and CBD-S05-MW03) were newly installed during the Base-wide ESI at Site 5. Groundwater samples were analyzed for VOCs, SVOCs, PCBs, pesticides, total and dissolved metals, and total and dissolved mercury.

## 6.3 Analytical Results

A summary of the constituents detected in soil and groundwater during the Base-wide ESI at Site 5 are presented in **Tables 6-1, 6-2**, and **6-3** respectively, and discussed as follows. The complete analytical results for both the SI and ESI are presented in **Appendix E**.

### 6.3.1 Surface Soil Analytical Results

A total of 17 surface soil samples were collected at Site 5 during the 2018 Base-wide ESI field activities. The results of the surface soil sampling are summarized as follows.

- **SVOCs** – Eighteen SVOCs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, di-n-butylphthalate, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene) were detected in surface soil. The SVOC detections were found in all surface soil samples except at location CBD-S05-DP14.
- **Pesticides and PCBs** –Four pesticides, (4,4’-DDD, 4,4’-DDE, 4,4’-DDT, and alpha-chlordane) were detected in surface soil samples at nine locations (CBD-S05-DP07, CBD-S05-DP09, CBD-S05-DP10, CBD-S05-DP11, CBD-S05-DP12, CBD-S05-DP13, CBD-S05-DP14, CBD-S05-SS21, and CBD-S05-SS23). No PCBs were detected in surface soil.
- **Metals** – Twenty-three metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in surface soil. Detections of metals were found in all surface soil samples.

### 6.3.2 Subsurface Soil Analytical Results

A total of ten subsurface soil samples were collected at Site 5 during the 2018 Base-wide ESI field activities. The results of the subsurface soil sampling are summarized as follows.

- **SVOCs** – Eleven SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, and phenanthrene) were detected in subsurface soil. The SVOC detections were only present at one sample location (CBD-SO5-DP15).
- **Pesticides and PCBs** – Two pesticides (aldrin and endosulfan II) were detected in subsurface soil at CBD-S05-DP12 and CBD-S05-DP15, respectively. No PCBs were detected in subsurface soil.
- **Metals** – Twenty metals (aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in subsurface soil. Detections of metals were found in all subsurface soil samples.

### 6.3.3 Groundwater Analytical Results

Three groundwater samples were collected at Site 5 during the 2018 Base-wide ESI field activities. The results of the groundwater sampling are summarized as follows.

- **VOCs** – One VOC (carbon disulfide) was detected in CBD-S05-MW01 and CBD-S05-MW03.

- **SVOCs** – Three SVOCs (benzo[a]anthracene, chrysene, and fluoranthene) were detected in the groundwater samples. Fluoranthene was detected in all three groundwater samples.
- **Pesticides and PCBs** – No pesticides and PCBs were detected in the groundwater samples.
- **Metals** – Nineteen total metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, thallium, vanadium, and zinc) and 18 dissolved metals (aluminum, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc) were detected in the groundwater samples. In general, the magnitude of the dissolved metals concentrations did not decrease significantly when compared against their total metals counterparts.

## 6.4 Human Health Risk Screening

The HHRS for Site 5 was conducted in three steps using the risk-ratio technique (Navy, 2000) described in detail in Section 3.4. Results were reported for the Navy, USEPA, and MDE target risk levels. Table 1 in **Appendix F** lists the samples that were included in the Site 5 HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.3**.

### 6.4.1.1 Surface Soil

The risk-based screening and risk-ratio evaluation for surface soil at Site 5 are provided in **Appendix F.3**, **Tables 2.1 through 2.1c**.

Step 1: Twelve constituents were identified as COPCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, aluminum, arsenic, cobalt, iron, manganese, thallium, and vanadium (**Appendix F.3, Table 2.1**).

Step 2: Cumulative cancer risk of 1 × $10^{-4}$; this value is greater than the Navy risk-ratio screening benchmark of 5 × $10^{-5}$ and the MDE target risk level, and is equal to the upper end of the USEPA target risk range. Cumulative target organ HIs range from 0.2 to 1. One target organ HI (associated with hair) exceeds the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5; but does not exceed the MDE and USEPA cumulative target organ target HI of 1. Vanadium is identified as a COPC based on the Navy benchmark value. Constituents contributing to the cumulative cancer risk are identified as COPCs and include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and arsenic (**Appendix F.3, Table 2.1a**).

Step 3: Cumulative cancer risk of 7 × $10^{-5}$; this value is greater than the Navy risk-ratio screening benchmark of 5 × $10^{-5}$ and the MDE target risk level of 1 × $10^{-5}$ but is less than the USEPA 1 × $10^{-4}$ upper end of target risk range. Constituents contributing to the cumulative cancer risk are identified as COPCs and include: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene and arsenic. However, the maximum detected concentration of arsenic does not exceed the site-specific surface soil BTV (**Appendix F.3, Table 2.1c**). Cumulative target organ HIs are 0.1 – 0.2 which, are below the Navy, MDE, and USEPA target HI levels (**Appendix F.3, Table 2.1b**). The ProUCL output file for Site 5 surface soil is included in **Appendix F.3**.

No screening criteria were available for carbazole and dimethyl phthalate. Therefore, potential risks could not be evaluated for these constituents.

Of the constituents that were 100 percent nondetected, a few SVOCs exceeded their respective RSL, primarily in one sample. It is unlikely that if these SVOCs are present in surface soil at concentrations below the detection limits they would contribute significantly to site risk. Screening criteria were not available for several constituents.

Exposure to surface soil at Site 5 may result in unacceptable human health risks associated with PAHs and primarily associated with the concentrations detected in two surface soil samples (CBD-S05-SS03-1012 and CBD-S05-SS15-000H).

### 6.4.1.2 Subsurface Soil

The risk-based screening and risk-ratio evaluation for subsurface soil at Site 5 are provided in **Appendix F.3**, **Tables 2.2 through 2.2c**.

Step 1: Six constituents were identified as COPCs: aluminum, arsenic, cobalt, iron, manganese, and thallium.

Step 2: Cumulative cancer risk of $2 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$ and the $1 \times 10^{-4}$ upper end of the USEPA target risk range but exceeds the MDE target risk level of $1 \times 10^{-5}$. Based on the MDE target risk level arsenic is a COPC; the contribution from cobalt to the carcinogenic risk ($3 \times 10^{-7}$) is minimal, and therefore, cobalt was not identified as a COPC based on cumulative carcinogenic risk. The target organ HIs range from 0.4 to 5. Four cumulative target organ HIs (dermal, thyroid, respiratory, and gastrointestinal) exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5, associated with arsenic, cobalt, iron, and thallium. Two target organ HIs (thyroid and respiratory) exceed the MDE and USEPA cumulative target organ target HI of 1 associated with cobalt.

Step 3: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, the USEPA target risk level of $1 \times 10^{-4}$, and does not exceed the MDE target risk level of $1 \times 10^{-5}$. Cumulative target organ HIs (thyroid, respiratory, and gastrointestinal) exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 associated with cobalt and iron. The only constituent contributing to a cumulative target organ HI greater than 1 (thyroid and respiratory) and identified as a COPC based on the USEPA and MDE cumulative target organ target HI is cobalt. Since iron was not identified as a COPC based on the MDE benchmark, iron is not retained as a COPC. The ProUCL output file for Site 5 subsurface soil is included in **Appendix F.3**.

The maximum detected concentrations of cobalt  and iron exceed their respective site-specific subsurface soil BTV. This indicates that concentrations in soil in Site 5 subsurface soil are not consistent with concentrations in unimpacted site soils. (**Appendix F.3**, **Table 2.2c**).

No screening criteria were available for dimethyl phthalate. Therefore, potential risks could not be evaluated for this constituent.

Of the constituents that were 100 percent nondetected, a few VOCs and SVOCs exceeded their respective RSL. It is unlikely that if these VOCs or SVOCs are present in subsurface soil at concentrations less than the detection limits they would contribute significantly to site risk. Screening criteria were not available for several constituents.

Based on the results of the human health screening, exposure to subsurface soil at Site 5 may result in unacceptable human health risks associated with cobalt. The hazard associated with cobalt is associated with the concentration detected in one sample (CBD-S05-SB04-2022) collected from a depth of 20 to 22 feet bgs. It is unlikely human receptors would contact soil at this depth.

### 6.4.1.3 Groundwater

The risk-based screening and risk-ratio evaluation for groundwater at Site 5 are provided in **Appendix F.3**.

Step 1: Five constituents were identified as COPCs: arsenic, chromium, cobalt, manganese, and thallium (**Appendix F.3, Table 2.1**).

Step 2: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy and USEPA risk-ratio screening benchmark levels of $5 \times 10^{-5}$, $1 \times 10^{-4}$, respectively. This cumulative risk does not exceed the MDE risk ratio screening benchmark of $1 \times 10^{-5}$. Cumulative target organ HIs of 1 exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 associated with arsenic, thallium, chromium, cobalt and iron. This HI value is greater than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but less than the MDE and USEPA cumulative target organ target HI of 1. However, the maximum detected concentrations of arsenic, cobalt and thallium s were less than the BTV (**Appendix F.3, Table 2.3b**). No site-specific COPCs were retained as Site 5 groundwater COPCs.

Step 3 was not performed because fewer than 10 samples were available for groundwater.

Of the constituents that were 100 percent nondetected, the detection limits for a few VOCs, SVOC, and pesticides exceeded the RSL. It is unlikely that if these VOCs, SVOCs, or pesticides are present in groundwater at concentrations less than the detection limits they would contribute significantly to site risk. Screening criteria were not available for several constituents.

Exposure to groundwater at Site 5 would not be expected to result in any unacceptable human health risks.

## 6.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

Of the detected analytes, HMW PAHs were retained as a COPCs (**Appendix G**, **Table 5**) and had an EPC-based HQ of 124. Consequently, HMW PAHs were identified as potentially posing unacceptable risk to ecological receptors at Site 5. While mercury had an EPC-based HQ of 2.7, only two of the seven detections had concentrations that substantially exceeded background; therefore, mercury was not identified as posing an unacceptable risk to ecological receptor populations on a sitewide basis.

All other analytes either were not detected, had EPC-based HQs less than one, were consistent with background, were macronutrients, or had a low frequency of detection. Additionally, five detected analytes lacked screening values. As discussed in Section 3.4.6, these analytes were not identified as COPCs.

Consequently, HMW PAHs were identified as potentially posing unacceptable risk and further evaluation of risk or consideration of remediation is recommended.

## 6.6 Site Characterization

The potential for waste disposal at Site 5 was characterized through the installation of test pits located across the site based on the results of the DGM survey performed in 2012. Based on the results of the test pitting activities conducted, waste placement is isolated to the area of Testpits 3, 4, and 9 which is in the area of the suspected disposal/burn pit identified in historical documents.

**Figure 6-2** shows the analytical results of PAHs in surface soil at Site 5. **Figure 6-3** shows the sum of the high molecular weight (HMW) PAHs in surface soil at Site 5. The HMW PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene. PAHs were determined to be human health and ecological COPCs in surface soil. PAH concentrations increased by several orders of magnitude within the suspected disposal/burn pit compared with results from the rest of the site. Elevated PAH concentrations also were observed adjacent to the suspected disposal/burn pit. The maximum concentrations of PAHs were detected at CBD-S05-DP03, located in the center of the suspected disposal/burn pit.

## 6.7 Findings and Recommendations

### 6.7.1 Findings

SVOCs, pesticides, and metals were detected in surface and subsurface soils at Site 5. In addition, one VOC, SVOCs, and metals were detected in groundwater at Site 5. Based on the HHRS and ERA, the constituents presented in **Table 6-4** may present potentially unacceptable risk and were retained as COPCs for Site 5.

Table 6-4. Human Health and Ecological Risk COPCs for Site 5

| **Media** | **COPCs** | |
|---|---|---|
| | **Human Health** | **Ecological** |
| Surface Soil | Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene | HMW PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene |
| Subsurface Soil | Cobalt | N/A |
| Groundwater | None | N/A |

## 6.7.2 Risk Considerations

### 6.7.2.1 Human Health

- While cobalt was retained as a COPC for subsurface soil, the following considerations should be made regarding further evaluation of cobalt: The hazard associated with cobalt is based on the concentration detected in one sample (CBD-S05-SB04-2022) collected from a depth of 20 to 22 feet bgs. It is unlikely human receptors would contact soil at this depth, so this single sample does not pose a likely exposure point to residential use.
- The non-cancer toxicity value (reference dose [RfD]) used to derive the RSL for cobalt is not a Tier 1 value (from the USEPA Integrated Risk Information System) but is a Tier 2 value. The Tier 2 value is from the Provisional Peer Reviewed Toxicity Values (PPRTVs) database. The PPRTV value was adjusted based on a second review of data in the PPRTV database in 2008 and decreased 2 orders of magnitude. The value is now derived using the highest level of modifying and uncertainty factors (3,000, when previously it had been 10). This value change implies there is very low confidence in the RfD (non-cancer toxicity value used to derive the RSL).

## 6.7.3 Recommendations

Site 5 is recommended for further evaluation based upon potential unacceptable human health and ecological risks associated with HMW PAHs in surface soil.

## Table 6-1. Site 5 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S05-DP07 | CBD-S05-DP08 | CBD-S05-DP09 | CBD-S05-DP10 | CBD-S05-DP11 | CBD-S05-DP12 | CBD-S05-DP13 | | CBD-S05-DP14 | CBD-S05-DP15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S05-SS07-000H | CBD-S05-SS08-000H | CBD-S05-SS09-000H | CBD-S05-SS10-000H | CBD-S05-SS11-000H | CBD-S05-SS12-000H | CBD-S05-SS13-000H | CBD-S05-SS13P-000H | CBD-S05-SS14-000H | CBD-S05-SS15-000H |
| **Sample Date** | | | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 2-Methylnaphthalene | -- | 24,000 | NA | NA | NA | NA | NA | 2.4 U | 2.3 U | 2.4 U | 2.1 U | 59 J- |
| Acenaphthene | -- | 360,000 | NA | NA | NA | NA | NA | 15 | 1.2 U | 1.3 U | 1.1 U | 190 J- |
| Acenaphthylene | -- | -- | NA | NA | NA | NA | NA | 2.7 J | 1.6 J | 1.3 U | 1.1 U | 15 J |
| Anthracene | -- | 1,800,000 | NA | NA | NA | NA | NA | 39 | 5 U | 5.2 U | 4.6 U | 600 J |
| Benzo(a)anthracene | -- | 1,100 | NA | NA | NA | NA | NA | 340 | 9.4 J | 5.2 U | 4.6 U | **1,600** |
| Benzo(a)pyrene | -- | 110 | NA | NA | NA | NA | NA | **330** | 10 J | 5.2 U | 4.6 U | **1,600** |
| Benzo(b)fluoranthene | -- | 1,100 | NA | NA | NA | NA | NA | 450 | 21 | 8 U | 7 U | **2,300** |
| Benzo(g,h,i)perylene | -- | -- | NA | NA | NA | NA | NA | 230 | 8.6 J | 8 U | 7 U | 890 |
| Benzo(k)fluoranthene | -- | 11,000 | NA | NA | NA | NA | NA | 160 | 6.5 J | 5.2 U | 4.6 U | 800 J |
| Chrysene | -- | 110,000 | NA | NA | NA | NA | NA | 320 | 13 | 5.2 U | 4.6 U | 1,700 |
| Dibenz(a,h)anthracene | -- | 110 | NA | NA | NA | NA | NA | 56 | 7.7 U | 8 U | 7 U | **270 J-** |
| Di-n-butylphthalate | 200,000 | 630,000 | NA | NA | NA | NA | NA | 233 U | 161 U | 164 U | 216 U | 127 U |
| Fluoranthene | -- | 240,000 | NA | NA | NA | NA | NA | 430 | 15 | 5.2 U | 4.6 U | 3,300 |
| Fluorene | -- | 240,000 | NA | NA | NA | NA | NA | 9.9 J | 3.1 U | 3.2 U | 2.8 U | 250 J- |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | NA | NA | NA | NA | NA | 260 | 10 J | 8 U | 7 U | **1,300** |
| Naphthalene | -- | 3,800 | NA | NA | NA | NA | NA | 2.4 U | 2.3 U | 2.4 U | 2.1 U | 150 J- |
| Phenanthrene | -- | -- | NA | NA | NA | NA | NA | 150 | 5.2 J | 8 U | 7 U | 2,600 |
| Pyrene | -- | 180,000 | NA | NA | NA | NA | NA | 390 | 13 | 8 U | 7 U | 2,600 |
| | | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | | |
| 4,4'-DDD | 100 | 190 | 0.176 UJ | 0.121 U | 5.15 J- | 4.16 J- | 0.221 UJ | 0.691 | 0.14 U | 0.137 U | 0.204 U | 0.123 U |
| 4,4'-DDE | 100 | 2,000 | 0.431 J- | 0.121 U | *150* | *153* | 7.18 J- | 0.154 U | 1.12 J | 2.72 J | 0.204 U | 0.123 U |
| 4,4'-DDT | 100 | 1,900 | 0.351 UJ | 0.241 U | *152* | *181* | 0.443 UJ | 0.308 U | 0.281 UJ | 1.47 J | 0.409 U | 0.246 U |
| alpha-Chlordane | 2.2 | 1,700 | 0.176 UJ | 0.121 U | 0.214 UJ | 0.27 J | 0.221 UJ | 0.154 U | 0.14 U | 0.137 U | 0.204 U | 0.123 U |
| | | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | | |
| Aluminum | -- | 7,700 | NA | NA | NA | NA | NA | **9,200** | **8,700** | **9,000** | 3,300 | 4,300 |
| Antimony | 5 | 3.1 | NA | NA | NA | NA | NA | 0.18 U | 0.16 U | 0.16 U | 0.14 U | 0.056 J |
| Arsenic | 6.8 | 0.68 | NA | NA | NA | NA | NA | **3.9** | **5.2** | **6** | **0.99** | **1.3** |
| Barium | 110 | 1,500 | NA | NA | NA | NA | NA | 32 | 12 | 13 | 8.5 | 15 |
| Beryllium | 2.5 | 16 | NA | NA | NA | NA | NA | 0.63 J | 0.27 J | 0.24 J | 0.21 J | 0.4 J |
| Cadmium | 32 | 7.1 | NA | NA | NA | NA | NA | 0.24 J | 0.16 U | 0.1 J | 0.14 U | 0.14 U |
| Calcium | -- | -- | NA | NA | NA | NA | NA | 3,280 | 577 | 714 | 94 | 48.2 |
| Chromium | 10 | 0.3 | NA | NA | NA | NA | NA | ***21*** | ***18*** | ***15*** | **4.4** | **5** |
| Cobalt | 13 | 2.3 | NA | NA | NA | NA | NA | **3.2** | 1.3 J | 0.95 J | 1.4 | 1.6 |
| Copper | 70 | 310 | NA | NA | NA | NA | NA | 6.4 | 9.9 | 12 | 1.7 | 2.1 |
| Iron | -- | 5,500 | NA | NA | NA | NA | NA | **18,000** | **16,000** | **13,000** | 4,000 | 3,800 |
| Lead | 120 | 400 | NA | NA | NA | NA | NA | 10 | 7.1 | 8.4 | 2.9 | 3.3 |
| Magnesium | -- | -- | NA | NA | NA | NA | NA | 1,540 | 1,200 | 1,020 | 238 | 329 |
| Manganese | 220 | 180 | NA | NA | NA | NA | NA | 80 | 20 J | 6.2 J | 32 | 51 |
| Mercury | 0.05 | 2.3 | NA | NA | NA | NA | NA | 0.18 U | 0.16 U | *0.28 J* | 0.14 U | 0.14 U |
| Nickel | 38 | 150 | NA | NA | NA | NA | NA | 8.1 | 3.3 | 3.2 | 1.9 | 3.3 |
| Potassium | -- | -- | NA | NA | NA | NA | NA | 902 | 923 | 793 | 180 | 255 |
| Selenium | 0.52 | 39 | NA | NA | NA | NA | NA | *0.97* | *0.98* | *1.5* | 0.28 U | *0.71* |
| Silver | 560 | 39 | NA | NA | NA | NA | NA | 0.15 J | 0.13 J | 0.35 | 0.081 J | 0.11 J |
| Sodium | -- | -- | NA | NA | NA | NA | NA | 16.3 J+ | 12.5 U | 12 U | 4.7 U | 5 U |
| Thallium | 0.05 | 0.078 | NA | NA | NA | NA | NA | ***0.18 J*** | ***0.16 J*** | ***0.12 J*** | 0.14 U | *0.077 J* |
| Vanadium | 60 | 39 | NA | NA | NA | NA | NA | 19 | 15 | 14 | 6 | 6.5 |
| Zinc | 120 | 2,300 | NA | NA | NA | NA | NA | 45 | 33 | 26 | 7.3 | 11 |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 6-1. Site 5 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S05-DP16 | CBD-S05-SS17 | CBD-S05-SS18 | | CBD-S05-SS19 | CBD-S05-SS20 | CBD-S05-SS21 | CBD-S05-SS22 | CBD-S05-SS23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S05-SS16-000H | CBD-S05-SS17-000H | CBD-S05-SS18-000H | CBD-S05-SS18P-000H | CBD-S05-SS19-000H | CBD-S05-SS20-000H | CBD-S05-SS21-000H | CBD-S05-SS22-000H | CBD-S05-SS23-000H |
| **Sample Date** | | | 04/05/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 2-Methylnaphthalene | -- | 24,000 | 2.4 U | 2.9 U | 2.5 U | 2.3 U | 2.2 U | 2.9 U | 14 U | 2.9 U | 2.4 U |
| Acenaphthene | -- | 360,000 | 15 | 1.5 U | 4 J | 1.2 U | 0.95 J | 1.8 J | 37 | 6.6 J | 8.3 J |
| Acenaphthylene | -- | -- | 0.83 J | 1.5 U | 4 J | 2.2 J | 2 J | 2.3 J | 14 J | 1.8 J | 1.7 J |
| Anthracene | -- | 1,800,000 | 31 | 11 J | 3.7 J | 3.3 J | 3.2 J | 9.5 J | 100 | 21 | 14 |
| Benzo(a)anthracene | -- | 1,100 | 81 | 26 | 14 | 12 | 20 | 92 | 560 | 160 | 89 |
| Benzo(a)pyrene | -- | 110 | 74 | 18 | 20 | 17 | 26 | 94 | **630** | **200** | 99 |
| Benzo(b)fluoranthene | -- | 1,100 | 97 | 50 | 44 | 37 | 43 | 140 | 870 | 280 | 140 |
| Benzo(g,h,i)perylene | -- | -- | 46 | 17 | 20 | 16 | 22 | 69 | 490 | 150 | 70 |
| Benzo(k)fluoranthene | -- | 11,000 | 35 | 16 | 12 U | 10 U | 14 | 45 | 290 | 89 | 50 |
| Chrysene | -- | 110,000 | 77 | 35 | 22 | 19 | 24 | 93 | 550 | 170 | 98 |
| Dibenz(a,h)anthracene | -- | 110 | 13 | 4.8 J | 4.6 J | 3.5 J | 4.9 J | 19 | **130** | 39 | 20 |
| Di-n-butylphthalate | 200,000 | 630,000 | 237 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 129 J | 216 U | 187 U |
| Fluoranthene | -- | 240,000 | 150 | 38 | 20 | 19 | 31 | 110 | 790 | 210 | 150 |
| Fluorene | -- | 240,000 | 12 | 12 J | 5.1 J | 3.3 J | 1.7 J | 5.1 J | 46 | 15 | 9.7 J |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | 59 | 22 | 23 | 19 | 26 | 86 | 600 | 170 | 87 |
| Naphthalene | -- | 3,800 | 4.3 U | 2.9 U | 2.5 U | 2.3 U | 2.2 U | 2.9 U | 21 | 3.8 U | 2.4 U |
| Phenanthrene | -- | -- | 130 | 13 J | 9.9 J | 8 J | 12 | 32 | 390 | 89 | 86 |
| Pyrene | -- | 180,000 | 120 | 29 | 19 | 18 | 27 | 98 | 680 | 190 | 130 |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| 4,4'-DDD | 100 | 190 | 0.244 U | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 1.19 |
| 4,4'-DDE | 100 | 2,000 | 0.244 U | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 21.1 | 0.176 U | 6.19 |
| 4,4'-DDT | 100 | 1,900 | 0.488 U | 0.928 UJ | 0.316 U | 0.35 UJ | 0.303 U | 0.345 U | 0.384 U | 0.353 U | 14.1 |
| alpha-Chlordane | 2.2 | 1,700 | 0.244 U | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.616 |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | -- | 7,700 | **14,000** | **8,400** | **15,000 J** | 7,000 J | 4,300 | 6,200 | 7,000 | 4,300 | **13,000** |
| Antimony | 5 | 3.1 | 0.17 U | 0.22 J | 0.13 J | 0.14 J | 0.16 U | 0.2 U | 0.74 | 0.22 J | 0.18 U |
| Arsenic | 6.8 | 0.68 | **4.9** | **5.3** | **4.3** | **3.3** | **1.7** | **3.5** | **5.7** | **2.4** | **5.7** |
| Barium | 110 | 1,500 | 28 | 56 | 35 | 28 | 14 | 34 | 76 | 28 | 31 |
| Beryllium | 2.5 | 16 | 0.37 J | 0.54 J | 0.37 J | 0.28 J | 0.32 U | 0.55 J | 0.36 J | 0.25 J | 0.42 J |
| Cadmium | 32 | 7.1 | 0.17 U | 0.51 J | 0.26 J | 0.26 J | 0.18 J | 0.66 | 1.2 | 0.37 J | 0.13 J |
| Calcium | -- | -- | 2,310 | 4,490 | 1,460 | 1,520 | 580 | 2,640 | 6,300 | 2,680 | 1,020 |
| Chromium | 10 | 0.3 | ***22*** | ***24*** | ***17*** | ***13*** | **9.2** | ***18*** | ***17*** | **8.1** | ***22*** |
| Cobalt | 13 | 2.3 | 1.6 | **3.5** | **3.1** | **2.4** | 1.2 | **3.4** | **2.6** | 1.7 | **3.3** |
| Copper | 70 | 310 | 6.9 | 8.7 | 9.2 | 8.8 | 5.2 | 8.1 | *180* | 28 | 15 |
| Iron | -- | 5,500 | **24,000** | **16,000** | **28,000 J** | **13,000 J** | **8,600** | **13,000** | **15,000** | **7,300** | **22,000** |
| Lead | 120 | 400 | 12 | 15 | 40 | 32 | 14 | 14 | *270* | 25 | 26 |
| Magnesium | -- | -- | 1,010 | 2,350 | 1,150 | 910 | 406 | 1,520 | 1,460 | 846 | 1,530 |
| Manganese | 220 | 180 | 30 | ***230*** | 140 | 130 | 41 | 100 | ***290*** | 160 | 70 |
| Mercury | 0.05 | 2.3 | 0.17 U | 0.34 U | *0.13 J* | *0.11 J* | 0.16 U | 0.2 U | *0.35 J* | 0.19 U | 0.18 U |
| Nickel | 38 | 150 | 4 | 8.3 | 26 | 26 | 5.7 | 7.6 | 11 | 5.5 | 9.2 |
| Potassium | -- | -- | 791 | 1,620 | 708 | 565 | 297 | 917 | 1,220 | 625 | 924 |
| Selenium | 0.52 | 39 | *0.66 J* | *1.4* | *0.7 J* | *0.57 J* | 0.32 U | *1.2* | *1* | *0.56 J* | *0.61 J* |
| Silver | 560 | 39 | 0.21 J | 0.24 J | 1 | 0.92 | 0.078 J | 0.17 J | 0.54 | 0.19 J | 0.69 |
| Sodium | -- | -- | 13.1 J+ | 41.2 J+ | 19.3 J+ | 16 U | 22.6 J+ | 14.8 U | 24 J+ | 13.9 U | 27.1 J+ |
| Thallium | 0.05 | 0.078 | ***0.11 J*** | ***0.17 J*** | ***0.17 J*** | ***0.12 J*** | 0.16 U | ***0.18 J*** | ***0.13 J*** | 0.19 U | ***0.14 J*** |
| Vanadium | 60 | 39 | 26 | 26 | 23 | 17 | 12 | 18 | 30 | 13 | ***380*** |
| Zinc | 120 | 2,300 | 18 | 69 | 45 | 38 | 29 | 81 | *280* | 59 | 39 |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 6-2. Site 5 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S05-DP07 | CBD-S05-DP08 | CBD-S05-DP09 | CBD-S05-DP10 | CBD-S05-DP11 | CBD-S05-DP12 | | CBD-S05-DP13 |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-S05-SB07-0810 | CBD-S05-SB08-0810 | CBD-S05-SB09-0810 | CBD-S05-SB10-0810 | CBD-S05-SB11-0810 | CBD-S05-SB12-0810 | CBD-S05-SB12P-0810 | CBD-S05-SB13-0810 |
| **Sample Date** | | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| Benzo(a)anthracene | 1,100 | NA | NA | NA | NA | NA | 5.6 U | 5.8 U | 5.3 U |
| Benzo(b)fluoranthene | 1,100 | NA | NA | NA | NA | NA | 8.6 U | 8.9 U | 8.1 U |
| Benzo(g,h,i)perylene | -- | NA | NA | NA | NA | NA | 8.6 U | 8.9 U | 8.1 U |
| Benzo(k)fluoranthene | 11,000 | NA | NA | NA | NA | NA | 5.6 U | 5.8 U | 5.3 U |
| Chrysene | 110,000 | NA | NA | NA | NA | NA | 5.6 U | 5.8 U | 5.3 U |
| Dibenz(a,h)anthracene | 110 | NA | NA | NA | NA | NA | 8.6 U | 8.9 U | 8.1 U |
| Fluoranthene | 240,000 | NA | NA | NA | NA | NA | 5.6 U | 5.8 U | 5.3 U |
| Fluorene | 240,000 | NA | NA | NA | NA | NA | 3.4 U | 3.6 U | 3.2 U |
| Indeno(1,2,3-cd)pyrene | 1,100 | NA | NA | NA | NA | NA | 8.6 U | 8.9 U | 8.1 U |
| Naphthalene | 3,800 | NA | NA | NA | NA | NA | 2.6 U | 2.7 U | 2.4 U |
| Phenanthrene | -- | NA | NA | NA | NA | NA | 8.6 U | 8.9 U | 8.1 U |
| | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | |
| Aldrin | 39 | 0.221 U | 0.215 U | 0.252 UJ | 0.234 U | 0.136 U | 0.876 J | 0.26 UJ | 0.243 U |
| Endosulfan II | 47,000 | 0.221 U | 0.215 U | 0.252 UJ | 0.234 U | 0.136 U | 0.272 U | 0.26 U | 0.243 U |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 7,700 | NA | NA | NA | NA | NA | **12,000** | **13,000** | **14,000** |
| Arsenic | 0.68 | NA | NA | NA | NA | NA | **5 J** | **9.7 J** | **5.8** |
| Barium | 1,500 | NA | NA | NA | NA | NA | 13 | 12 | 9.4 |
| Beryllium | 16 | NA | NA | NA | NA | NA | 0.21 J | 0.26 J | 0.29 J |
| Calcium | -- | NA | NA | NA | NA | NA | 47.1 | 44.6 | 115 |
| Chromium | 0.3 | NA | NA | NA | NA | NA | **23** | **30** | **26** |
| Cobalt | 2.3 | NA | NA | NA | NA | NA | 0.6 | 0.77 | 1.1 |
| Copper | 310 | NA | NA | NA | NA | NA | 6.5 | 8.5 | 6.3 |
| Iron | 5,500 | NA | NA | NA | NA | NA | **15,000 J** | **29,000 J** | **30,000** |
| Lead | 400 | NA | NA | NA | NA | NA | 9.8 | 11 | 7.3 |
| Magnesium | -- | NA | NA | NA | NA | NA | 1,070 | 1,210 | 1,600 |
| Manganese | 180 | NA | NA | NA | NA | NA | 5 | 4.4 | 6 |
| Nickel | 150 | NA | NA | NA | NA | NA | 1.1 | 1.2 | 1.7 |
| Potassium | -- | NA | NA | NA | NA | NA | 791 | 839 | 1,040 |
| Selenium | 39 | NA | NA | NA | NA | NA | 0.65 | 0.97 | 1.1 |
| Silver | 39 | NA | NA | NA | NA | NA | 0.16 U | 0.17 U | 0.17 U |
| Sodium | -- | NA | NA | NA | NA | NA | 31.1 J+ | 31 J+ | 14.5 J+ |
| Thallium | 0.078 | NA | NA | NA | NA | NA | **0.092 J** | **0.092 J** | **0.14 J** |
| Vanadium | 39 | NA | NA | NA | NA | NA | 15 J | 23 J | 24 |
| Zinc | 2,300 | NA | NA | NA | NA | NA | 6.7 J | 10 J | 16 |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

Table 6-2. Site 5 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S05-DP14 | CBD-S05-DP15 | CBD-S05-DP16 |
|---|---|---|---|---|
| **Sample ID** | | CBD-S05-SB14-0810 | CBD-S05-SB15-0810 | CBD-S05-SB16-0810 |
| **Sample Date** | | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | |
| | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | |
| Benzo(a)anthracene | 1,100 | 4.8 U | 2.1 J | 5 U |
| Benzo(b)fluoranthene | 1,100 | 7.3 U | 4.5 J | 7.7 U |
| Benzo(g,h,i)perylene | -- | 7.3 U | 2.8 J | 7.7 U |
| Benzo(k)fluoranthene | 11,000 | 4.8 U | 3.6 J | 5 U |
| Chrysene | 110,000 | 4.8 U | 3.4 J | 5 U |
| Dibenz(a,h)anthracene | 110 | 7.3 U | 3.4 J | 7.7 U |
| Fluoranthene | 240,000 | 4.8 U | 4.2 J | 5 U |
| Fluorene | 240,000 | 2.9 U | 1.1 J | 3.1 U |
| Indeno(1,2,3-cd)pyrene | 1,100 | 7.3 U | 3.7 J | 7.7 U |
| Naphthalene | 3,800 | 2.2 U | 0.89 J | 2.3 U |
| Phenanthrene | -- | 7.3 U | 8.4 J | 7.7 U |
| | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | |
| Aldrin | 39 | 0.237 U | 0.224 U | 0.148 U |
| Endosulfan II | 47,000 | 0.237 U | 0.268 J | 0.148 U |
| | | | | |
| **Total Metals (MG/KG)** | | | | |
| Aluminum | 7,700 | **11,000** | **15,000** | **9,100** |
| Arsenic | 0.68 | **6.4** | **6.3** | **13** |
| Barium | 1,500 | 49 | 19 | 8.3 |
| Beryllium | 16 | 0.37 J | 0.44 J | 0.25 J |
| Calcium | -- | 237 | 45.8 | 302 |
| Chromium | 0.3 | **16** | **24** | **18** |
| Cobalt | 2.3 | 1.5 | 1.6 | 1.2 |
| Copper | 310 | 3 | 6.7 | 5.3 |
| Iron | 5,500 | **12,000** | **22,000** | **46,000** |
| Lead | 400 | 8.3 | 9.1 | 5.9 |
| Magnesium | -- | 2,100 | 1,920 | 1,080 |
| Manganese | 180 | 10 | 14 | 6.9 |
| Nickel | 150 | 2.8 | 2.7 | 1.8 |
| Potassium | -- | 1,370 | 965 | 661 |
| Selenium | 39 | 1.3 | 0.99 | 0.86 |
| Silver | 39 | 0.069 J | 0.15 U | 0.15 U |
| Sodium | -- | 38.4 J+ | 43.6 J+ | 21.3 J+ |
| Thallium | 0.078 | **0.19 J** | **0.17 J** | **0.12 J** |
| Vanadium | 39 | 14 | 17 | 21 |
| Zinc | 2,300 | 21 | 17 | 13 |

#REF!

**Notes:**

Shading indicates detections
**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**
NA - Not analyzed
J - Analyte present, value may or may not be accurate or precise
J+ - Analyte present, value may be biased high, actual value may be lower
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

# Table 6-3. Site 5 Analytical Results – Detected Constituents in Groundwater

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Tapwater (HQ=0.1) 0519** | CBD-S05-MW01 | CBD-S05-MW02 | CBD-S05-MW03 |
|---|---|---|---|---|
| **Sample ID** | | CBD-S05-GW01-0418 | CBD-S05-GW02-0418 | CBD-S05-GW03-0418 |
| **Sample Date** | | 04/25/18 | 04/25/18 | 04/25/18 |
| **Chemical Name** | | | | |
| | | | | |
| **Volatile Organic Compounds (UG/L)** | | | | |
| Carbon disulfide | 81 | 1.04 | 1 U | 1.53 |
| | | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | | |
| Benzo(a)anthracene | 0.03 | 0.012 U | 0.009 J | 0.0046 J |
| Chrysene | 25 | 0.012 U | 0.0095 J | 0.0065 J |
| Fluoranthene | 80 | 0.0053 J | 0.0085 J | 0.0051 J |
| | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | | |
| *No Detections* | | | | |
| | | | | |
| **Total Metals (UG/L)** | | | | |
| Aluminum | 2,000 | 26 J+ | 430 | 35 J+ |
| Arsenic | 0.052 | **0.33 J** | **0.77** | **0.16 J** |
| Barium | 380 | 29 | 60 | 36 |
| Beryllium | 2.5 | 0.13 U | 0.15 J | 0.13 U |
| Cadmium | 0.92 | 0.5 | 0.79 | 0.81 |
| Calcium | -- | 155,000 | 106,000 | 61,900 |
| Chromium | 0.035 | 0.3 U | **1.1** | **0.52** |
| Cobalt | 0.6 | **1** | **4.9** | **6.5** |
| Copper | 80 | 0.13 U | 0.82 | 0.33 J |
| Iron | 1,400 | 83 | 480 | 48 |
| Lead | 15 | 0.13 U | 0.42 J | 0.13 U |
| Magnesium | -- | 2,730 | 5,060 | 7,780 |
| Manganese | 43 | 29 | **56** | **44** |
| Nickel | 39 | 4.4 | 8.8 | 21 |
| Potassium | -- | 1,240 | 1,420 | 2,430 |
| Sodium | -- | 5,740 | 6,680 | 5,730 |
| Thallium | 0.02 | 0.5 U | 0.5 U | **0.16 J** |
| Vanadium | 8.6 | 0.59 | 1.5 | 0.47 J |
| Zinc | 600 | 3 J+ | 15 | 30 |
| | | | | |
| **Dissolved Metals (UG/L)** | | | | |
| Aluminum, Dissolved | 2,000 | 4.2 J+ | 38 | 11 J+ |
| Arsenic, Dissolved | 0.052 | **0.35 J** | **0.44 J** | **0.25 J** |
| Barium, Dissolved | 380 | 28 | 59 | 44 |
| Cadmium, Dissolved | 0.92 | 0.48 J | 0.74 | 0.4 J |
| Calcium, Dissolved | -- | 149,000 | 117,000 | 74,200 |
| Chromium, Dissolved | 0.035 | **0.14 J** | **0.2 J** | **0.11 J** |
| Cobalt, Dissolved | 0.6 | **0.95 J** | **3.6** | **2** |
| Copper, Dissolved | 80 | 0.49 U | 0.28 U | 1.2 |
| Iron, Dissolved | 1,400 | 53 | 72 | 30 |
| Magnesium, Dissolved | -- | 2,600 | 4,380 | 5,800 |
| Manganese, Dissolved | 43 | 27 | **50** | 42 |
| Mercury, Dissolved | 0.57 | 0.13 U | 0.13 U | 0.09 J |
| Nickel, Dissolved | 39 | 4.4 | 7.3 | 6.6 |
| Potassium, Dissolved | -- | 1,180 | 1,310 | 2,520 |
| Selenium, Dissolved | 10 | 0.5 U | 0.29 J | 0.75 J |
| Sodium, Dissolved | -- | 5,550 | 6,110 | 5,390 |
| Vanadium, Dissolved | 8.6 | 0.52 | 0.76 | 0.34 J |
| Zinc, Dissolved | 600 | 4.4 | 8.3 | 7.5 |

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Tapwater (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UG/L - Micrograms per liter

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure06-01_NRL-CBD_Site5Landfill3.mxd 2/19/2019 jcarr3

**Legend**

- ● ESI Monitoring Well Location
- ● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS Location Only for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS/SB Location for Pesticides Only
- ○ SI SS/SB Location (for DP01 - DP05)
  SI SS Location (for DP06)
- ▬ ESI Test Pit Location
- ▬ SI Test Pit Location
- ☐ Suspected Disposal and/or Burn Pit
- ☐ Site Boundary

Imagery: Calvert County, MD - 2017

Notes:
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

N

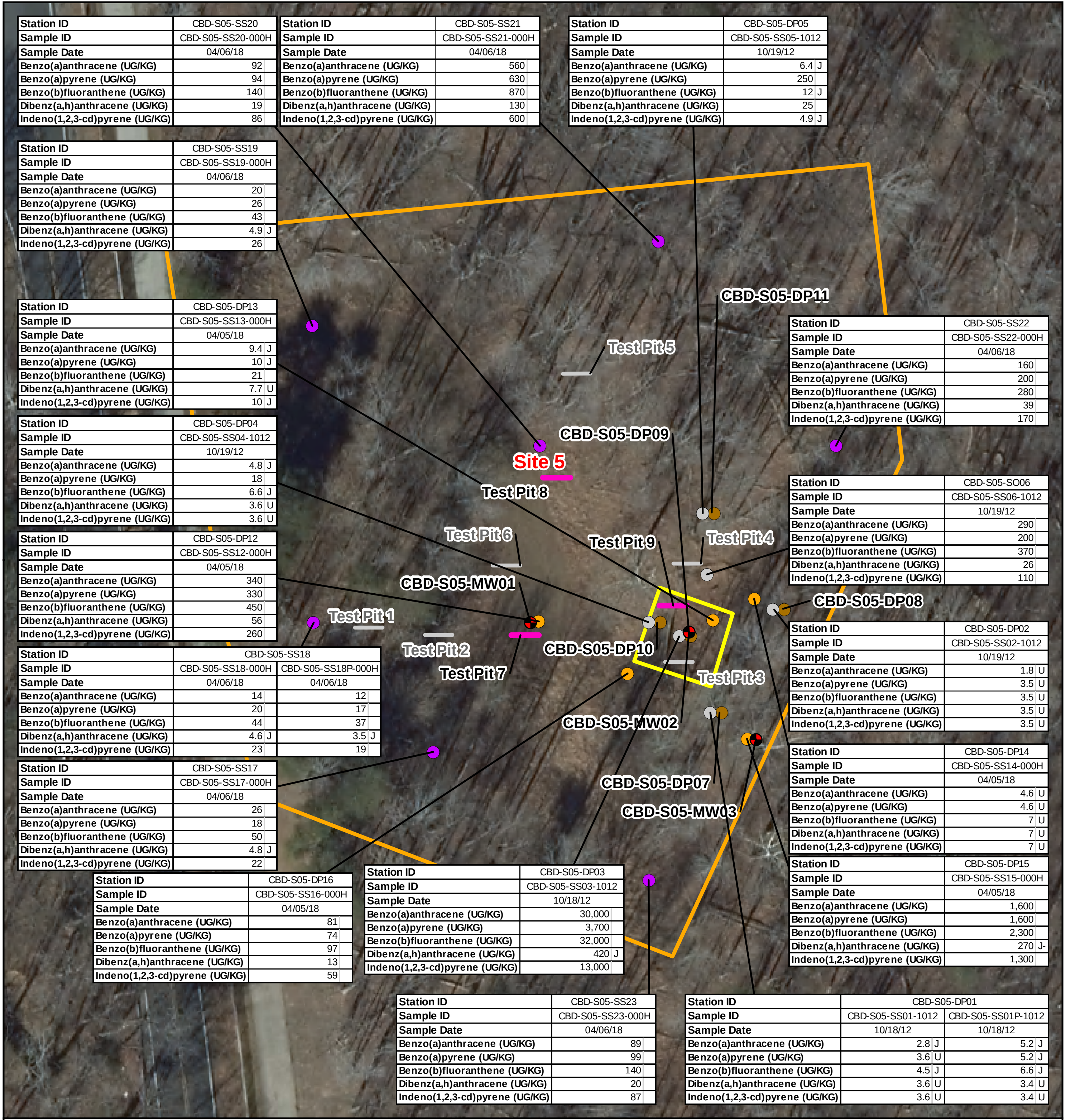
0 20 40
Feet

1 inch = 40 feet

**Figure 6-1**
**Site 5 Landfill No. 3**
**Sample Locations**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure06-02_NRL-CBD_Site5Landfill3_RiskSurfaceSoil.mxd 2/20/2019 jcarr3



| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS20 | |
| **Sample ID** | CBD-S05-SS20-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 92 | |
| **Benzo(a)pyrene (UG/KG)** | 94 | |
| **Benzo(b)fluoranthene (UG/KG)** | 140 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 19 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 86 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS21 | |
| **Sample ID** | CBD-S05-SS21-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 560 | |
| **Benzo(a)pyrene (UG/KG)** | 630 | |
| **Benzo(b)fluoranthene (UG/KG)** | 870 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 130 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 600 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP05 | |
| **Sample ID** | CBD-S05-SS05-1012 | |
| **Sample Date** | 10/19/12 | |
| **Benzo(a)anthracene (UG/KG)** | 6.4 | J |
| **Benzo(a)pyrene (UG/KG)** | 250 | |
| **Benzo(b)fluoranthene (UG/KG)** | 12 | J |
| **Dibenz(a,h)anthracene (UG/KG)** | 25 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 4.9 | J |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS19 | |
| **Sample ID** | CBD-S05-SS19-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 20 | |
| **Benzo(a)pyrene (UG/KG)** | 26 | |
| **Benzo(b)fluoranthene (UG/KG)** | 43 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 4.9 | J |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 26 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS22 | |
| **Sample ID** | CBD-S05-SS22-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 160 | |
| **Benzo(a)pyrene (UG/KG)** | 200 | |
| **Benzo(b)fluoranthene (UG/KG)** | 280 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 39 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 170 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP13 | |
| **Sample ID** | CBD-S05-SS13-000H | |
| **Sample Date** | 04/05/18 | |
| **Benzo(a)anthracene (UG/KG)** | 9.4 | J |
| **Benzo(a)pyrene (UG/KG)** | 10 | J |
| **Benzo(b)fluoranthene (UG/KG)** | 21 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 7.7 | U |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 10 | J |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP04 | |
| **Sample ID** | CBD-S05-SS04-1012 | |
| **Sample Date** | 10/19/12 | |
| **Benzo(a)anthracene (UG/KG)** | 4.8 | J |
| **Benzo(a)pyrene (UG/KG)** | 18 | |
| **Benzo(b)fluoranthene (UG/KG)** | 6.6 | J |
| **Dibenz(a,h)anthracene (UG/KG)** | 3.6 | U |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 3.6 | U |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SO06 | |
| **Sample ID** | CBD-S05-SS06-1012 | |
| **Sample Date** | 10/19/12 | |
| **Benzo(a)anthracene (UG/KG)** | 290 | |
| **Benzo(a)pyrene (UG/KG)** | 200 | |
| **Benzo(b)fluoranthene (UG/KG)** | 370 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 26 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 110 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP12 | |
| **Sample ID** | CBD-S05-SS12-000H | |
| **Sample Date** | 04/05/18 | |
| **Benzo(a)anthracene (UG/KG)** | 340 | |
| **Benzo(a)pyrene (UG/KG)** | 330 | |
| **Benzo(b)fluoranthene (UG/KG)** | 450 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 56 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 260 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP02 | |
| **Sample ID** | CBD-S05-SS02-1012 | |
| **Sample Date** | 10/19/12 | |
| **Benzo(a)anthracene (UG/KG)** | 1.8 | U |
| **Benzo(a)pyrene (UG/KG)** | 3.5 | U |
| **Benzo(b)fluoranthene (UG/KG)** | 3.5 | U |
| **Dibenz(a,h)anthracene (UG/KG)** | 3.5 | U |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 3.5 | U |

| | | | | |
|---|---|---|---|---|
| **Station ID** | CBD-S05-SS18 | | | |
| **Sample ID** | CBD-S05-SS18-000H | | CBD-S05-SS18P-000H | |
| **Sample Date** | 04/06/18 | | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 14 | | 12 | |
| **Benzo(a)pyrene (UG/KG)** | 20 | | 17 | |
| **Benzo(b)fluoranthene (UG/KG)** | 44 | | 37 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 4.6 | J | 3.5 | J |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 23 | | 19 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP14 | |
| **Sample ID** | CBD-S05-SS14-000H | |
| **Sample Date** | 04/05/18 | |
| **Benzo(a)anthracene (UG/KG)** | 4.6 | U |
| **Benzo(a)pyrene (UG/KG)** | 4.6 | U |
| **Benzo(b)fluoranthene (UG/KG)** | 7 | U |
| **Dibenz(a,h)anthracene (UG/KG)** | 7 | U |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 7 | U |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS17 | |
| **Sample ID** | CBD-S05-SS17-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 26 | |
| **Benzo(a)pyrene (UG/KG)** | 18 | |
| **Benzo(b)fluoranthene (UG/KG)** | 50 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 4.8 | J |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 22 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP15 | |
| **Sample ID** | CBD-S05-SS15-000H | |
| **Sample Date** | 04/05/18 | |
| **Benzo(a)anthracene (UG/KG)** | 1,600 | |
| **Benzo(a)pyrene (UG/KG)** | 1,600 | |
| **Benzo(b)fluoranthene (UG/KG)** | 2,300 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 270 | J- |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 1,300 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP16 | |
| **Sample ID** | CBD-S05-SS16-000H | |
| **Sample Date** | 04/05/18 | |
| **Benzo(a)anthracene (UG/KG)** | 81 | |
| **Benzo(a)pyrene (UG/KG)** | 74 | |
| **Benzo(b)fluoranthene (UG/KG)** | 97 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 13 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 59 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP03 | |
| **Sample ID** | CBD-S05-SS03-1012 | |
| **Sample Date** | 10/18/12 | |
| **Benzo(a)anthracene (UG/KG)** | 30,000 | |
| **Benzo(a)pyrene (UG/KG)** | 3,700 | |
| **Benzo(b)fluoranthene (UG/KG)** | 32,000 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 420 | J |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 13,000 | |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS23 | |
| **Sample ID** | CBD-S05-SS23-000H | |
| **Sample Date** | 04/06/18 | |
| **Benzo(a)anthracene (UG/KG)** | 89 | |
| **Benzo(a)pyrene (UG/KG)** | 99 | |
| **Benzo(b)fluoranthene (UG/KG)** | 140 | |
| **Dibenz(a,h)anthracene (UG/KG)** | 20 | |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 87 | |

| | | | | |
|---|---|---|---|---|
| **Station ID** | CBD-S05-DP01 | | | |
| **Sample ID** | CBD-S05-SS01-1012 | | CBD-S05-SS01P-1012 | |
| **Sample Date** | 10/18/12 | | 10/18/12 | |
| **Benzo(a)anthracene (UG/KG)** | 2.8 | J | 5.2 | J |
| **Benzo(a)pyrene (UG/KG)** | 3.6 | U | 5.2 | J |
| **Benzo(b)fluoranthene (UG/KG)** | 4.5 | J | 6.6 | J |
| **Dibenz(a,h)anthracene (UG/KG)** | 3.6 | U | 3.4 | U |
| **Indeno(1,2,3-cd)pyrene (UG/KG)** | 3.6 | U | 3.4 | U |

**Legend**

- ⊕ ESI Monitoring Well Location
- ● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS Location Only for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS/SB Location for Pesticides Only
- ○ SI SS/SB/GW Location (for DP01 - DP03)<br>SI SS/SB Location (for DP04 - DP05)<br>SI SS Location (for DP06)
- ▬ ESI Test Pit Location
- ▬ SI Test Pit Location
- ☐ Suspected Disposal and/or Burn Pit
- ☐ Site Boundary

Imagery: Calvert County, MD - 2017

Notes:
GW = groundwater
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
ESI = Expanded Site Inspection
SI = Site Inspection

N

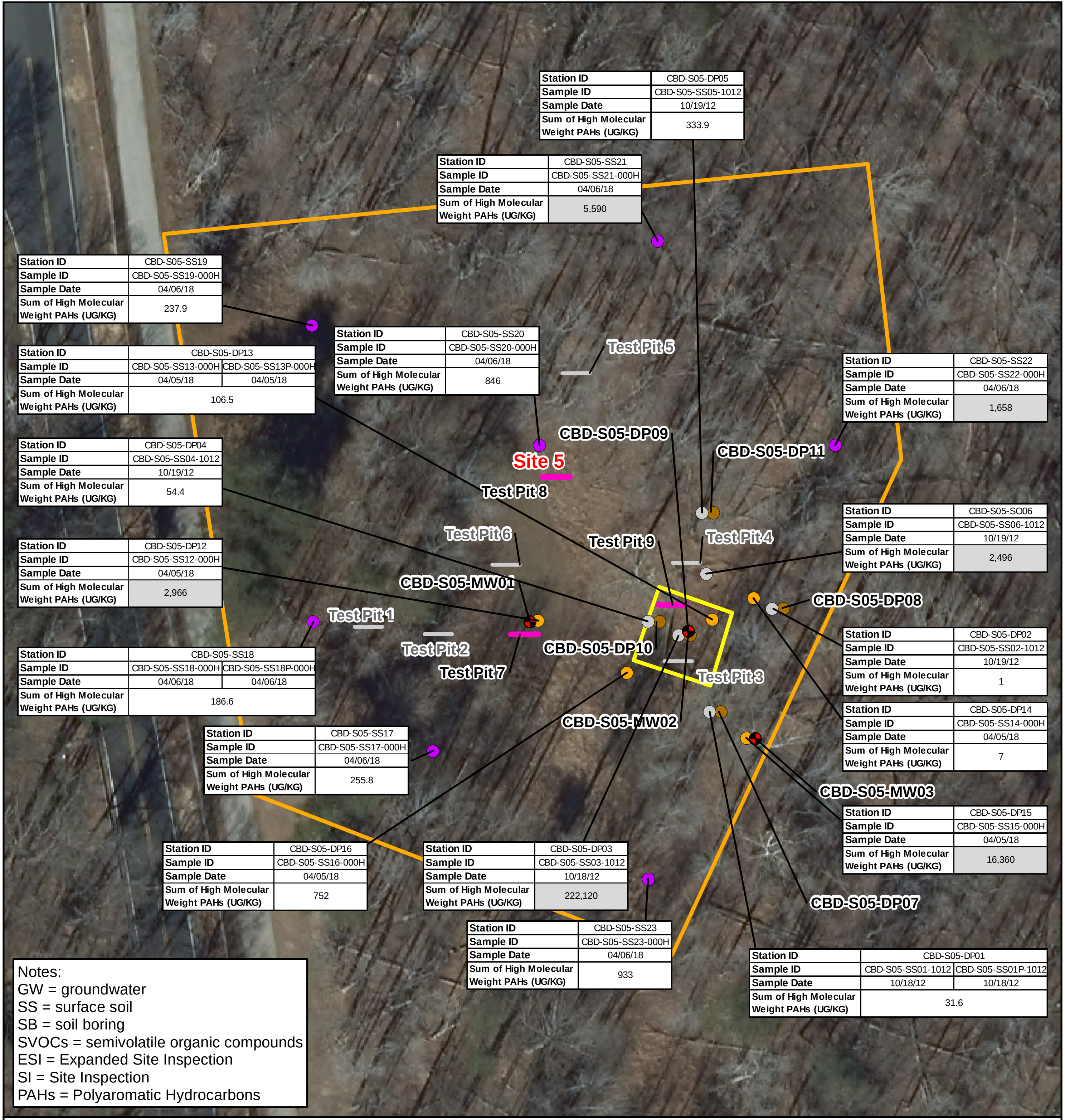
0 20 40
Feet
1 inch = 50 feet

# Figure 6-2
# Site 5 Landfill No. 3
# Human Health Risk
# COPCs in Surface Soil

Base-Wide Expanded Site
Inspection Report
***NRL-CBD***
***Chesapeake Beach, Maryland***

ch2m

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure06-03_NRL-CBD_Site5Landfill3_EcoRiskSurfaceSoil.mxd 2/20/2019 jcarr3



| | |
|---|---|
| **Station ID** | CBD-S05-DP05 |
| **Sample ID** | CBD-S05-SS05-1012 |
| **Sample Date** | 10/19/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 333.9 |

| | |
|---|---|
| **Station ID** | CBD-S05-SS21 |
| **Sample ID** | CBD-S05-SS21-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 5,590 |

| | |
|---|---|
| **Station ID** | CBD-S05-SS19 |
| **Sample ID** | CBD-S05-SS19-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 237.9 |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP13 | |
| **Sample ID** | CBD-S05-SS13-000H | CBD-S05-SS13P-000H |
| **Sample Date** | 04/05/18 | 04/05/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 106.5 | |

| | |
|---|---|
| **Station ID** | CBD-S05-SS20 |
| **Sample ID** | CBD-S05-SS20-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 846 |

| | |
|---|---|
| **Station ID** | CBD-S05-SS22 |
| **Sample ID** | CBD-S05-SS22-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 1,658 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP04 |
| **Sample ID** | CBD-S05-SS04-1012 |
| **Sample Date** | 10/19/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 54.4 |

| | |
|---|---|
| **Station ID** | CBD-S05-SO06 |
| **Sample ID** | CBD-S05-SS06-1012 |
| **Sample Date** | 10/19/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 2,496 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP12 |
| **Sample ID** | CBD-S05-SS12-000H |
| **Sample Date** | 04/05/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 2,966 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP02 |
| **Sample ID** | CBD-S05-SS02-1012 |
| **Sample Date** | 10/19/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 1 |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-SS18 | |
| **Sample ID** | CBD-S05-SS18-000H | CBD-S05-SS18P-000H |
| **Sample Date** | 04/06/18 | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 186.6 | |

| | |
|---|---|
| **Station ID** | CBD-S05-DP14 |
| **Sample ID** | CBD-S05-SS14-000H |
| **Sample Date** | 04/05/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 7 |

| | |
|---|---|
| **Station ID** | CBD-S05-SS17 |
| **Sample ID** | CBD-S05-SS17-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 255.8 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP15 |
| **Sample ID** | CBD-S05-SS15-000H |
| **Sample Date** | 04/05/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 16,360 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP16 |
| **Sample ID** | CBD-S05-SS16-000H |
| **Sample Date** | 04/05/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 752 |

| | |
|---|---|
| **Station ID** | CBD-S05-DP03 |
| **Sample ID** | CBD-S05-SS03-1012 |
| **Sample Date** | 10/18/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 222,120 |

| | |
|---|---|
| **Station ID** | CBD-S05-SS23 |
| **Sample ID** | CBD-S05-SS23-000H |
| **Sample Date** | 04/06/18 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 933 |

| | | |
|---|---|---|
| **Station ID** | CBD-S05-DP01 | |
| **Sample ID** | CBD-S05-SS01-1012 | CBD-S05-SS01P-1012 |
| **Sample Date** | 10/18/12 | 10/18/12 |
| **Sum of High Molecular Weight PAHs (UG/KG)** | 31.6 | |

Notes:
GW = groundwater
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
ESI = Expanded Site Inspection
SI = Site Inspection
PAHs = Polyaromatic Hydrocarbons

**Legend**

- ⊕ ESI Monitoring Well Location
- ● ESI SS/SB Location for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS Location Only for SVOCs, PCBs, Pesticides, and Metals
- ● ESI SS/SB Location for Pesticides Only
- ○ SI SS/SB Location (for DP01 - DP05)<br>SI SS Location (for DP06)
- ▬ ESI Test Pit Location
- ▬ SI Test Pit Location
- ☐ Suspected Disposal and/or Burn Pit
- ☐ Site Boundary

Imagery: Calvert County, MD - 2017

N

0 20 40 Feet

1 inch = 50 feet

**Figure 6-3**
**Site 5 Landfill No. 3**
**Ecological Risk COPCs in Surface Soil**
**(Expressed in High Molecular Weight Concentrations)**
Base-Wide Expanded Site
Inspection Report
***NRL-CBD***
***Chesapeake Beach, Maryland***

ch2m

SECTION 7

# Site 7 – Road Oil Application

## 7.1 Site Description

Site 7, also known as "Road Oil Application," encompasses the historical dirt roads located on the portion of NRL-CBD located west of Bayside Road (**Figure 7-1**). From 1940 through 1952, waste oils were reportedly spread twice a year on dirt roads located on NRL-CBD west of Maryland State Route 261 for use as dust-control measures during dry periods (NEESA, 1984). The oil used in this application was primarily spent crankcase oil and paint thinner. Other liquid waste products such as engine cleaner, steam cleaning waste, dishwashing soap, and gasoline were also mixed in with the waste oil (NEESA, 1984). It was reported, but not confirmed, that a small volume (less than 10 pints per year) of PCB-contaminated liquids may have been mixed with the waste oils (NEESA, 1984). Approximately one to two 55-gallon drums per year of spent oil was sprayed onto the road surfaces during this process. Today the former dirt roads either no longer exist or they have been improved with asphalt and are used as the current base access roads.

## 7.2 Investigation Summary

The Site 7 Base-wide ESI field activities, consisting of soil sampling activities, were conducted in April 2018.

### 7.2.1 Soil Sampling

Eight soil borings were advanced during the Base-wide ESI at Site 7 to further assess whether historical activities at the site contributed to the presence of contamination in soil (**Figure 7-1**). The soil borings were advanced to a depth of 8 feet bgs using the DPT rig. The boring logs for each soil boring are presented in **Appendix B.** No signs of contamination (soil staining or odors) were observed in any of the soil borings. At each boring, surface soil samples were collected from 0 to 0.5 feet bgs and subsurface soil samples were collected from 5 to 8 feet bgs. All eight soil borings were analyzed for PCBs and metals in the surface and subsurface intervals.

## 7.3 Analytical Results

A summary of the constituents detected in surface and subsurface soil during the Base-wide ESI at Site 7 are presented in **Table 7-1** and **7-2** respectively and discussed as follows. The complete analytical results for both the SI and ESI data are presented in **Appendix E**.

### 7.3.1 Surface Soil Analytical Results

A total of eight surface soil samples were collected at Site 7 during the 2018 Base-wide ESI field activities. The results of the surface soil sampling are summarized as follows:

- **PCBs** – One PCB (Aroclor-1260) was detected in surface soil. Detections were found at four sample locations (CBD-S07-DP20, CBD-S07-DP21, CBD-S07-DP22, and CBD-S07-DP27).
- **Metals** – Twenty-two metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in surface soil. One or more metals detections were found in all sample locations.

### 7.3.2 Subsurface Soil Analytical Results

A total of eight subsurface soil samples were collected at Site 7 during the April 2018 Base-wide ESI. The results of the subsurface soil sampling are summarized as follows:

- **PCBs** – One PCB (Aroclor-1260) was detected in subsurface soil at one location (CBD-S07-DP20).

- **Metals** – Twenty-two metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in subsurface soil. Detections of metals were found in all subsurface soil samples.

## 7.4 Human Health Risk Screening

The HHRS for Site 7 was conducted in three steps using the risk-ratio technique (Navy, 2000) described in Section 3.4. Results were reported for the Navy, USEPA, and MDE target risk levels. Table 1 in **Appendix F** lists the samples that were included in the Site 7 HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.4**.

### 7.4.1.1 Surface Soil

The risk-based screening and risk-ratio evaluation for surface soil at Site 7 are provided in **Appendix F.4**, **Tables 2.1 and 2.1a**.

Step 1: Seven constituents were identified as COPCs: Aroclor-1260, arsenic, hexavalent chromium, cobalt, iron, thallium, and vanadium (**Appendix F.4, Table 2.1**).

Step 2: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, the USEPA target risk level of $1 \times 10^{-4}$, and does not exceed the MDE target risk level of $1 \times 10^{-5}$. The target organ HIs range from 0.1 to 0.4 which does not exceed the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 or the MDE or USEPA cumulative target organ target HI of 1. No constituents were identified as COPCs.

Of the constituents that were 100 percent nondetected, none exceeded the RSL. Screening criteria were not available for several constituents.

Exposure to surface soil at Site 7 would not be expected to result in any unacceptable human health risks.

### 7.4.1.2 Subsurface Soil

The risk-based screening and risk-ratio evaluation for subsurface soil at Site 7 are provided in **Appendix F.4**, **Tables 2.2 through 2.2b**.

Step 1: Seven constituents were identified as COPCs: aluminum, arsenic, hexavalent chromium, cobalt, iron, manganese, and thallium.

Step 2: Cumulative cancer risk of $9 \times 10^{-6}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, the MDE target risk level of $1 \times 10^{-5}$, and the USEPA target risk level of $1 \times 10^{-4}$. Target organ HIs range from 0.2 to 0.9. The target organ HI of 0.9 (dermal) is greater than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but less than the MDE and USEPA cumulative target organ target HI of 1. The only constituents contributing to a cumulative target organ HI greater than 0.5 and identified as a COPC is arsenic and thallium. No COPCs were identified based on MDE or USEPA target hazard levels.

Step 3: Cumulative cancer risk of $5 \times 10^{-6}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, the MDE target risk level of $1 \times 10^{-5}$, and the USEPA target risk level of $1 \times 10^{-4}$. The target organ HI is 0.4 (dermal), which is less than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5, and the MDE and USEPA cumulative target organ target HI of 1 (**Appendix F.4, Table 2.2b**). Therefore, no COPCs were identified for subsurface soil. The ProUCL output file for Site 7 subsurface soil is included in **Appendix F.4**.

Of the constituents that were 100 percent nondetected, none exceeded the RSL. Screening criteria were not available for several constituents.

Based on the results of the human health screening, exposure to subsurface soil at Site 7 would not be expected to result in unacceptable human health risks.

## 7.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

No surface soil COPCs were identified for Site 7. All analytes either were not detected, had EPC-based HQs less than one, were consistent with background, were macronutrients, or had a low magnitude of exceedance (**Appendix G**, **Table 6**). Additionally, three detected analytes lacked screening values. As discussed in Section 3.4.6, these analytes were not identified as COPCs. Consequently, no unacceptable risk was identified, and no further ecological investigation or evaluation is recommended for surface soils at Site 7.

## 7.6 Site Characterization

No human health and ecological COPCs were identified in surface and subsurface soil at Site 7. Aroclor-1260 was detected in surface and subsurface soil; however, detections were sporadic across the site. Aroclor-1260 concentrations in surface soil exhibited higher concentrations and detection frequencies than the subsurface soil samples (where PCBs were not detected with the exception of one location). Metals were detected site-wide in surface and subsurface soil during the Base-wide SI and ESI; however, concentrations were generally of lower magnitude in the subsurface soil compared with the surface soil detections.

## 7.7 Findings and Recommendations

### 7.7.1 Findings

PCBs and metals were detected in surface and subsurface soils at Site 7. Based on the HHRS and ERA, no COPCs were identified for surface and subsurface soil, as indicated in **Table 7-0**.

Table 7-3. Human Health and Ecological Risk COPCs for Site 7

| Media | COPCs | |
|---|---|---|
| | Human Health | Ecological |
| Surface Soil | None | None |
| Subsurface Soil | None | N/A |

### 7.7.2 Recommendations

Site 7 is recommended for no further action because there are no human health and ecological risk impacts to soil.

## Table 7-1. Site 7 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S07-DP20 | CBD-S07-DP21 | | CBD-S07-DP22 | CBD-S07-DP23 | CBD-S07-DP24 | CBD-S07-DP25 | CBD-S07-DP26 | CBD-S07-DP27 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S07-SS20-000H | CBD-S07-SS21-000H | CBD-S07-SS21P-000H | CBD-S07-SS22-000H | CBD-S07-SS23-000H | CBD-S07-SS24-000H | CBD-S07-SS25-000H | CBD-S07-SS26-000H | CBD-S07-SS27-000H |
| **Sample Date** | | | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| Aroclor-1260 | 160 | 240 | 110 J- | ***490 J*** | *180 J* | 6.3 J | 6.7 U | 6 U | 6.5 U | 6.5 U | ***260 J*** |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | -- | 7,700 | 5,400 | 5,800 | 6,600 | 2,800 | 4,800 | 3,200 | 3,000 | 4,300 | 5,700 |
| Antimony | 5 | 3.1 | 0.13 J | 0.13 J | 0.084 J | 0.063 J | 0.19 U | 0.16 U | 0.13 U | 0.15 U | 0.14 U |
| Arsenic | 6.8 | 0.68 | **2.6** | **2.5** | **2.9** | **2** | **2.8** | **1.6** | **2.2** | **2.6** | **3.5** |
| Barium | 110 | 1,500 | 16 | 27 | 28 | 13 | 14 | 8.4 | 12 | 19 | 27 |
| Beryllium | 2.5 | 16 | 0.3 J | 0.37 J | 0.47 J | 0.3 J | 0.28 J | 0.22 J | 0.25 J | 0.4 J | 0.38 J |
| Cadmium | 32 | 7.1 | 0.14 U | 0.18 J | 0.19 J | 0.17 J | 0.19 U | 0.16 U | 0.13 U | 0.096 J | 0.31 |
| Calcium | -- | -- | 341 | 2,010 | 1,980 | 515 | 361 | 171,000 | 89,000 | 397,000 | 5,870 |
| Chromium | 10 | 0.3 | ***26*** | ***12 J*** | ***19 J*** | **6.7** | **7.1** | **9.3** | **5.9** | **9.2** | ***21*** |
| Cobalt | 13 | 2.3 | 1.4 | **2.5** | **2.8** | 1.6 | **2.4** | 1.1 | 0.93 | **2.4** | 2.2 |
| Copper | 70 | 310 | 4.8 | 15 J | 9.7 J | 2.6 | 3.6 | 2.6 | 2.4 | 2.8 | 8.3 |
| Iron | -- | 5,500 | **9,100** | **8,300** | **8,800** | **7,400** | **8,300** | 5,200 | 4,400 | **7,500** | **13,000** |
| Lead | 120 | 400 | 82 | 11 | 11 | 4 | 6.4 | 2.7 | 10 | 7.1 | 47 |
| Magnesium | -- | -- | 494 | 721 J | 1,220 J | 476 | 498 | 276,000 | 357,000 | 626,000 | 3,020 |
| Manganese | 220 | 180 | 40 | 61 | 48 | 71 | 66 | 27 | 34 | 94 | 73 |
| Nickel | 38 | 150 | 3.4 | 8.7 | 11 | 2.5 | 2.8 | 1.7 | 2.6 | 6.4 | 24 |
| Potassium | -- | -- | 308 | 488 | 605 | 379 | 499 | 259,000 | 273,000 | 431,000 | 916 |
| Selenium | 0.52 | 39 | *0.57* | *0.85* | *1* | 0.46 J | *0.62 J* | 0.35 J | 0.49 J | *0.78* | *1* |
| Silver | 560 | 39 | 0.14 J | 0.18 U | 0.19 U | 0.063 J | 0.19 U | 0.16 U | 0.13 U | 0.15 U | 0.14 U |
| Sodium | -- | -- | 8.8 J+ | 19.9 J+ | 18.5 J+ | 5.9 U | 6.5 U | 4,310 | 2,710 | 4,880 | 58.4 J+ |
| Thallium | 0.05 | 0.078 | ***0.11 J*** | ***0.16 J*** | ***0.24 J*** | ***0.088 J*** | 0.19 U | 0.16 U | ***0.093 J*** | ***0.12 J*** | ***0.11 J*** |
| Vanadium | 60 | 39 | 11 | 13 | 15 | 7.1 | 12 | 6.9 | 10 | 28 | ***120*** |
| Zinc | 120 | 2,300 | 15 | 31 | 34 | 16 | 34 | 5.8 | 16 | 19 | *220* |

#REF!

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

## Table 7-2. Site 7 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S07-DP20 | CBD-S07-DP21 | CBD-S07-DP22 | CBD-S07-DP23 | CBD-S07-DP24 | CBD-S07-DP25 | | CBD-S07-DP26 | CBD-S07-DP27 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-S07-SB20-0508 | CBD-S07-SB21-0508 | CBD-S07-SB22-0508 | CBD-S07-SB23-0508 | CBD-S07-SB24-0508 | CBD-S07-SB25-0508 | CBD-S07-SB25P-0508 | CBD-S07-SB26-0508 | CBD-S07-SB27-0508 |
| **Sample Date** | | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| Aroclor-1260 | 240 | 54 | 15 U | 13 U | 7.4 U | 7 U | 6.3 U | 6.5 UJ | 6.3 U | 12 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | 7,700 | 4,800 | **8,000** | 5,100 | 7,100 | 6,100 | 5,200 | 4,500 | 3,700 | **9,300** |
| Antimony | 3.1 | 0.068 J | 0.19 U | 0.16 U | 0.14 J | 0.14 U | 0.13 U | 0.15 U | 0.14 U | 0.088 J |
| Arsenic | 0.68 | **1.4** | **4.4** | **2.1** | **3.8** | **2.8** | **5.5 J** | **2.3 J** | **2.9** | **1.9** |
| Barium | 1,500 | 16 | 21 | 11 | 35 J+ | 16 | 28 | 21 | 16 | 51 |
| Beryllium | 16 | 0.24 J | 1.3 | 0.41 J | 0.64 | 0.31 J | 0.89 | 0.42 J | 0.39 J | 0.83 |
| Cadmium | 7.1 | 0.15 U | 0.49 | 0.16 U | 0.18 J | 0.14 U | 0.18 J | 0.15 U | 0.13 J | 0.12 J |
| Calcium | -- | 417 | 1,340 | 674 | 929 | 330,000 | 390,000 J | 116,000 J | 531,000 | 847 |
| Chromium | 0.3 | **14** | **28** | **18** | **14** | **9.7** | **9.4** | **12** | **7.2** | **14** |
| Cobalt | 2.3 | 1.2 | **3.6** | 0.92 | **3.1** | 1.6 | 2 | 2.1 | 1.8 | **4** |
| Copper | 310 | 2.7 | 7 | 2.4 | 25 J | 5.9 | 2.9 | 3.1 | 3.3 | 1.5 |
| Iron | 5,500 | 4,700 | **23,000** | **11,000** | **12,000** | **8,400** | **11,000 J** | **6,900 J** | **7,400** | **9,800** |
| Lead | 400 | 4.2 | 8.5 | 6.5 | 21 | 6.3 | 3.4 J | 5.5 J | 8.7 | 4.6 |
| Magnesium | -- | 576 | 2,110 | 1,200 | 946 | 528,000 | 641,000 | 480,000 | 494,000 | 1,100 |
| Manganese | 180 | 20 | 34 | 12 | 160 | 57 | 74 J | 130 J | 73 | **190** |
| Nickel | 150 | 3.1 | 7.6 | 2.1 | 6.3 | 3.2 | 6.2 J | 4.3 J | 3.8 | 11 |
| Potassium | -- | 382 | 1,240 | 811 | 576 | 399,000 | 349,000 | 292,000 | 315,000 | 554 |
| Selenium | 39 | 0.89 | 1.5 | 0.56 J | 1.3 | 0.72 | 1.1 | 0.93 | 0.7 | 1.7 |
| Silver | 39 | 0.15 U | 0.19 U | 0.16 U | 0.16 J | 0.14 U | 0.13 U | 0.15 U | 0.14 U | 0.077 J |
| Sodium | -- | 7.2 U | 216 | 13.8 J+ | 13.7 J+ | 6,640 | 4,830 | 6,630 | 4,410 | 138 |
| Thallium | 0.078 | **0.19 J** | **0.58** | **0.13 J** | **0.18 J** | **0.09 J** | **0.13 J** | **0.1 J** | **0.1 J** | **0.21 J** |
| Vanadium | 39 | 9.5 | 21 | 9.8 | 17 | 12 | 12 | 9.7 | 9.3 | 13 |
| Zinc | 2,300 | 11 | 120 | 17 | 36 | 13 | 22 | 18 | 18 | 40 |

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure07-01_NRL-CBD_Site7.mxd 2/19/2019 jcarr3

● ESI SS/SB Location for PCBs and Metals

● SI SS/SB Location (for DP01 - DP09)
SI SB Location (for DP10 - DP19)

▭ Study Area Boundary

Imagery: Calvert County, MD - 2017

Notes:
SS = surface soil
SB = soil boring
PCBs = polychlorinated biphenyls
ESI = Expanded Site Inspection
SI = Site Inspection

N

0 40 80
Feet
1 inch = 80 feet

**Figure 7-1**
**Site 7 Road Oil Application**
**Sample Locations**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach. Maryland*

ch2m:

SECTION 8

# Site 9 – Photo-processing Waste Discharge

## 8.1 Site Description

Site 9, also known as "Photo-processing Waste Discharge," is associated with a photography laboratory that was housed inside former Building 43 (**Figure 2-1**). Waste water from the photo-processing laboratory reportedly was disposed of through a drain that discharged to the ground immediately outside the building (NEESA, 1984). Recent discussions with current base personnel indicated that the former photograph laboratory was located in the southeastern corner of Building 43. This operation reportedly occurred from the late 1950s until the early 1960s and from the late 1960s until 1975 (NEESA, 1984). The photograph laboratory was used once or twice during each year of operation, generating 10 to 15 gallons of waste solution (e.g. sodium thiosulfate and hydroquinone) per event (NEESA, 1984). For the purpose of defining a site boundary, a 20-foot boundary around the former building 43 was established, which likely would include the area of the direct discharge. The site boundary around the former Building 43 is 8,486 $ft^2$ in size. The building has been demolished and the site is relatively level and covered with grass with an approximate maximum elevation of 128 feet amsl. The road network that surrounds the former building is still intact.

## 8.2 Investigation Summary

The Site 9 Base-wide ESI field activities, consisting of soil sampling activities, were conducted in April 2018.

### 8.2.1 Soil Sampling

Six soil borings were advanced during the Base-wide ESI at Site 9 to further assess whether historical activities at the site contributed to the presence of contamination in soil (**Figure 8-1**). The soil borings were advanced to a depth of 10 feet bgs using the DPT. The boring logs for each soil boring are presented in **Appendix B.** No signs of contamination (soil staining or odors) were observed in any of the soil borings. At each boring, surface soil samples were collected from 0 to 0.5 foot bgs and subsurface soil samples were collected from 8 to 10 feet bgs. All six soil borings were analyzed for SVOCs and metals in the surface and subsurface intervals.

## 8.3 Analytical Results

A summary of the constituents detected in surface and subsurface soil during the Base-wide ESI at Site 9 are presented in **Table 8-1** and **Table 8-2** and discussed as follows. The complete analytical results for both the SI and ESI data are presented in **Appendix E**.

### 8.3.1 Surface Soil Analytical Results

A total of six surface soil samples were collected at Site 9 during the April 2018 Base-wide ESI. The results of the surface soil sampling are summarized as follows:

- **SVOCs** – Thirteen SVOCs (acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene) were detected in surface soil. Detections were found in surface soil at five locations (CBD-S09-DP05, CBD-S09-DP06, CBD-S09-DP07, CBD-S09-DP08, and CBD-S09-DP10).
- **Metals** – Twenty-three metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in surface soil. Detections of metals were found in all surface soil samples.

### 8.3.2 Subsurface Soil Analytical Results

A total of six subsurface soil samples were collected at Site 9 during the 2018 Base-wide ESI field activities. The results of the subsurface soil sampling are summarized as follows:

- **SVOCs** – One SVOCs (phenanthrene) was detected in subsurface soil at CBD-S09-DP08.
- **Metals** – Twenty-two metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) were detected in subsurface soil. Detections of metals were found in all subsurface soil samples.

## 8.4 Human Health Risk Screening

The HHRS for Site 9 was conducted in three steps using the risk-ratio technique (Navy, 2000) described in detail in Section 3.4. Results were reported for the Navy, USEPA, and MDE target risk levels. Table 1 in **Appendix F** lists the samples that were included in the Site 9 HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.5**.

#### 8.4.1.1 Surface Soil

The risk-based screening and risk-ratio evaluation for surface soil at Site 9 are provided in **Appendix F.5**, **Tables 2.1 and 2.1a**.

Step 1: Seven constituents were identified as COPCs: aluminum, arsenic, hexavalent chromium, cobalt, iron, manganese, and thallium.

Step 2: Cumulative cancer risk of $8 \times 10^{-6}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, the MDE target risk level of $1 \times 10^{-5}$, and the USEPA target risk level of $1 \times 10^{-4}$. The target organ HI range is 0.09 to 0.3; which, is less than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 and the MDE and USEPA cumulative target organ target HI of 1. No constituents were identified as COPCs.

Of the constituents that were 100 percent nondetected, the maximum detection limit of a few SVOCs exceeded their respective RSL. However, it is unlikely that if these SVOCs are present in surface soil at concentrations below the detection limits they would contribute significantly to site risks. Screening criteria were not available for several constituents.

Exposure to surface soil at Site 9 would not be expected to result in any unacceptable human health risks.

#### 8.4.1.2 Subsurface Soil

The risk-based screening and risk-ratio evaluation for subsurface soil at Site 9 are provided in **Appendix F.5**, **Tables 2.2 through 2.2b**.

Step 1: Seven constituents were identified as COPCs: aluminum, arsenic, hexavalent chromium, cobalt, iron, manganese, and thallium.

Step 2: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, less than the USEPA target risk level of $1 \times 10^{-4}$; and does not exceed the MDE target risk level of $1 \times 10^{-5}$. Cumulative target organ HIs ranged from 0.2 to 2; two target organ HI values (respiratory and thyroid) are greater than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 and the MDE and USEPA cumulative target organ target HI of 1. The constituents contributing to a cumulative target organ HI greater than 0.5 (and 1) and identified as a COPC are hexavalent chromium and cobalt. Arsenic and thallium contribute to a target organ HI greater than the Navy cumulative target organ (dermal) HI risk-ratio screening benchmark of 0.5 but less the MDE and USEPA cumulative target organ target HI of 1.

Step 3: Cumulative cancer risk of $1 \times 10^{-5}$; this value is less than the Navy risk-ratio screening benchmark of $5 \times 10^{-5}$, less than the USEPA target risk level of $1 \times 10^{-4}$, and does not exceed the MDE target risk level of $1 \times 10^{-5}$.

Cumulative target organ HIs are 1 (respiratory and thyroid); the target organ HIs exceeds than the Navy cumulative target organ HI risk-ratio screening benchmark of 0.5 but not the MDE and USEPA cumulative target organ target HI of 1. Cobalt contributes to the cumulative target organ HI greater than 0.5; therefore, cobalt is identified as a COPC based on the Navy risk-ratio screening benchmark HI. Hexavalent chromium also contributes to the respiratory target organ , however, the HI from hexavalent chromium alone is less than 0.01, and hexavalent chromium is not considered a COPC. Since cobalt was not identified as a COPC based on the MDE benchmark, cobalt is not retained as a COPC. The ProUCL output file for Site 9 subsurface soil is included in **Appendix F.5**.

The maximum detected concentration of cobalt exceeds its site-specific subsurface soil BTV. This indicates that concentrations in soil in Site 9 subsurface soil are not consistent with concentrations in unimpacted site soils. (**Appendix F.5**, **Table 2.2c**).

Of the constituents that were 100 percent nondetected, a few SVOCs had maximum detection limits that slightly exceeded their respective RSL. Because of the low level of exceedances, it is unlikely that if these SVOCs are present in subsurface soil at concentrations less than the detection limits they would contribute significantly to site risks. Screening criteria were not available for several constituents.

Exposure to subsurface soil at Site 9 would not result in unacceptable human health risks based on the MDE benchmark level.

### Groundwater

Groundwater samples were not collected during the ESI, however, groundwater samples were collected during the SI and evaluated in the HHRS included in the SI report. The SI identified thallium as a COPC in groundwater. The maximum detected concentrations of thallium in the Site 9 groundwater in SI groundwater samples (0.29 μg/L in the unfiltered samples and 1 μg/L in the filtered samples) are below the current BTVs for thallium in both unfiltered and filtered groundwater (2.12 μg/L for unfiltered groundwater and 1.94 μg/L for filtered groundwater).

## 8.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

No surface soil COPCs were identified for Site 9. All analytes either were not detected, had EPC-based HQs less than one, were consistent with background, were macronutrients, or had a low magnitude of exceedance (**Appendix G**, **Table 7**). Additionally, six detected analytes lacked screening values. As discussed in Section 3.4.6, these analytes were not identified as COPCs. Consequently, no unacceptable risk was identified, and no further ecological investigation or evaluation is recommended for surface soils at Site 9.

## 8.6 Site Characterization

No ecological or human health COPCs were identified in surface and subsurface soil. SVOCs were detected in surface and subsurface soil; however, detections were mostly related to PAHs. SVOC concentrations in surface soil exhibited higher concentrations and detection frequencies than the subsurface soil samples (where SVOCs were not detected except at one location).

# 8.7 Findings and Recommendations

## 8.7.1 Findings

SVOCs and metals were detected in surface and subsurface soils at Site 9. Based on the HHRS and ERA, the constituents presented in **Table 8-3** may present potentially unacceptable risk and were retained as COPCs for Site 9.

Table 8-3. Human Health and Ecological Risk COPCs for Site 9

| Media | COPCs | |
|---|---|---|
| | **Human Health** | **Ecological** |
| Surface Soil | None | None |
| Subsurface Soil | None | N/A |
| Groundwater | None | N/A |

## 8.7.2 Recommendations

While the results of the Expanded SI support the recommendation for no further action, during review of this document the Navy acknowledges MDE’s comment that sodium thiosulfate and hydroquinone specifically has not been sampled or evaluated at Site 9.  Therefore, the Navy concurs with the recommendation to conduct additional investigation as part of the Expanded SI.

Table 8-1. Site 9 Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S09-DP05 | CBD-S09-DP06 | | CBD-S09-DP07 | CBD-S09-DP08 | CBD-S09-DP09 | CBD-S09-DP10 |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-S09-SS05-000H | CBD-S09-SS06-000H | CBD-S09-SS06P-000H | CBD-S09-SS07-000H | CBD-S09-SS08-000H | CBD-S09-SS09-000H | CBD-S09-SS10-000H |
| **Sample Date** | | | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| Acenaphthene | -- | 360,000 | 1.4 U | 14 U | 13 U | 11 U | 0.6 J | 45 U | 1.1 U |
| Acenaphthylene | -- | -- | 1.1 J | 14 U | 13 U | 3.6 J | 2.6 J | 45 U | 1.1 U |
| Anthracene | -- | 1,800,000 | 2 J | 56 U | 52 U | 46 U | 2.6 J | 180 U | 4.6 U |
| Benzo(a)anthracene | -- | 1,100 | 11 U | 56 U | 52 U | 46 U | 11 | 180 U | 4.6 U |
| Benzo(a)pyrene | -- | 110 | 15 J | 32 J | 52 U | 33 J | 16 | 180 U | 1.8 J |
| Benzo(b)fluoranthene | -- | 1,100 | 27 U | 87 U | 80 U | 70 U | 21 | 280 U | 7.1 U |
| Benzo(g,h,i)perylene | -- | -- | 14 J | 32 J | 80 U | 35 J | 16 | 280 U | 7.1 U |
| Chrysene | -- | 110,000 | 16 U | 56 U | 52 U | 46 U | 12 | 180 U | 4.6 U |
| Dibenz(a,h)anthracene | -- | 110 | 8.7 U | 87 U | 80 U | 70 U | 3.1 J | 280 U | 7.1 U |
| Fluoranthene | -- | 240,000 | 20 U | 56 U | 52 U | 46 U | 15 | 180 U | 4.6 U |
| Indeno(1,2,3-cd)pyrene | -- | 1,100 | 16 J | 87 U | 80 U | 29 J | 17 | 280 U | 7.1 U |
| Phenanthrene | -- | -- | 9 J | 87 U | 80 U | 70 U | 6.3 J | 280 U | 7.1 U |
| Pyrene | -- | 180,000 | 17 J | 43 J | 80 U | 40 J | 14 | 280 U | 7.1 U |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | -- | 7,700 | 2,900 | **8,100** | 6,200 | 6,600 | 6,700 | 3,700 | 3,000 |
| Antimony | 5 | 3.1 | 0.15 J | 0.1 J | 0.12 J | 0.15 U | 0.098 J | 0.14 U | 0.17 U |
| Arsenic | 6.8 | 0.68 | **1.1** | **2.9** | **2.4** | **2.1** | **3** | **1.2** | **1** |
| Barium | 110 | 1,500 | 11 | 60 J | 39 J | 25 | 42 | 11 | 8.9 |
| Beryllium | 2.5 | 16 | 0.17 J | 0.5 J | 0.41 J | 0.22 J | 0.45 J | 0.27 U | 0.35 U |
| Cadmium | 32 | 7.1 | 0.14 J | 0.34 | 0.3 J | 0.11 J | 0.17 J | 0.14 U | 0.16 J |
| Calcium | -- | -- | 2,130 | 3,870 | 2,600 | 2,470 | 3,230 | 7,110 | 7,340 |
| Chromium | 10 | 0.3 | **9.7** | ***20*** | ***16*** | ***13*** | ***20*** | **7.8** | **8.2** |
| Cobalt | 13 | 2.3 | 1.4 | **6.1** | **5.1** | 1.9 | **5.7** | 0.71 | 0.72 |
| Copper | 70 | 310 | 8.2 | 13 | 11 | 4.8 | 16 | 3.2 | 3.7 |
| Iron | -- | 5,500 | 3,900 | **15,000 J** | **12,000 J** | **15,000** | **16,000** | **5,800** | 4,900 |
| Lead | 120 | 400 | 37 | 20 | 18 | 7 | 17 | 2.9 | 7.7 |
| Magnesium | -- | -- | 999 | 2,950 | 2,200 | 951 | 2,900 | 674 | 606 |
| Manganese | 220 | 180 | 39 | ***230*** | 170 | 65 | 170 | 29 | 21 |
| Mercury | 0.05 | 2.3 | *0.11 J* | *0.14 J* | 0.16 U | 0.15 U | 0.17 U | 0.14 U | 0.17 U |
| Nickel | 38 | 150 | 6.6 | 22 | 19 | 6.7 | 23 | 2.9 | 2.6 |
| Potassium | -- | -- | 419 | 1,320 | 1,210 | 516 | 1,460 | 230 | 309 |
| Selenium | 0.52 | 39 | *0.97* | *1.1* | *0.96* | 0.49 J | *0.98* | 0.31 J | 0.34 J |
| Silver | 560 | 39 | 1.3 | 0.079 J | 0.075 J | 0.15 U | 0.11 J | 0.14 U | 0.16 J |
| Sodium | -- | -- | 143 | 49.1 J | 28.9 J | 23.2 J+ | 22.4 J+ | 20.2 J+ | 17.6 J+ |
| Thallium | 0.05 | 0.078 | *0.078 J* | ***0.095 J*** | ***0.083 J*** | 0.15 U | *0.077 J* | 0.14 U | 0.17 U |
| Vanadium | 60 | 39 | 9.5 | 24 | 18 | 19 | 23 | 11 | 8.9 |
| Zinc | 120 | 2,300 | 37 | 51 | 48 | 16 | 38 | 6.1 | 27 |

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

ESVs are provided for Total LMW PAHs and Total HMW PAHs

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram

## Table 8-2. Site 9 Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-S09-DP05 | CBD-S09-DP06 | CBD-S09-DP07 | CBD-S09-DP08 | CBD-S09-DP09 | CBD-S09-DP10 | |
|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-S09-SB05-0810 | CBD-S09-SB06-0810 | CBD-S09-SB07-0810 | CBD-S09-SB08-0810 | CBD-S09-SB09-0810 | CBD-S09-SB10-0810 | CBD-S09-SB10P-0810 |
| **Sample Date** | | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | |
| | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | |
| Phenanthrene | -- | 11 U | 8.6 U | 7.8 U | 6 J | 8.8 U | 9.4 U | 8.6 U |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | 7,700 | 5,300 | 3,900 | 3,100 | **15,000** | 5,500 | 6,200 | 6,300 |
| Antimony | 3.1 | 0.17 U | 0.17 U | 0.097 J | 0.17 U | 0.2 U | 0.19 U | 0.18 U |
| Arsenic | 0.68 | **4.6** | **3.2** | **0.93** | **2** | **4.4** | **5.8 J** | **3.2 J** |
| Barium | 1,500 | 10 | 9.1 | 4.9 | 14 | 6.5 | 8.5 J | 53 J |
| Beryllium | 16 | 0.5 J | 0.33 J | 0.36 U | 0.72 | 0.4 J | 0.46 J | 0.53 J |
| Cadmium | 7.1 | 0.21 J | 0.3 J | 0.18 U | 0.14 J | 0.15 J | 0.19 U | 0.18 U |
| Calcium | -- | 1,680 | 1,090 | 1,100 | 1,140 | 1,460 | 1,320 | 1,430 |
| Chromium | 0.3 | **23** | **21** | **16** | **27** | **23** | **24** | **24** |
| Cobalt | 2.3 | **5.7** | 2.1 | 0.49 | **2.7** | **3.5** | **3.7** | **3.3** |
| Copper | 310 | 3.3 | 3.1 | 1.7 | 3.6 | 3.1 | 3 | 2.9 |
| Iron | 5,500 | **18,000** | **13,000** | 4,300 | **10,000** | **16,000** | **15,000 J** | **11,000 J** |
| Lead | 400 | 3.7 | 3 | 2 | 3.6 | 3.1 | 4.1 J | 9.2 J |
| Magnesium | -- | 2,380 | 1,650 | 1,120 | 2,110 | 2,180 | 2,120 | 2,200 |
| Manganese | 180 | **200** | 18 | 2 | 14 | 31 | 40 | 40 |
| Nickel | 150 | 9.8 | 5.6 | 1.1 | 12 | 11 | 5.9 | 6.1 |
| Potassium | -- | 1,300 | 1,120 | 606 | 1,120 | 1,220 | 1,140 | 1,320 |
| Selenium | 39 | 0.4 J | 1 | 0.49 J | 1.7 | 0.44 J | 1.4 J | 2.3 J |
| Silver | 39 | 0.17 U | 0.17 U | 0.18 U | 0.17 U | 0.16 J | 0.19 U | 0.18 U |
| Sodium | -- | 92.5 | 71.3 J+ | 78.2 | 120 | 66.5 J+ | 69.1 J+ | 73.9 |
| Thallium | 0.078 | **0.34 J** | **0.29 J** | **0.079 J** | **0.31 J** | **0.23 J** | **0.17 J** | **0.31 J** |
| Vanadium | 39 | 12 | 8.9 | 6.6 | 10 | 12 | 13 | 12 |
| Zinc | 2,300 | 63 | 53 | 14 | 82 | 100 | 62 | 65 |

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

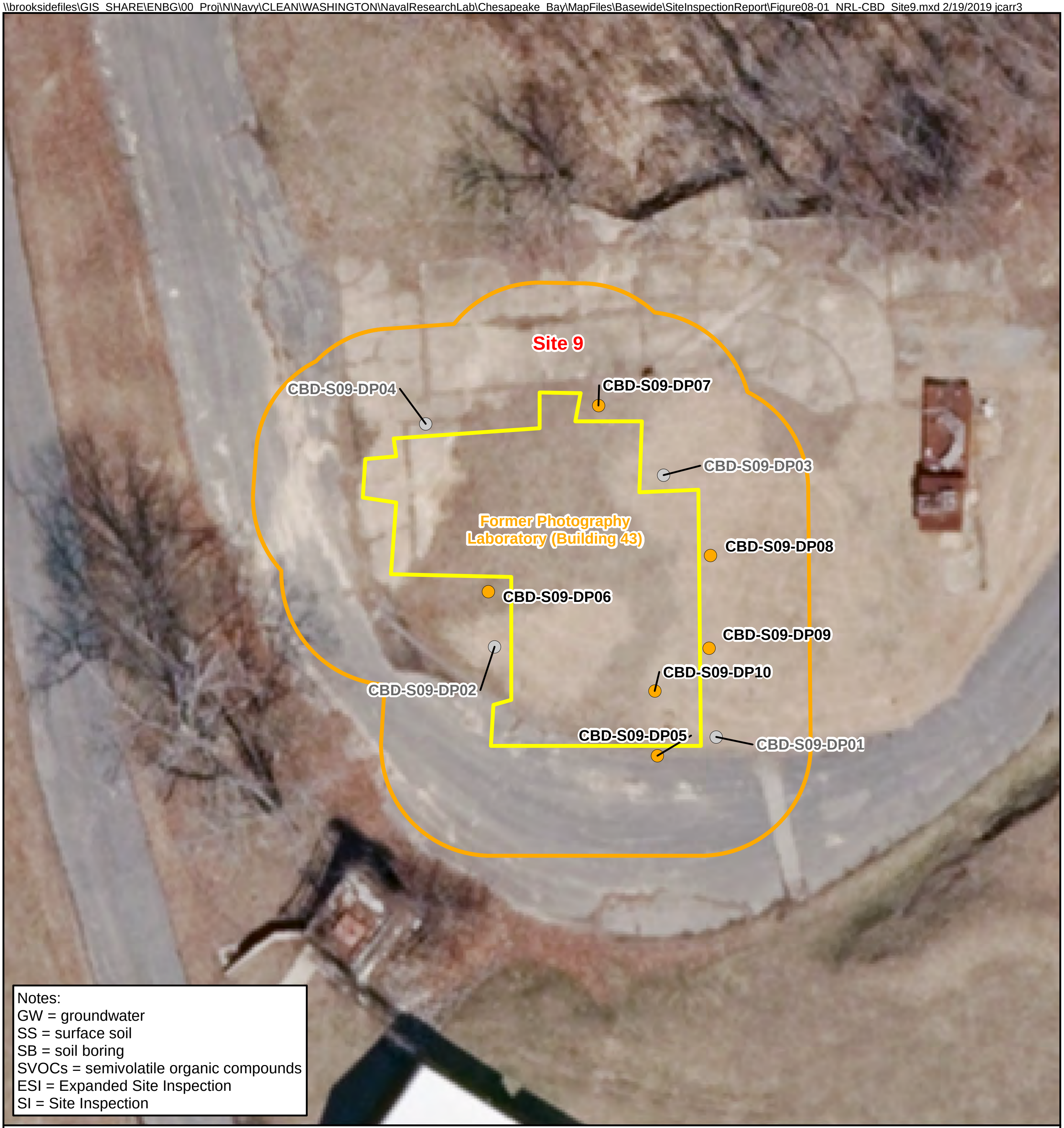
R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

UG/KG - Micrograms per kilogram



Notes:
GW = groundwater
SS = surface soil
SB = soil boring
SVOCs = semivolatile organic compounds
ESI = Expanded Site Inspection
SI = Site Inspection

**Legend**

- ● ESI SS/SB Location for SVOCs and Metals
- ○ SI SS/SB Location (for DP01, DP02, DP04)
  SI SS/SB/GW Location (for DP03)
- ▭ Footprint of former Building 43
- ▭ Site Boundary

Imagery: Calvert County, MD - 2014

**Figure 8-1**
**Site 9 Photoprocessing Waste Discharge Sample Locations**
Base-Wide Expanded Site Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m:

# AOC D – Water Tower

## 9.1 Site Description

AOC D, known as the water tower, is located on the western portion of NRL-CBD adjacent to Site 8 (**Figure 2-1**). The construction of the water tower dates to 1953 and currently remains onsite. The water tower has a reported capacity of 400,000 gallons for use as part of the potable water supply for the facility. Although there are no documented releases from this area, it is assumed that the ground surface below the water tower may have been impacted by lead due to lead-based paint migrating to the ground during maintenance on tower surface with lead-based paint, and from paint that has weathered over time. Recent documentation obtained from NRL-CBD shows that lead was detected at 148 mg/kg in paint chips obtained from the water tower in 2012. The document states that the last time the water tower was painted was in 1994, suggesting that the lead-based paint has been encapsulated by the more recent paint as lead-based paint use was banned in housing and other building settings in 1978. The condition of the paint surface on the water tower was noted as being in average condition with some localized areas of paint chipping or delaminating (Mumford-Bjorkman Associates, Inc., 2012).

## 9.2 Investigation Summary

The AOC D Base-wide ESI field activities, consisting of soil sampling and XRF activities, were conducted in April 2018.

### 9.2.1 Soil Sampling

As noted in Section 3.1.4, a 100-foot by 100-foot area at AOC D was marked-out with wooden stakes where the water tower sits at the center of this area. Twenty-five 20-foot by 20-foot XRF grids were established inside this 100-foot by 100-foot area (**Figure 9-1**). A five-point composite soil sample (at the center and at each of the corners of the XRF grid) was collected for both the surface (0 to 0.5 feet bgs) and subsurface (1.5 to 2 feet bgs) soil intervals. Each composite sample was then analyzed three times using the XRF to account for variability within the sample while deriving an average detected concentration for the sample.

A total of 125 soil borings were advanced during the Base-wide ESI at AOC D to further access whether the lead-based paint on the water tower contributed to the presence of contamination in soil. The soil borings were advanced to a depth of 2 feet bgs using hand auger. No signs of contamination (soil staining or odors) were observed in any of the soil borings. Using a random number generator program to pre-select the XRF grids where soil samples were to be sent to the laboratory for confirmation (discussed in **Appendix J**), 10 soil borings were analyzed for lead in the surface and subsurface intervals.

## 9.3 Analytical Results

A summary of the lead detected in surface and subsurface soil during the Base-wide ESI at AOC D are presented in **Table 9-1** and **Table 9-2** respectively and discussed as follows. The complete analytical results for both the SI and ESI data are presented in **Appendix E**.

### 9.3.1 XRF Surface and Subsurface Soil Screening Results

A total of 25 surface and 25 subsurface soil samples were collected at AOC D during the 2018 Base-wide ESI field activities. The XRF screening results are shown in **Figures 9-2 and 9-3** and in **Appendix J**.

- **Surface Soil** – Average lead screening values ranged from 101.6 to 1,172.3 mg/kg in surface soil.
- **Subsurface Soil** – Average lead screening values ranged from 13.2 to 180 mg/kg in subsurface soil.

### 9.3.2 Laboratory Surface and Subsurface Soil Analytical Results

A total of ten predetermined surface and ten predetermined subsurface soil samples were sent to the laboratory and analyzed for lead. The results are summarized as follows.

- **Surface Soil** – Detected lead concentrations ranged from 100 to 2,800 mg/kg in surface soil.
- **Subsurface Soil** – Detected lead concentrations ranged from 7.8 to 160 mg/kg in subsurface soil.

### 9.3.3 Statistical Analysis of XRF Results

Statistical analysis of XRF screening results was performed to determine if the XRF data and laboratory data were statistically equivalent at a 99% confidence level. EPA test method SW-846 6200 (see **Appendix E**) details the methodology for the regression analysis. Two regression models, linear and parametric (i.e., log-transformed), were evaluated for the analysis. The linear regression model showed that the XRF screening data do not meet the assumption of equal variances. In accordance with EPA method 6200, it states that “if the measured concentrations span more than one order of magnitude, the data should be log-transformed to standardize the variance which is proportional to the magnitude of measurement”. The XRF screening results fall within this category and the log-transformed regression model was used in the statistical analysis.

The log-transformed data showed a correlation coefficient (i.e., R-value) of 0.94 (see **Appendix J**). Central tendency tests indicate that the log-transformed data are statistically equivalent at a 99% confidence level. A plot of the log-transformed data for XRF screening concentrations against the laboratory analyzed concentrations showed a 250 parts-per-million (ppm) of lead from XRF would correspond to less than 400 ppm of lead from the laboratory. In other words, an XRF reading of 250 ppm of lead at AOC D corresponds to the analytical concentration of less than 400 ppm of lead at AOC D. A closer look of the correlation resulted in a 300 ppm of lead from XRF reading to less than 400 ppm of lead from the laboratory result at AOC D (see **Appendix J**).

Further evaluation of the XRF to laboratory correlation determined that the remaining 15 surface soil and 15 subsurface soil samples at AOC D did not need to be analyzed by the laboratory because the XRF results were of high confidence.

## 9.4 Human Health Risk Screening

The HHRS for AOC D was conducted using the risk-ratio technique (Navy, 2000) described in detail in Section 3.4. Table 1 in **Appendix F** lists the samples that were included in the AOC D HHRS. An overview of the various potential receptors and exposure pathways addressed in the HHRS is discussed in Section 3.4.1. The supporting tables for the evaluation are presented in **Appendix F.6**.

#### 9.4.1.1 Surface Soil

The risk-based screening evaluation for surface soil at AOC D is provided in **Appendix F.6**, **Table 2.1**. Lead was the only constituent analyzed for in surface soil samples.

Step 1: Lead was detected at concentrations in surface soil samples greater than the screening level and was identified as a COPC.

As discussed in Section 3.4, exposure to lead in surface soil by a potential future child resident was evaluated using the IEUBK model. The IEUBK model was run using the average lead surface soil concentration (1,306 mg/kg). The output from the IEUBK model is provided in **Appendix F.6, Table 2.1a, Figure Lead.2**, and the RAGS D IEUBK Lead Worksheet identified as **Table Lead.2**. The predicted geometric mean blood lead level for a young child exposed to AOC D surface soil is 11.7 μg/L with 63 percent of the population potentially experiencing concentrations exceeding 10 μg/L. This value is greater than the current blood lead goal as described in the 1994 OSWER directive (USEPA, 1994) of no more than 5 percent of children exceeding 10 μg/dL blood lead. Since the IEUBK model determined that exposure to lead in surface soil by a child resident, would result in a blood lead level above the current blood lead goal, exposure to lead in surface soil by future industrial workers was evaluated using the ALM.

The ALM was run using the average lead surface soil concentration (1,306 mg/kg). The output from the ALM is provided in **Appendix F.6, Table 2.1b** and the RAGS D IEUBK Lead Worksheet identified as Table Lead.3. The probabilities that the fetal blood lead levels exceed 10 µg/dL range from 0.3 to 5.4 percent. The upper end of this range of values slightly exceeds the current blood lead goal as described in the 1994 OSWER directive (USEPA, 1994) of no more than 5 percent of children (fetuses of exposed women) exceeding 10 µg/dL blood lead.

Exposure to surface soil at AOC D may result in unacceptable human health risks associated with lead.

### 9.4.1.2 Subsurface Soil

The risk-based screening evaluation for subsurface soil at AOC D is provided in **Appendix F.6**, **Table 2.2**. Lead was the only constituent analyzed for in subsurface soil samples.

Step 1: Lead was detected at concentrations in subsurface soil samples below the screening level and was not identified as a COPC.

Exposure to subsurface soil at AOC D would not be expected to result in unacceptable human health risks associated with lead, based on potential human exposure and risk.

## 9.5 Ecological Risk Screening

The ERA approach for surface soil is described in detail in Section 3.5. An overview of the various potential receptors and exposure pathways addressed in the ERA is discussed in Section 3.5.2. The supporting tables for the evaluation are presented in **Appendix G**.

Lead was the only analyte evaluated at AOC D. Lead was retained as a COPC based on a maximum-based HQ of 25 and an EPC-based HQ of 15 (**Appendix G**, **Table 8**). Additionally, all detected concentrations exceeded the 95% UTL for Soil Grouping 3 (Tetra Tech, 2015). Consequently, exposure to surface soil at AOC D may result in unacceptable ecological risk associated with lead and further evaluation of risk or consideration of remediation is recommended.

## 9.6 Site Characterization

**Figure 9-4** shows the analytical results of lead in surface soil at AOC D. Lead was determined to be a human health and ecological COPC in surface soil. Lead concentrations appear to be the highest in grids slightly north and east of the water tower. While areas with higher lead concentrations were mostly localized within the 100-foot by 100-foot area, elevated concentrations in Grid 7 suggest that further sampling may need to be conducted at step-off locations to the north of Grid 7 in order to fully delineate lead in surface soil at the site.

## 9.7 Findings and Recommendations

### 9.7.1 Findings

Based on the HHRS and ERA, lead may present potentially unacceptable risk and was retained as a COPC for AOC D, as indicated in **Table 9-3**.

Table 9-3. Human Health and Ecological Risk COPCs for AOC D

| **Media** | **COPCs** | |
|---|---|---|
| | **Human Health** | **Ecological** |
| Surface Soil | Lead | Lead |
| Subsurface Soil | none | N/A |

### 9.7.2 Recommendations

AOC D is recommended for further evaluation based upon potential unacceptable human health and ecological risks associated with lead in surface soil.

Table 9-1. AOC D Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-AOD-DP05 | CBD-AOD-DP07 | CBD-AOD-DP10 | CBD-AOD-DP11 | | CBD-AOD-DP12 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-AOD-SS05-000H | CBD-AOD-SS07-000H | CBD-AOD-SS10-000H | CBD-AOD-SS11-000H | CBD-AOD-SS11P-000H | CBD-AOD-SS12-000H | CBD-AOD-SS12P-000H |
| **Sample Date** | | | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Lead | 120 | 400 | *300* | ***1,300*** | *250* | *220* | *170* | ***1,300*** | ***1,300*** |

#REF!

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

MG/KG - Milligrams per kilogram

Table 9-1. AOC D Analytical Results – Detected Constituents in Surface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **NRL-CBD SS Eco ESVs (1019)** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-AOD-DP13 | | CBD-AOD-DP18 | CBD-AOD-DP19 | CBD-AOD-DP21 | CBD-AOD-DP25 |
|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | CBD-AOD-SS13-000H | CBD-AOD-SS13P-000H | CBD-AOD-SS18-000H | CBD-AOD-SS19-000H | CBD-AOD-SS21-000H | CBD-AOD-SS25-000H |
| **Sample Date** | | | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | | |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Lead | 120 | 400 | ***2,800*** | ***2,800*** | ***2,000*** | *370* | ***440*** | 100 |

#REF!

**Notes:**

Shading indicates detections

*Italics indicate exceedance of NRL-CBD SS Eco ESVs (1019)*

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

MG/KG - Milligrams per kilogram

Table 9-2. AOC D Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-AOD-DP05 | CBD-AOD-DP07 | CBD-AOD-DP10 | CBD-AOD-DP11 | | CBD-AOD-DP12 | |
|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-AOD-SB05-1H02 | CBD-AOD-SB07-1H02 | CBD-AOD-SB10-1H02 | CBD-AOD-SB11-1H02 | CBD-AOD-SB11P-1H02 | CBD-AOD-SB12-1H02 | CBD-AOD-SB12P-1H02 |
| **Sample Date** | | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | | |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Lead | 400 | 100 | 24 | 19 | 77 J | 35 J | 160 J | 41 J |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

Table 9-2. AOC D Analytical Results – Detected Constituents in Subsurface Soil

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Station ID** | **RSLs Residential Soil (HQ=0.1) 0519** | CBD-AOD-DP13 | | CBD-AOD-DP18 | CBD-AOD-DP19 | CBD-AOD-DP21 | CBD-AOD-DP25 |
|---|---|---|---|---|---|---|---|
| **Sample ID** | | CBD-AOD-SB13-1H02 | CBD-AOD-SB13P-1H02 | CBD-AOD-SB18-1H02 | CBD-AOD-SB19-1H02 | CBD-AOD-SB21-1H02 | CBD-AOD-SB25-1H02 |
| **Sample Date** | | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | |
| | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | |
| Lead | 400 | 42 | 41 | 140 | 7.8 | 63 | 130 |

#REF!

**Notes:**

Shading indicates detections

**Bolding idicates exceedance of RSLs Residential Soil (HQ=0.1) 0519**

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

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Notes:
XRF = X-ray Fluorescence
XRF sample IDs will range from CBD-AOD-XR01 to CBD-AOD-XR25
Laboratory confirmation samples will be selected from 10 XRF grids
SS = Surface Soil
SB = Subsurface Soil
ESI = Expanded Site Inspection
SI = Site Inspection

**Legend**

- ● XRF Location and Subsequent ESI SS/SB Location for Lead
- ● SI SS Location
- ▭ XRF Area (100 ft x 100 ft) - each grid is 20 feet x 20 feet
- ▭ AOC Boundary

Imagery: Calvert County, MD - 2017

1 inch = 20 feet

**Figure 9-1**
**AOC D Water Tower**
**Sample Locations**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

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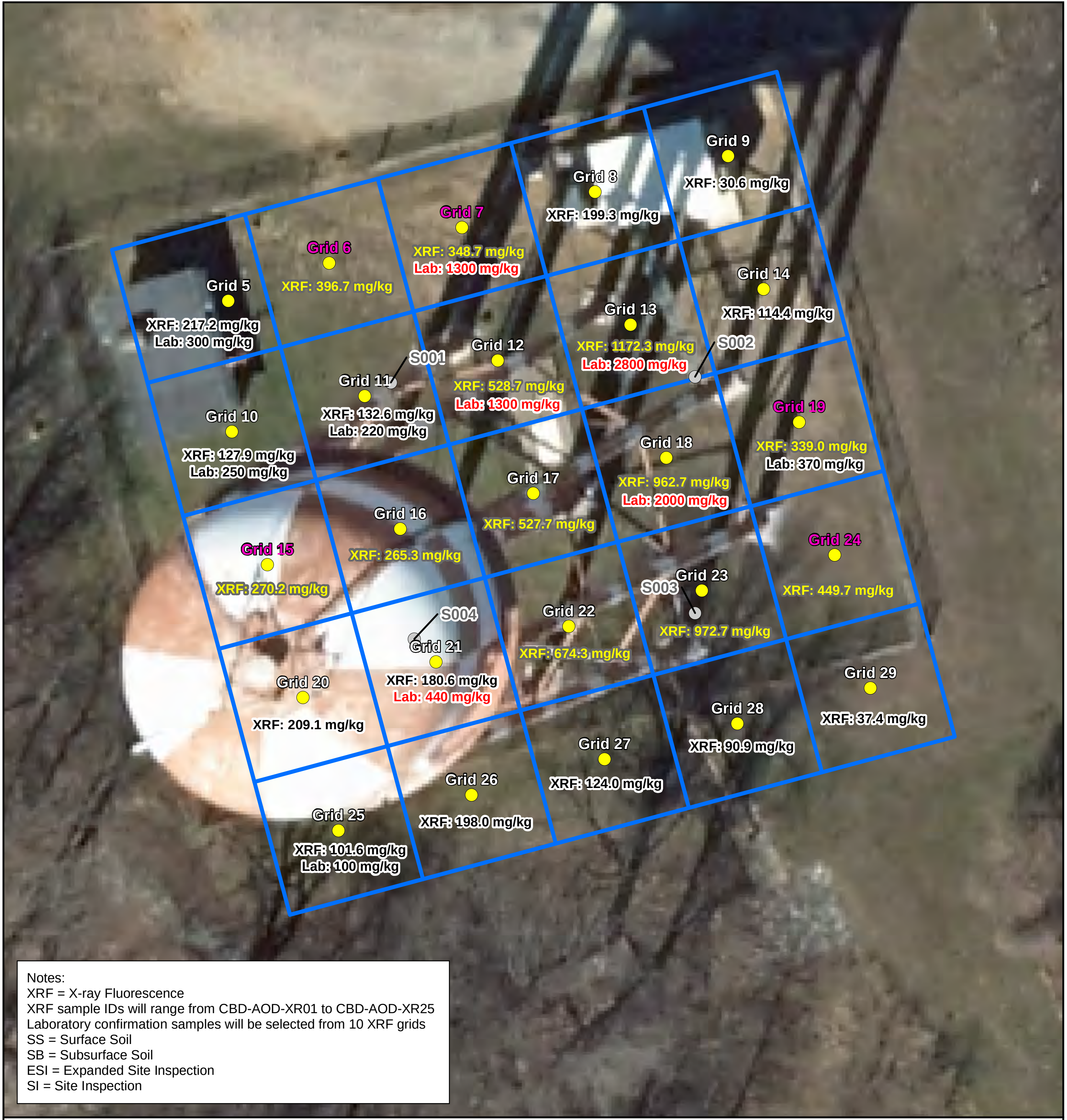


Notes:
XRF = X-ray Fluorescence
XRF sample IDs will range from CBD-AOD-XR01 to CBD-AOD-XR25
Laboratory confirmation samples will be selected from 10 XRF grids
SS = Surface Soil
SB = Subsurface Soil
ESI = Expanded Site Inspection
SI = Site Inspection

**Legend**

- 🟡 XRF Location and Subsequent ESI SS Location for Lead
- ● SI SS Location
- ▭ XRF Area (100 ft x 100 ft) - each grid is 20 feet x 20 feet

N

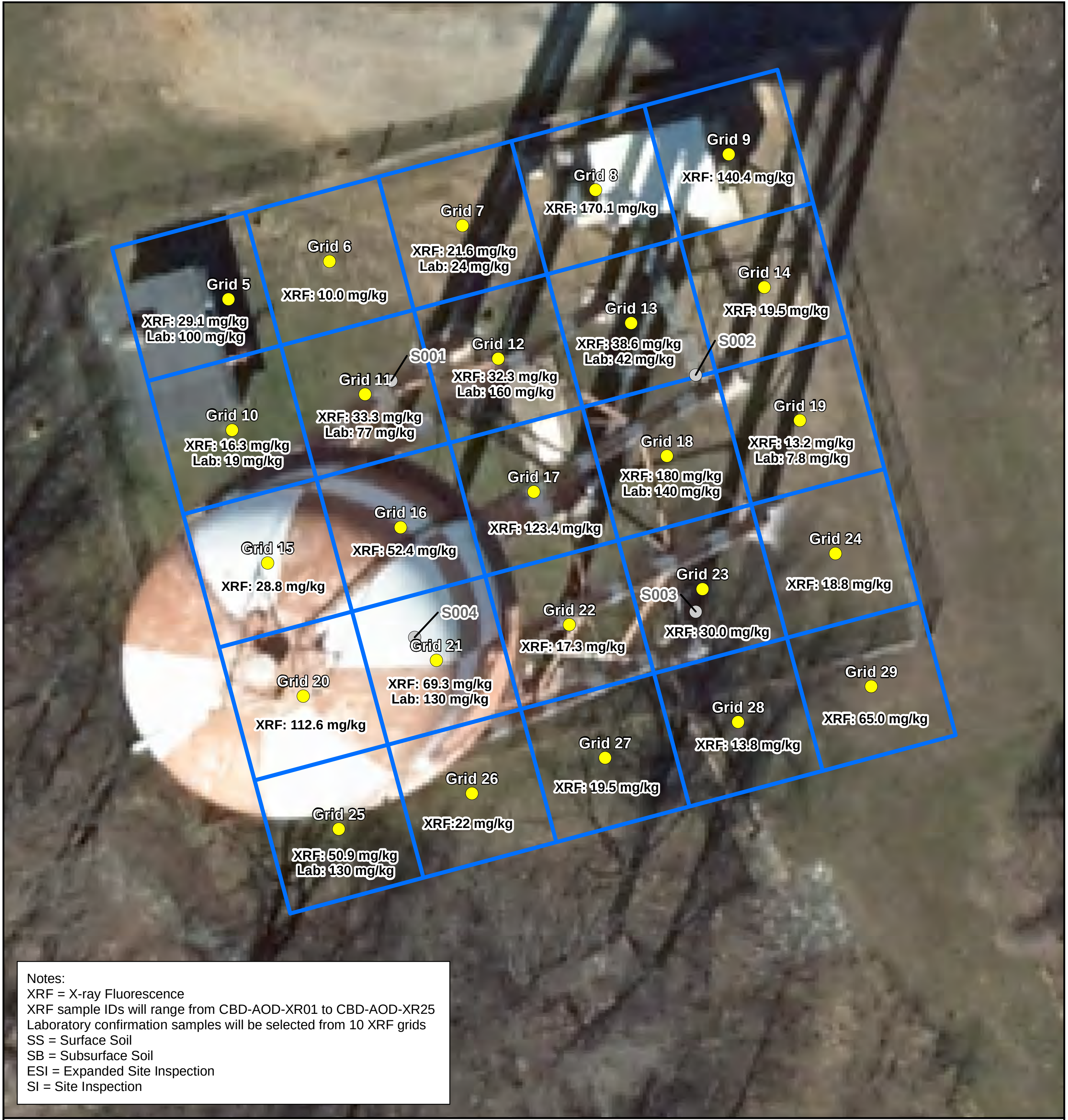
0 10 20
Feet

1 inch = 20 feet

Imagery: Calvert County, MD - 2017

**Figure 9-2**
**AOC D Water Tower**
**XRF and Laboratory Results for Surface Soil**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Basewide\SiteInspectionReport\Figure09-03_NRL-CBD_AOCD_SubsurfaceSoil.mxd 2/20/2019 jcarr3



Notes:
XRF = X-ray Fluorescence
XRF sample IDs will range from CBD-AOD-XR01 to CBD-AOD-XR25
Laboratory confirmation samples will be selected from 10 XRF grids
SS = Surface Soil
SB = Subsurface Soil
ESI = Expanded Site Inspection
SI = Site Inspection

**Legend**

- ● XRF Location and Subsequent ESI SB Location for Lead
- ● SI SS Location
- ▭ XRF Area (100 ft x 100 ft) - each grid is 20 feet x 20 feet

N

0 10 20
Feet

1 inch = 20 feet

Imagery: Calvert County, MD - 2017

**Figure 9-3**
**AOC D Water Tower**
**XRF and Laboratory Results for Subsurface Soil**
Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

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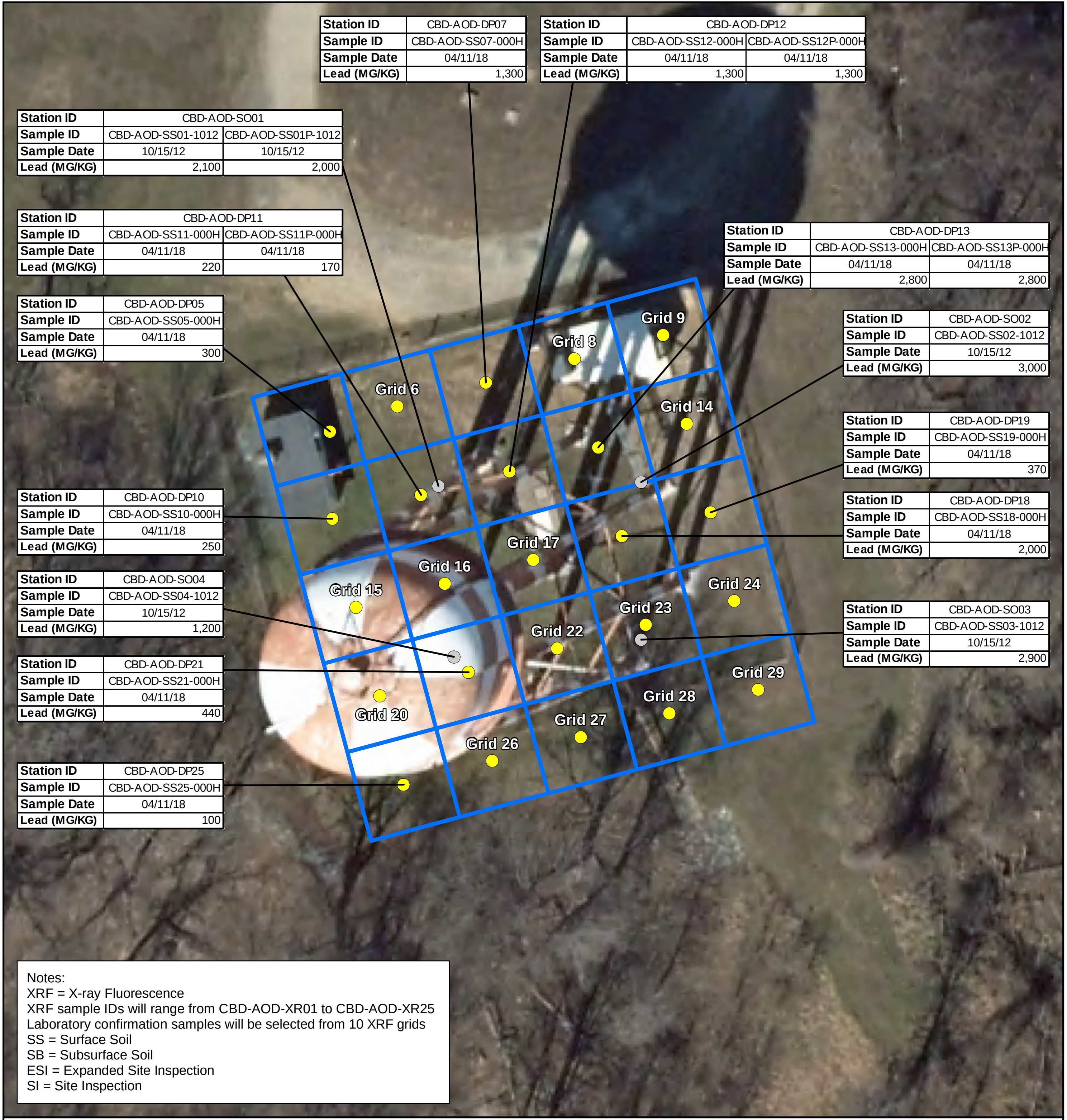

| Station ID | CBD-AOD-DP07 |
|---|---|
| Sample ID | CBD-AOD-SS07-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 1,300 |

| Station ID | CBD-AOD-DP12 | |
|---|---|---|
| Sample ID | CBD-AOD-SS12-000H | CBD-AOD-SS12P-000H |
| Sample Date | 04/11/18 | 04/11/18 |
| Lead (MG/KG) | 1,300 | 1,300 |

| Station ID | CBD-AOD-SO01 | |
|---|---|---|
| Sample ID | CBD-AOD-SS01-1012 | CBD-AOD-SS01P-1012 |
| Sample Date | 10/15/12 | 10/15/12 |
| Lead (MG/KG) | 2,100 | 2,000 |

| Station ID | CBD-AOD-DP11 | |
|---|---|---|
| Sample ID | CBD-AOD-SS11-000H | CBD-AOD-SS11P-000H |
| Sample Date | 04/11/18 | 04/11/18 |
| Lead (MG/KG) | 220 | 170 |

| Station ID | CBD-AOD-DP13 | |
|---|---|---|
| Sample ID | CBD-AOD-SS13-000H | CBD-AOD-SS13P-000H |
| Sample Date | 04/11/18 | 04/11/18 |
| Lead (MG/KG) | 2,800 | 2,800 |

| Station ID | CBD-AOD-DP05 |
|---|---|
| Sample ID | CBD-AOD-SS05-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 300 |

| Station ID | CBD-AOD-SO02 |
|---|---|
| Sample ID | CBD-AOD-SS02-1012 |
| Sample Date | 10/15/12 |
| Lead (MG/KG) | 3,000 |

| Station ID | CBD-AOD-DP19 |
|---|---|
| Sample ID | CBD-AOD-SS19-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 370 |

| Station ID | CBD-AOD-DP10 |
|---|---|
| Sample ID | CBD-AOD-SS10-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 250 |

| Station ID | CBD-AOD-DP18 |
|---|---|
| Sample ID | CBD-AOD-SS18-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 2,000 |

| Station ID | CBD-AOD-SO04 |
|---|---|
| Sample ID | CBD-AOD-SS04-1012 |
| Sample Date | 10/15/12 |
| Lead (MG/KG) | 1,200 |

| Station ID | CBD-AOD-SO03 |
|---|---|
| Sample ID | CBD-AOD-SS03-1012 |
| Sample Date | 10/15/12 |
| Lead (MG/KG) | 2,900 |

| Station ID | CBD-AOD-DP21 |
|---|---|
| Sample ID | CBD-AOD-SS21-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 440 |

| Station ID | CBD-AOD-DP25 |
|---|---|
| Sample ID | CBD-AOD-SS25-000H |
| Sample Date | 04/11/18 |
| Lead (MG/KG) | 100 |

Notes:
XRF = X-ray Fluorescence
XRF sample IDs will range from CBD-AOD-XR01 to CBD-AOD-XR25
Laboratory confirmation samples will be selected from 10 XRF grids
SS = Surface Soil
SB = Subsurface Soil
ESI = Expanded Site Inspection
SI = Site Inspection

## Legend

● XRF Location and Subsequent ESI SS/SB Location for Lead
● SI SS Location
☐ XRF Area (100 ft x 100 ft) - each grid is 20 feet x 20 feet

N

0 10 20 Feet

1 inch = 30 feet

# Figure 9-4
## AOC D Water Tower
## Human Health and Ecological Risk
## COPC in Surface Soil

Base-Wide Expanded Site
Inspection Report
*NRL-CBD*
*Chesapeake Beach, Maryland*

Imagery: Calvert County, MD - 2017

SECTION 10

# Summary and Recommendations

The primary objective of the Base-wide ESI was to assess whether previous historical activities have resulted in a site-related release that poses a potential human health or ecological risk associated with the six sites that were included in this investigation. This objective was achieved by collecting additional soil and groundwater data during the Base-wide ESI field investigation. The combined dataset from the Base-wide SI and ESI were evaluated with respect to human health and ecological risk. The secondary objective of the ESI was to delineate waste at Sites 3, 4, and 5. This objective was achieved by excavating test pits at Sites 3, 4, and 5 based on the results of DGM surveying conducted in 2012. The results and recommendations for the investigation areas are summarized in **Table 10-1**.

Table 10-1. Investigation Results Summary

| Investigation Area | Recommendation |
|---|---|
| Site 3 – Landfill No. 1 | Further evaluation of surface soil |
| Site 4 – Landfill No. 2 | Further evaluation of surface soil |
| Site 5 – Landfill No. 3 | Further evaluation of surface soil |
| Site 7 – Road Oil Application | No further action |
| Site 9 – Photo-processing Waste | Further evaluation for hydroquinone in soil and groundwater |
| AOC D – Water Tower | Further evaluation of surface soil |

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# Appendix A
# Test Pit Logs

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 3 Test Pit 3

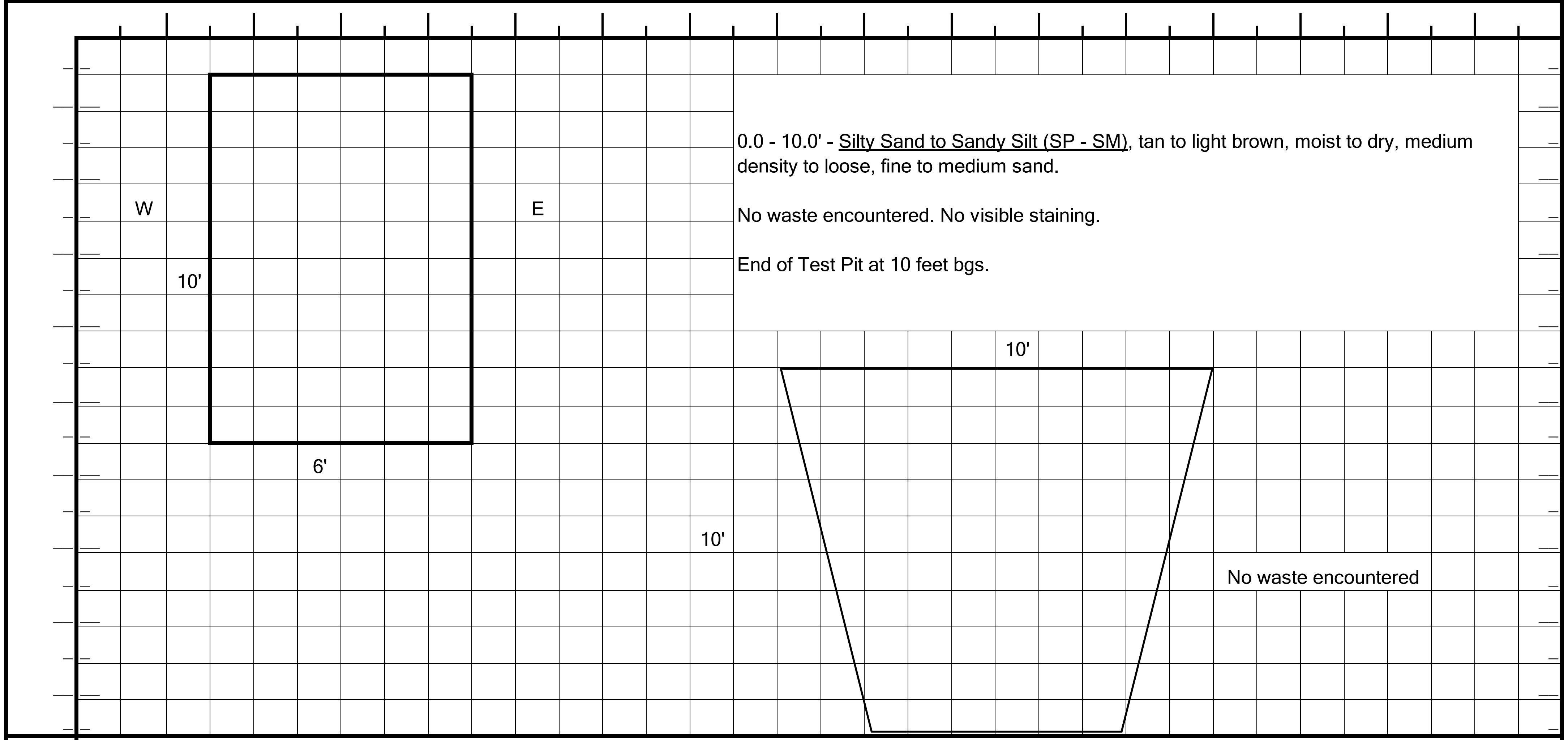
SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 3 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED 4/2/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Silty Sand to Sandy Silt (SP - SM), tan to light brown, moist to dry, medium density to loose, fine to medium sand.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 3 Test Pit 4

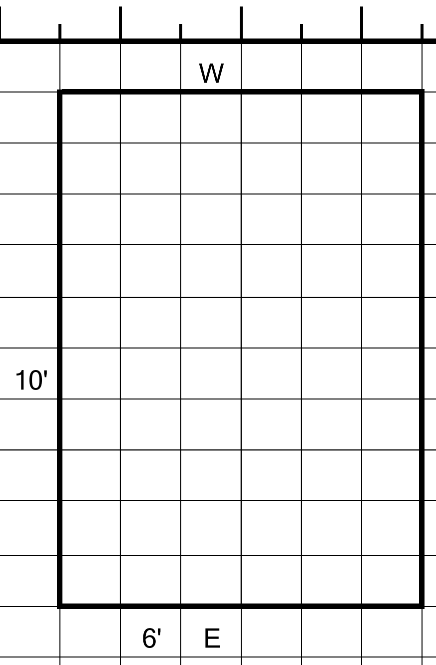
SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 3 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATEI 4/2/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

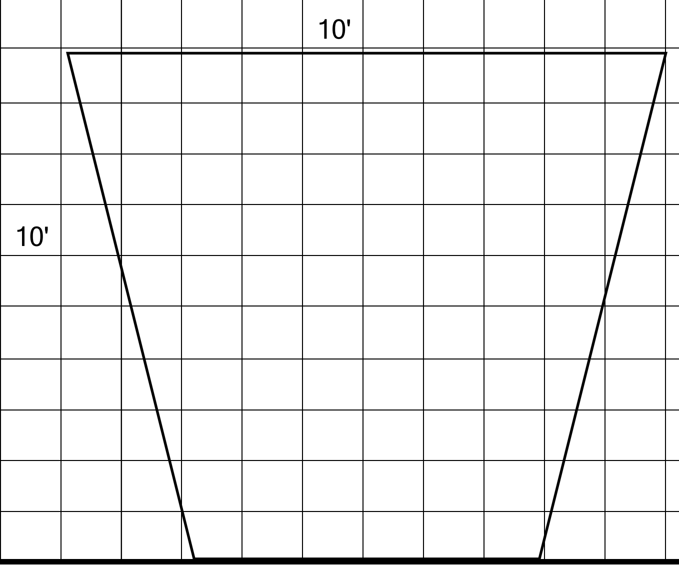
TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Silty Sand to Sandy Silt (SP - SM), tan, moist, medium density to loose, fine to medium sand.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

ch2m

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 3 Test Pit 5

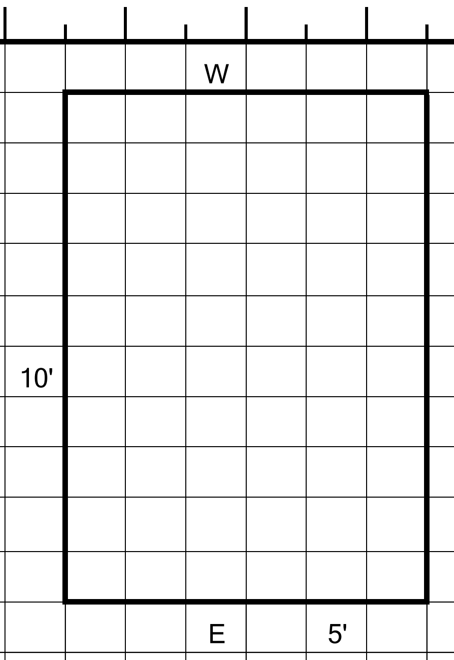
SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 3 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED: 4/3/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 5' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

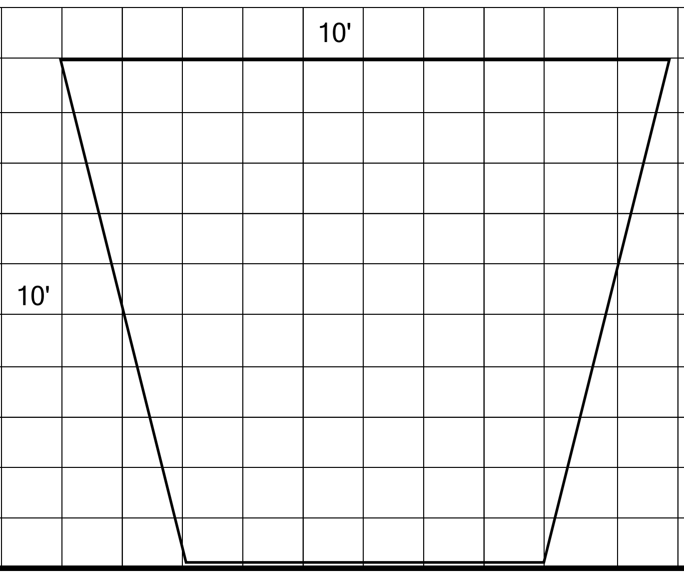
TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Silty Sand to Sandy Silt (SP - SM), light yellowish brown to tan, dry to moist, medium density to loose, fine to medium sand.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 4 Test Pit 6

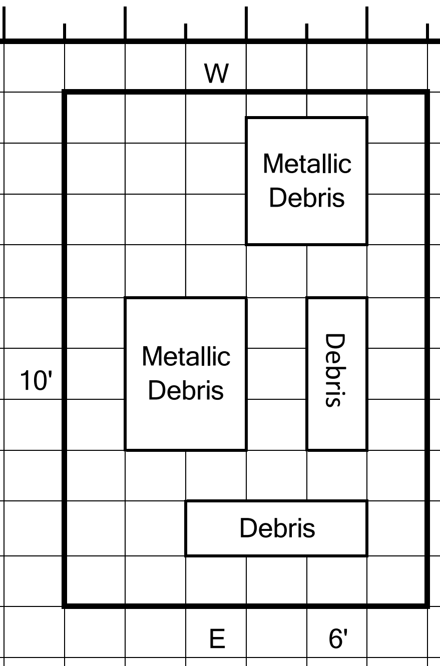
SHEET __ OF ___

# TEST PIT LOG

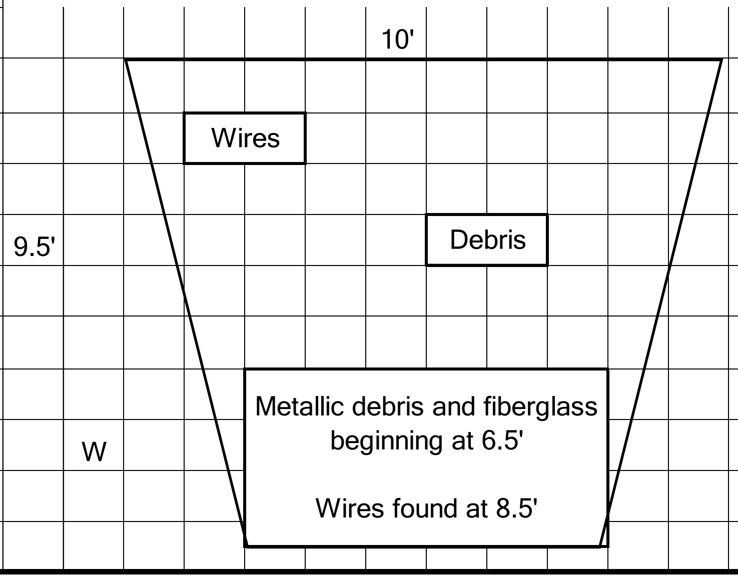
PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 4 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATE 4/3/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 9.5'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

TEST PIT DIMENSIONS (FT)



0.0 - 3.0' - Clayey Sand (SC), brown, moist, medium density, some silt, fine to medium sand, no debris.
3.0 - 9.5' - Silty Sand (SM), yellowish brown to tan, moist, med plasticity, trace clay, fine to medium sand. Corroded metal debris encountered beginning at 6.5' bgs, including fiberglass, cans, bottles, wires, and other associated litter persisting to the bottom. Litter fragments mixed with silty sand.
Canister encountered at 8.5' bgs registering a Rad reading four times over background.
End of Test Pit at 9.5 feet' bgs.



PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 4 Test Pit 7

SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 4 LOGGER : S. Dronfield

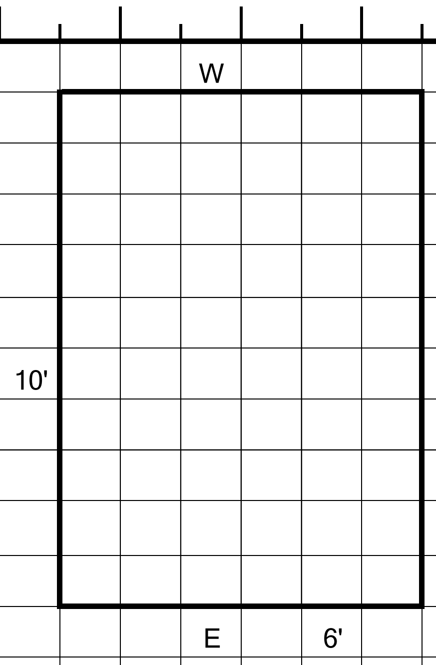
ELEVATION : CONTRACTOR : JSA

EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED: 4/3/18

WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

TEST PIT DIMENSIONS (FT)

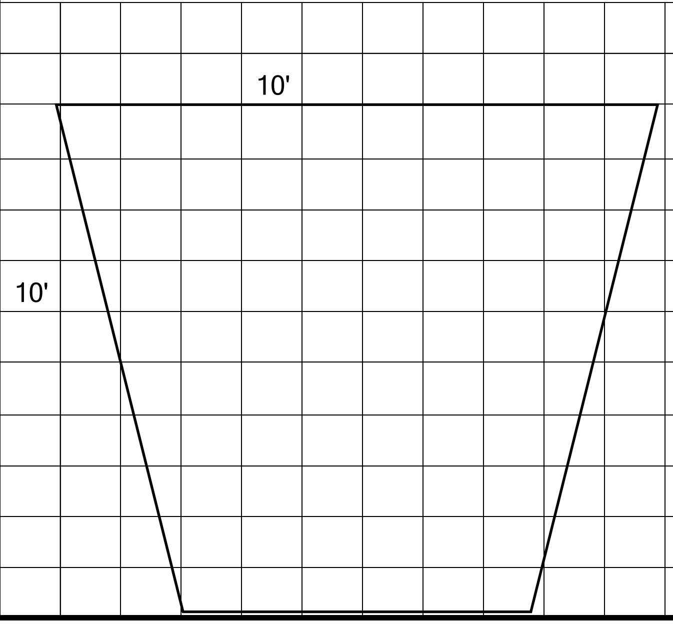


0.0 - 4.0' - <u>Clayey Sand (SC),</u> yellow brown, moist, med density, fine to medium sand, low to medium plasticity, clay, trace silt.

4.0 - 10.0' - <u>Silty Sand (SM)</u>, light yellow brown to tan, moist, med density, fine to medium sand, trace clay.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

ch2m

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 4 Test Pit 8

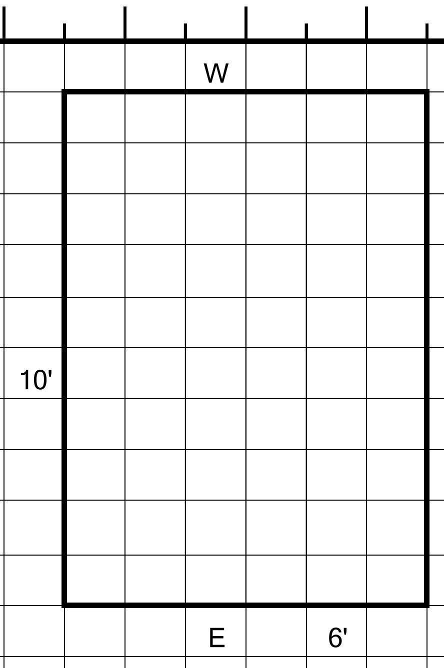
SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 4 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED 4/3/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

TEST PIT DIMENSIONS (FT)

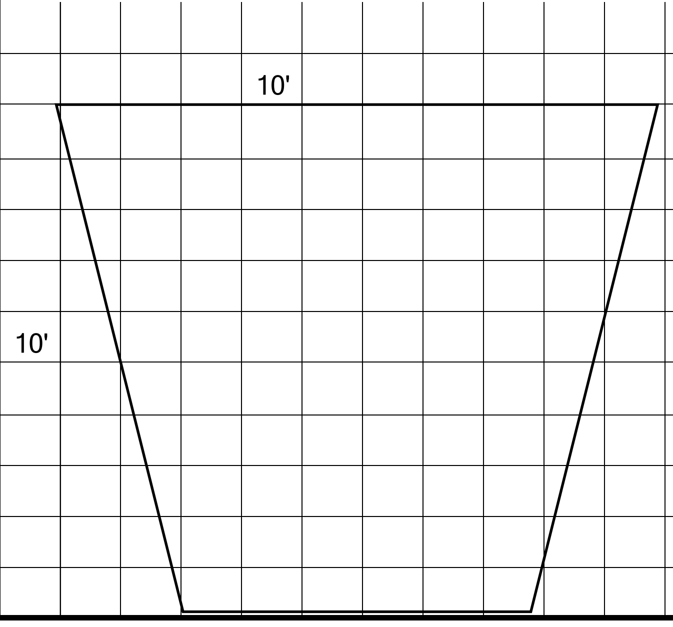


0.0 - 5.0' - Clayey Sand (SC), brown, moist, medium density, fine to medium sand, some low plasticity clay, trace silt.

5.0 - 10.0' - Silty Sand (SM), light yellowish brown, moist, med density, fine to medium sand, trace clay.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

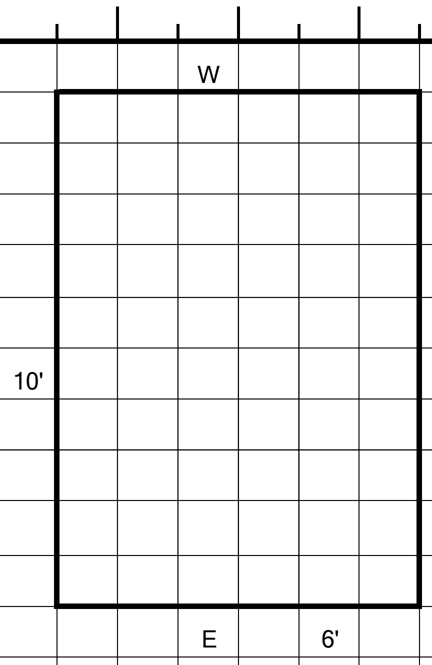
| PROJECT NUMBER | TEST PIT NUMBER |
|---|---|
| 692409CH | Site 4 Test Pit 9 SHEET __ OF ___ |

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 4 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED: 4/3/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

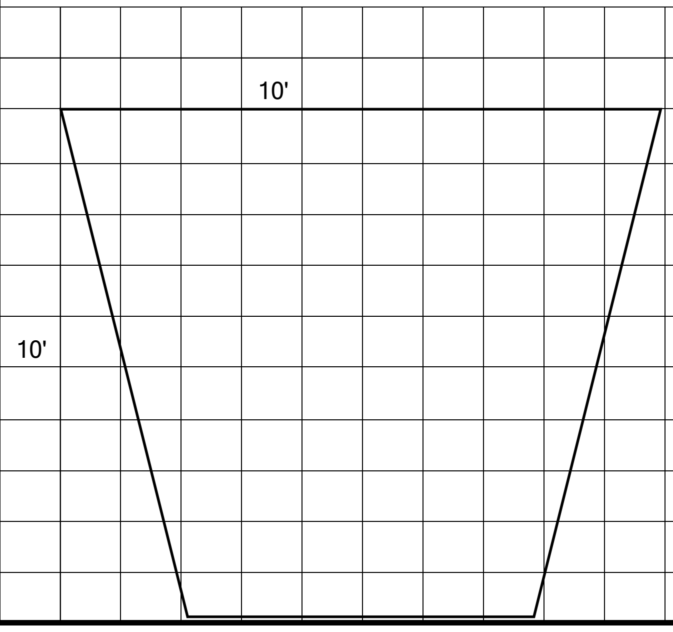
TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Silty Sand with some Cobbles (SM), brown to yellowish brown, moist, medium density, fine to medium sand, trace subrounded cobbles, a few trace nails, glass shards, and a piece of rebar in top 0.0 - 2.0'.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 4 Test Pit 10

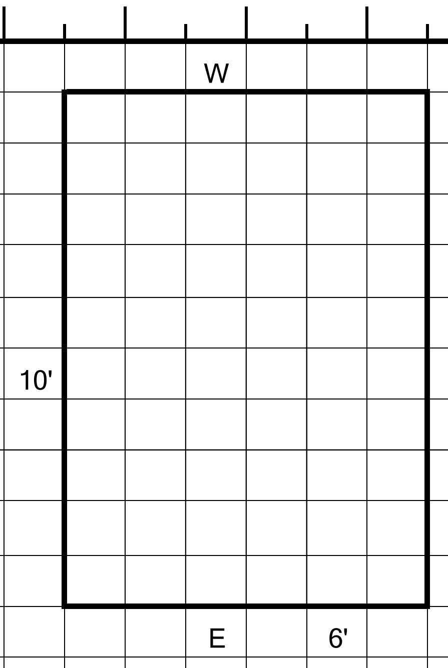
SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 4 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED: 4/3/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

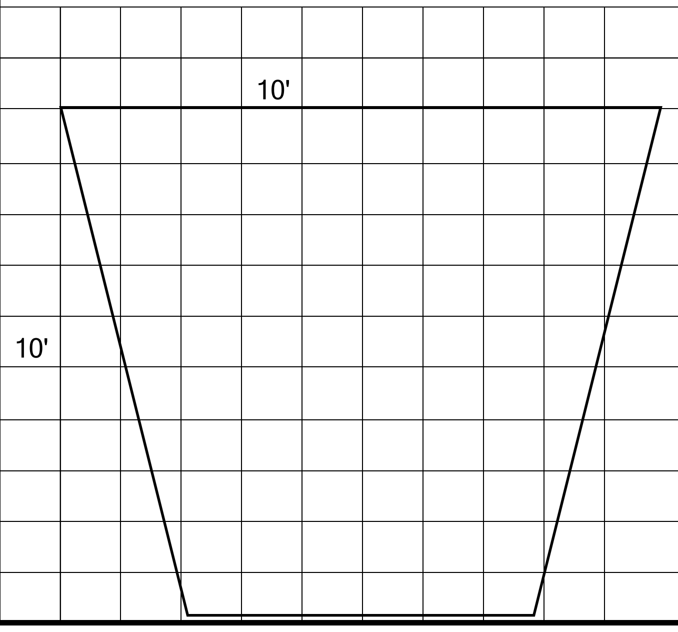
TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Silty Sand (SM), light brownish yellow, moist, medium density, fine to medium sand.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs.



No waste encountered

ch2m

PROJECT NUMBER
692409CH

TEST PIT NUMBER
Site 5 Test Pit 7

SHEET __ OF ___

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 5 LOGGER : S. Dronfield

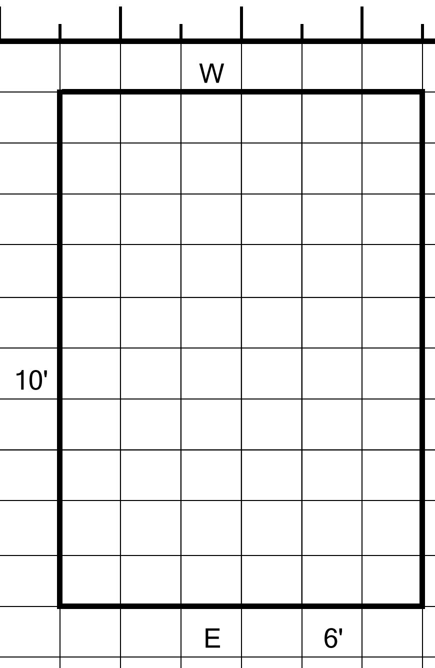
ELEVATION : CONTRACTOR : JSA

EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED: 4/4/18

WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

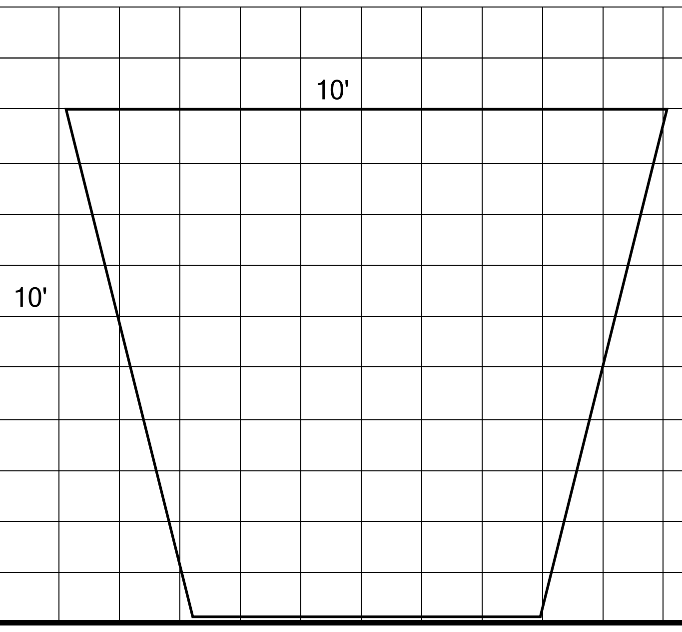
TEST PIT DIMENSIONS (FT)



0.0 - 9.0' - Clayey Sand (SC), strong brown, moist, medium density, fine to medium sand, medium plasticity, organic fragments, loamy near surface. More clay with mottling beginning at 5' bgs.

9.0 - 10.0' - Silty Sand (SM), light brown to tan, moist, medium density, fine to medium sand, some clay.

No waste encountered. No visible staining.



No waste encountered

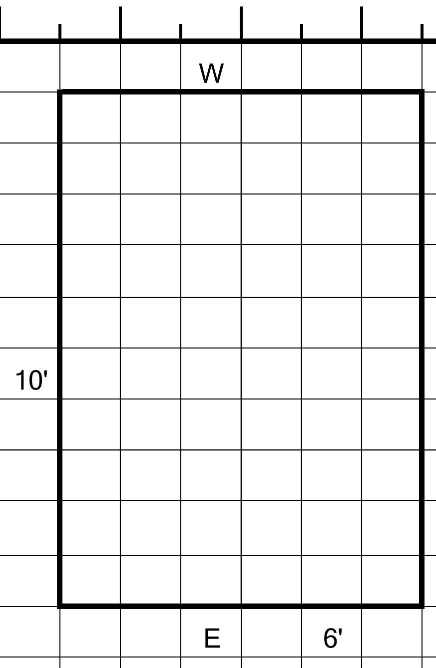
| PROJECT NUMBER | TEST PIT NUMBER |
|---|---|
| 692409CH | Site 5 Test Pit 8 SHEET __ OF ___ |

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 5 LOGGER : S. Dronfield
ELEVATION : CONTRACTOR : JSA
EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATED 4/4/18
WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

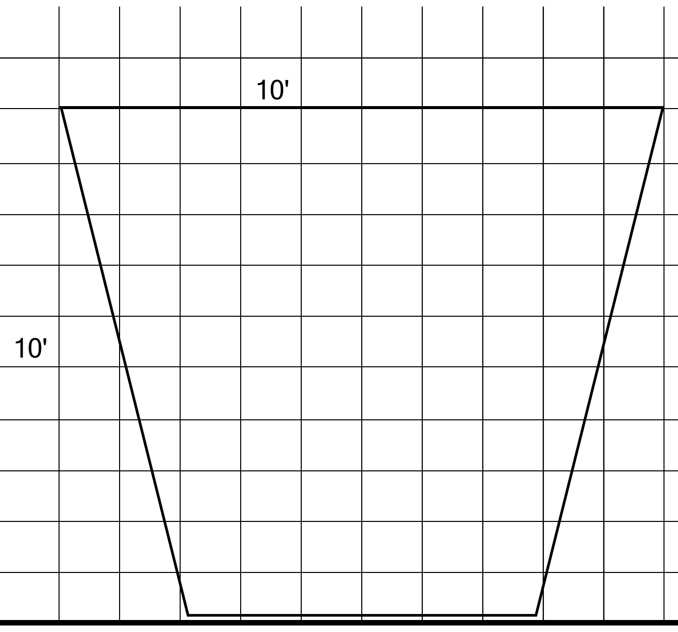
TEST PIT DIMENSIONS (FT)



0.0 - 10.0' - Clayey Sand (SC), strong brown, moist, medium density, fine to medium sand, trace silt, roots and organic material encountered, becoming more of a sandy clay beginning at 4' bgs with mottling.

No waste encountered. No visible staining.

End of Test Pit at 10 feet bgs



No waste encountered

| PROJECT NUMBER | TEST PIT NUMBER |
|---|---|
| 692409CH | Site 5 Test Pit 9 SHEET __ OF ___ |

# TEST PIT LOG

PROJECT : Naval Research Lab, Chesapeake Beach Detachment LOCATION : Site 5 LOGGER : S. Dronfield

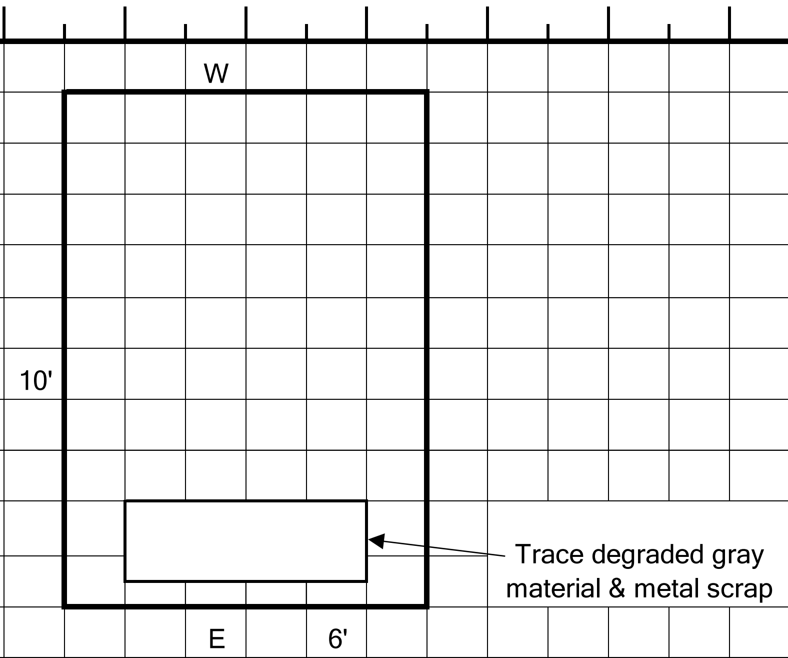
ELEVATION : CONTRACTOR : JSA

EXCAVATION EQUIPMENT USED : Backhoe DATE EXCAVATEI 4/4/18

WATER LEVEL : APPROX. DIMENS: Length: 10' Width: 6' Max. Depth: 10'

| DESCRIPTION | COMMENTS |
|---|---|
| SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | DIFFULCULTY IN EXCAVATION, RUNNING GRAVEL, CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, GRADATIONAL CONTACTS, TESTS, INSTRUMENTS, WATER SEEPAGE |

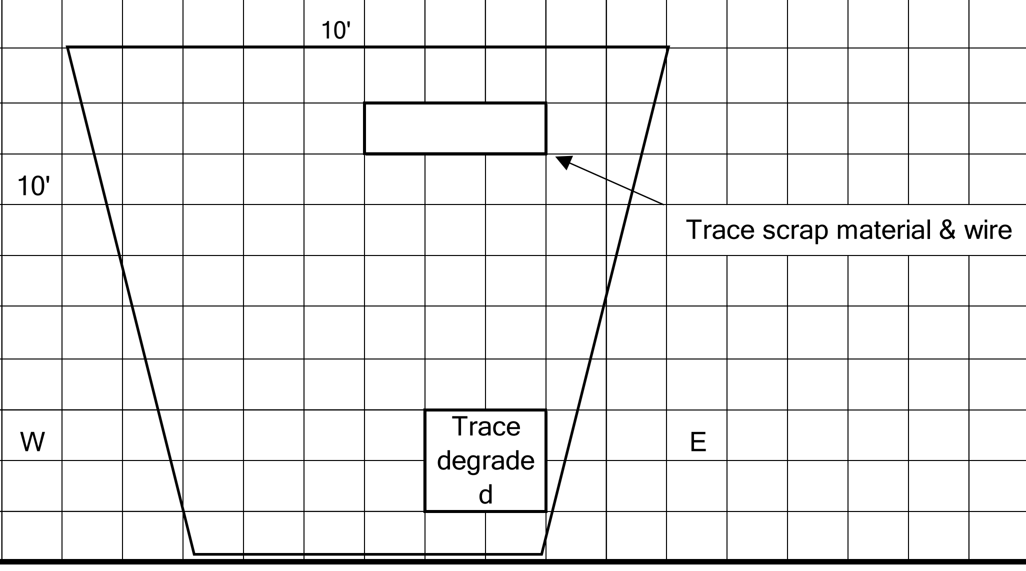
TEST PIT DIMENSIONS (FT)



0.0 - 9.0' - Clayey Sand (SC), strong brown, moist, medium density, fine to medium sand, medium plasticity, organic fragments, loamy near surface. Some metal fragments and wire encountered scattered in the sand.

6.0 - 10.0' - Silty Sand (SM), tan with some yellow brown mottling, dry, medium density, fine to medium sand. Some gray degraded material and a wire encountered at 9', degraded metal encountered at 10'. Overall, very few trace degraded material.

End of Test Pit at 10 feet bgs.



# Appendix B
# Soil Boring and Monitoring Well Construction Logs

| PROJECT NUMBER | | |
|---|---|---|
| 692409CH.SI.DR | Boring Number: | CBD-S03-DP06 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 1510
END : 1525
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(43") | 0 | | | | 0-11" topsoil | 1520 Surface soil sample collected 0-0.5' |
| | | | SM | moist | 10 YR 4/6 | 11-23" silty sand (SM), dark yellowish brown (10 YR 4/6), moist, medium dense, fine to medium sand | |
| | | 0 | | | | | |
| | | | CL | moist | 10 YR 4/6 | 23-36" silty clay (CL), dark yellowish brown ( 10 YR 4/6), moist, firm, fine to medium sand | |
| | | 0 | | | | | |
| | | | SM | moist | 10 YR 5/8 | 36-43" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10'<br>(36") | 0 | SM | moist | 10 YR 6/8 | 0-36" same as above except color change to brownish yellow (10 YR 6/8) | 1525 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S03-DP07 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1450 END : 1505 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-11" topsoil | 1500 Surface soil sample collected 0-0.5' |
| | (42") | | CL | moist | 10 YR 4/4 | 11-25" silty clay (CL), dark yellowish brown ( 10 YR 4/4), moist, hard, some fine to medium sand | |
| | | 0 | | | | | |
| | | | SM | moist | 10 YR 6/3 | 25-42" silty sand (SM), pale brown (10 YR 6/3), moist, medium dense, some fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 6/3 | 0-36" same as above except dense at bottom | 1505 Subsurface soil sample collected 8-10' |
| | (36") | | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S03-DP08 |

# SOIL BORING LOG

| | |
|---|---|
| PROJECT : ESI at NRL-CBD | LOCATION : Chesapeake Beach, MD |
| ELEVATION : | DRILLING CONTRACTOR : Geologic Exploration |

DRILLING METHOD AND EQUIPMENT USED : DPT

WATER LEVELS : START : 1430 END : 1445 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(36") | 0<br>0<br>0 | SM | moist | 10 YR 5/8<br>10 YR 6/8 | 0-7" topsoil<br>7-36" silty sand (SM), yellowish brown (10 YR 5/8) to brownish yellow (10 YR 6/8), moist, medium dense, some fine sand | 1440 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(30") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-30" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense to dense, some fine to medium sand | 1445 Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER

692409CH.SI.DR

Boring Number: CBD-S03-DP09

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1330 END : 1400 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-5" topsoil | 1355 Surface soil sample collected 0-0.5' |
| _ | (36") | | SM | moist | 10 YR 4/3 | 5-21" silty sand with gravel (SM), brown (10 YR 4/3), moist, medium dense, fine to medium sand, some subrounded gravel | |
| | | 0 | | | | | |
| _ | | | SM | moist | 10 YR 6/4 | 21-36" same as above except color change to light yellowish brown (10 YR 6/4) | |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 6/4 | 0-53" same as above | 1400 Subsurface soil sample collected 8-10' |
| _ | (59") | | SP | wet | 10 YR 7/4 | 53-59" medium sand (SP), very pale brown (10 YR 7/4), wet, medium dense, some fine sand | |
| | | 0 | | | | | |
| _ | | 0 | | | | | |
| _ | | 0 | | | | | |
| _ | | 0 | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S03-DP10 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1405 END : 1425 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-12" topsoil | 1420 Surface soil sample collected 0-0.5' |
| _ | (57") | 0 | SC | moist | 10 YR 5/4 | 12-22" clayey sand (SC), yellowish brown (10 YR 5/4), moist, dense, some fine to medium sand, some clay | |
| _ | | 0 | CL | moist | 10 YR 5/4 | 22-45" silty clay (CL), yellowish brown (10 YR 5/4), moist, firm, some fine to medium sand | |
| _ | | 0 | ML | moist | 10 YR 5/4 | 45-57" sandy silt (ML), yellowish brown (10 YR 5/4), moist, firm, some fine to medium sand | |
| _ | | 0 | | | | | |
| 5 | 5 - 10' | 0 | ML | moist | 10 YR 5/4 | 0-8" same as above | 1425 Subsurface soil sample collected 8-10' |
| _ | (43") | 0 | SM | moist | 10 YR 5/8<br>10 YR 7/1 | 8-23" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, some clay lenses colored light grey (10 YR 7/1) | |
| _ | | 0 | CL | moist | 10 YR 7/4 | 23-36" clay with fine sand (CL), very pale brown (10 YR 7/4), moist, firm, some fine sand | |
| _ | | 0 | SM | moist | 10 YR 5/8 | 36-43" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense | |
| _ | | | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

ch2m

PROJECT NUMBER
692409CH.SI.DR

Boring Number: CBD-S03-DP11

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 1530
END : 1610
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-5" topsoil | 1600 Surface soil sample collected |
| | (41") | | CL | moist | 10 YR 3/6 | 5-19" silty clay (CL), dark yellowish brown (10 YR 3/6), moist, firm | 1605 (duplicate) 0-0.5' |
| | | 0 | SM | moist | 10 YR 4/6 | 19-41" silty sand (SM), dark yellowish brown (10 YR 4/6) to brownish yellow (10 YR 6/8), moist, medium dense, fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | 10 YR 6/8 | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 6/8 | 0-40" same as above except color change to light yellowish brown (10 YR 6/4) at 24" | 1610 Subsurface soil sample collected 8-10' |
| | (40") | 0 | | | | | |
| | | 0 | | | 10 YR 6/4 | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER 692409CH.SI.DR

Boring Number: CBD-S03-DP12

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 1455
END : 1530
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(48") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 3/4<br>10 YR 5/8 | 0-8" topsoil<br>8-48" silty sand (SM), dark yellowish brown (10 YR 3/4) to yellowish brown (10 YR 5/8) at 38", moist, medium dense to dense at bottom, fine to medium sand | 1525 Surface soil sample collected (MS/MSD) 0-0.5' |
| 5 | 5 - 10'<br>(40") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-40" same as above except color change to brownish yellow (10 YR 6/8) and medium dense | 1530 Subsurface soil sample collected 8-10' |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S03-DP13 |
|---|---|---|
| ch2m | SOIL BORING LOG | |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1615 END : 1635 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(36") | 0<br>0<br>0 | ML<br>CL<br>SM | moist<br>moist<br>moist | 10 YR 3/6<br>10 YR 4/6<br>10 YR 6/6 | 0-12" topsoil<br>12-21" sandy silt (ML), dark yellowish brown (10 YR 3/6), moist, firm, fine to medium sand<br>21-29" silty clay (CL), dark yellowish brown (10 YR 4/6), moist, firm<br>29-36" silty sand (SM), brownish yellow (10 YR 6/6), moist, medium dense, fine to medium sand | 1625 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(36") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-36" same as above except color change to yellowish brown (10 YR 5/8) | 1630 Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| PROJECT NUMBER | |
|---|---|
| 692409CH.SI.DR | Boring Number: CBD-S03-DP14 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD

ELEVATION : DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT

WATER LEVELS : START : 1415 END : 1445 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(47") | 0 | SM | moist | 10 YR 5/8 | 0-12" topsoil<br>12-47" silty sand (SM), yellowish brown (10 YR 5/8), moist, dense to medium dense at bottom, fine to medium sand | 1445 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10'<br>(46") | 0 | SM | moist | 10 YR 5/8<br>10 YR 7/4 | 0-46" same as above except a mixture of very pale brown (10 YR 7/4) along with yellowish brown (10 YR 5/8) | 1450 Subsurface soil sample collected (MS/MSD) 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S03-DP15 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1635 END : 1715 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(34") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-4" topsoil<br>4-34": silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | 1700 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(35") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-35" same as above | 1705 Subsurface soil sample collected 1710 (duplicate) 8-10' |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | |
|---|---|
| PROJECT NUMBER 692409CH.SI.DR | Boring Number: CBD-S04-DP07 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-5" topsoil | Surface soil sample collected 0-0.5' |
| _ | (48") | | CL | moist | 10 YR 7/6 | 5-33" sandy clay (CL), yellow (10 YR 7/6), moist, dense, some fine to medium sand, medium plasticity | |
| | | 0 | | | | | |
| _ | | | SC | moist | 10 YR 5/6 | 33-48" clayey sand (SC), yellow brown (10 YR 5/6), moist, medium density, fine to medium sand | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SP | moist | 10 YR 5/6 | 0-35" poorly-graded sand (SP), yellow brown (10 YR 5/6), moist, medium density, fine to medium sand, some silt | Subsurface soil sample collected 8-10' |
| _ | (35") | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER 692409CH.SI.DR

Boring Number: CBD-S04-DP08

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 4/5/18
END : 4/5/18
LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-12" topsoil | Surface soil sample collected 0-0.5' |
| | (51") | | CL | moist | 10 YR 5/6 | 12-27" sandy clay (CL), yellowish brown (10 YR 5/6), moist, medium density, fine to medium sand | |
| | | 0 | | | | | |
| | | | SP | moist | 10 YR 5/6 | 27-51" poorly graded sand (SP), yellowish brown (10 YR 5/6), moist, medium dense to loose, fine to medium sand, trace silt | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SP | moist | 10 YR 7/4 | 0-42" same as above, very pale brown (10 YR 7/4) | Subsurface soil sample collected 8-10' |
| | (42") | | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | | End of Boring at 10 ft bgs | |
| | | 0 | | | | | |
| 10 | | | | | | | |

PROJECT NUMBER

692409CH.SI.DR

Boring Number: CBD-S04-DP09

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 1615
END : 1635
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(50") | 0 | SM | moist | 10 YR 5/8 | 0-10" topsoil<br>10-50" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | 1630 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(38") | 0 | SM | moist | 10 YR 5/8 | 0-38" same as above, quartz lense at 13" | 1635 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-DP10 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1545 END : 1610 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(28") | 0<br>0<br>0 | SM | moist | 10 YR 2/2 | 0-8" topsoil<br>8-28" silty sand with gravel (SM), very dark brown (10 YR 2/2), moist, medium dense, fine to medium sand, some subangular gravel | 1605 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(38") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-38" silty sand (SM), brownish yellow (10 YR 6/8), moist, loose, fine to medium sand | 1610 Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-DP11 |
|---|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(41") | 0<br>0<br>0<br>0 | CL<br>SM | moist<br>moist | 10 YR 4/3<br>10 YR 5/6 | 0-12" topsoil<br>12-24" sandy clay (CL), brown (10 YR 4/3), moist, medium dense, low plasticity<br>24-41" silty sand (SM), yellow brown (10 YR 5/6), moist, medium dense, fine to medium sand | 1135 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(43") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 5/6 | 0-43" same as above | 1140 Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-DP12 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(57") | 0 | CL | moist | 10 YR 7/6 | 0-7" topsoil<br>7-57" sandy clay (CL), yellow (10 YR 7/6), moist, dense, some fine to medium sand, low plasticity | 1110 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(41") | 0 | CL<br>SP | moist<br>moist | 10 YR 7/6<br>10 YR 5/6 | 0-7" same as above<br>7-41" poorly graded sand (SP), yellow brown (10 YR 5/6), moist, loose, some silt, fine to medium sand | 1115 Subsurface soil sample collected 1120 (duplicate) 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER 692409CH.SI.DR

Boring Number: CBD-S04-DP13

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 4/5/18
END : 4/5/18
LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | | | | | SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | |
| | 0 - 5'<br>(56") | 0 | CL | moist | 10 YR 5/6 | 0-8" topsoil<br>8-56" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity | 1050 Surface soil sample collected<br>1055 (duplicate) 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(43") | 0 | CL<br>SP | moist<br>moist | 10 YR 5/6<br>10 YR 5/6 | 0-5" same as above<br>5-43" poorly graded sand (SP), yellow brown (10 YR 5/6), moist, loose, fine to medium sand | 1100 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-DP14 |
| | **SOIL BORING LOG** | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-10" topsoil | Surface soil sample collected 0-0.5' |
| _ | (49") | | CL | moist | 10 YR 5/6 | 10-32" sandy clay (CL), yellowish brown (10 YR 5/6), moist, firm, some fine to medium sand, medium plasticity | |
| | | 0 | | | | | |
| _ | | | SP | dry | 10 YR 5/6 | 32-49" poorly graded sand (SP), yellowish brown (10 YR 5/6), dry, loose, some silt, fine to medium sand, trace white gravel | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SP | dry | 10 YR 5/6 | 0-48" same as above | Subsurface soil sample collected 8-10' |
| _ | (48") | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

PROJECT NUMBER

692409CH.SI.DR

Boring Number: CBD-S04-DP15

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD | LOCATION : Chesapeake Beach, MD

ELEVATION : | DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT

WATER LEVELS : | START : 4/5/18 | END : 4/5/18 | LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(33") | 0<br>0<br>0 | SP | moist | 10 YR 5/6 | 0-8" topsoil<br>8-33" poorly graded sand (SP), yellowish brown (10 YR 5/6), moist, loose, fine to medium sand, trace silt | Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(34") | 0<br>0<br>0 | SP | moist | 10 YR 5/6 | 0-34" same as above | Subsurface soil sample collected 8-10' |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-DP16 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(18") | 0<br>0 | SM | moist | 10 YR 3/3 | 0-9" topsoil<br>9-18" silty sand (SM), dark brown (10 YR 3/3), moist, medium density, fine to medium sand, trace gravels, becoming tan at bottom | Surface soil sample collected 0-0.5' |
| 5 | | | | | | | |
| | 5 - 10'<br>(12") | 0 | SM<br>GW<br>SM | moist<br>very moist<br>moist | 10 YR 3/3<br>10 YR 2/1<br>10 YR 3/3 | 0-1" same as above<br>1-6" silty gravel (GW), black (10 YR 2/1), very moist, loose, some fine sand, glass and other waste material fragments<br>6-12" same as 0-1", loose | Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER
692409CH.SI.DR

Boring Number: CBD-S05-DP07

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 4/5/18
END : 4/5/18
LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(56") | 0 | CL | moist | 10 YR 5/6 | 0-13" topsoil<br>13-56" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity | 1415 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(56") | 0 | CL | moist | 10 YR 5/6 | 0-56" same as above, low plasticity, more sand at the bottom | 1420 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| PROJECT NUMBER | Boring Number: |
|---|---|
| 692409CH.SI.DR | CBD-S05-DP08 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-14" topsoil (some sand) | 1430 Surface soil sample collected 0-0.5' |
| _ | (31") | | CL | moist | 10 YR 5/6 | 14-31" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, some fine to medium sand, medium plasticity | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 5 __ | | | | | | | |
| | 5 - 10' | 0 | CL | moist | 10 YR 5/6 | 0-56" same as above, low plasticity, more sand and silt at the bottom | 1432 Subsurface soil sample collected 8-10' |
| _ | (56") | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | End of Boring at 10 ft bgs | |
| | | 0 | | | | | |
| 10 | | | | | | | |

PROJECT NUMBER 692409CH.SI.DR

Boring Number: CBD-S05-DP09

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD

ELEVATION : DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT

WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(33") | 0<br>0<br>0 | CL | moist | 10 YR 5/6 | 0-5" topsoil<br>5-33" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity | 1457 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(26") | 0<br>0<br>0 | CL | moist | 10 YR 5/6 | 0-26" same as above<br>End of Boring at 10 ft bgs | 1500 Subsurface soil sample collected 8-10' |
| 10 | | | | | | | |

PROJECT NUMBER
692409CH.SI.DR

Boring Number: CBD-S05-DP10

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-6" topsoil | 1517 Surface soil sample collected 0-0.5' |
| | (43") | | CL | moist | 10 YR 5/6 | 6-43" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10'<br>(16") | 0 | GW | moist | 10 YR 2/1 | 0-6" gravel (GW), black (10 YR 2/1), moist, loose, fine to medium sand, fine to medium subangular gravel, glass, other waste material | 1520 Subsurface soil sample collected 8-10' |
| | | 0 | CL | moist | 10 YR 5/6 | 6-16" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity | |
| | | | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

PROJECT NUMBER

692409CH.SI.DR

Boring Number: CBD-S05-DP11

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 4/5/18
END : 4/5/18
LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(50") | 0 | CL | moist | 10 YR 5/6 | 0-11" topsoil<br>11-50" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, fine to medium sand, medium plasticity, lithe fragments | 1508 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(57") | 0 | CL | moist | 10 YR 5/6 | 0-57" same as above, more sand | 1510 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S05-DP12 |
|---|---|---|
| | SOIL BORING LOG | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(50") | 0 | CL | moist | 10 YR 5/6 | 0-4" topsoil, concrete sublayer about 2" thick at 12-14"<br>14-50" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, medium plasticity | 1527 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(57") | 0 | CL | moist | 10 YR 5/6 | 0-57" same as above | 1530 Subsurface soil sample collected 1530 (duplicate) 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 10 ft bgs | |
| 10 | | | | | | | |

| PROJECT NUMBER | Boring Number: |
|---|---|
| 692409CH.SI.DR | CBD-S05-DP13 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD

ELEVATION : DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT

WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | | | | | SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | |
| | 0 - 5'<br>(53") | 0 | CL | moist | 10 YR 5/6 | 0-9" topsoil<br>9-53" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, some fine to medium sand, low plasticity | 1445 Surface soil sample collected<br>1447 (duplicate) 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(58") | 0 | CL | moist | 10 YR 5/6 | 0-58" same as above, more sand at the bottom | 1450 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | 0 | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER
692409CH.SI.DR

Boring Number: CBD-S05-DP14

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 4/5/18
END : 4/5/18
LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(29") | 0 | CL | moist | 10 YR 5/6 | 0-10" topsoil<br>10-29" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, some fine to medium sand, low plasticity | 1438 Surface soil sample collected 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(57") | 0 | CL | moist | 10 YR 5/6 | 0-57" same as above, more sand at the bottom | 1440 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | 0 | | | | End of Boring at 10 ft bgs | |

| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S05-DP15 |
|---|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : S Dronfield

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(38") | 0 | CL | moist | 10 YR 5/6 | 0-8" topsoil<br>8-38" sandy clay (CL), yellow brown (10 YR 5/6), moist, firm, some fine to medium sand, low plasticity | 1545 Surface soil sample collected (MS/MSD) 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 5 | 5 - 10'<br>(57") | 0 | CL | moist | 10 YR 5/6 | 0-57" same as above, more sand at the bottom, trace gravel throughout recovery interval | 1550 Subsurface soil sample collected 8-10' |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | 0 | | | | End of Boring at 10 ft bgs | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S05-DP16 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 4/5/18 END : 4/5/18 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(48") | 0<br>0<br>0<br>0 | CL | moist | 10 YR 5/8 | 0-8" topsoil<br>8-48" sandy clay (CL), yellow brown (10 YR 5/8), moist, firm, no plasticity | 1355 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(58") | 0<br>0<br>0<br>0<br>0 | CL | moist | 10 YR 6/8 | 0-58" same as above, except brownish yellow (10 YR 6/8) and medium plasticity | 1400 Subsurface soil sample collected 8-10' |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S07-DP20 |
|---|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 0830 END : 0900 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(46") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 5/6<br>10 YR 4/3<br>10 YR 5/6 | 0-12" topsoil<br>12-46" silty sand (SM), yellowish brown (10 YR 5/6), moist, medium dense, fine to medium sand, color change at 24-30" to brown (10 YR 4/3) | 0855 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(36") | 0<br>0<br>0 | SM | moist | 10 YR 5/6<br>10 YR 7/4<br>10 YR 5/6 | 0-36" same as above except color change at 6-12" to very pale brown (10 YR 7/4) and some clay at bottom<br>End of Boring at 8 ft bgs | 0900 Subsurface soil sample collected 5-8' |
| 10 | | | | | | | |

PROJECT NUMBER

692409CH.SI.DR

**Boring Number:** CBD-S07-DP21

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS :
START : 0905
END : 0935
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-12" topsoil | 0925 Surface soil sample collected |
| | (38") | 0 | SM | moist | 10 YR 4/6 | 12-31" silty sand with gravel and some cobbles (SM), dark yellowish brown (10 YR 4/6), moist, dense, fine to medium sand, subangular gravel, some subangular cobbles | 0930 (duplicate) 0-0.5' |
| | | 0 | SC | moist | 10 YR 4/6 | 31-38" clayey sand (SC), dark yellowish brown (10 YR 4/6), moist, dense, fine to medium sand | |
| | | 0 | | | | | |
| 5 | 5 - 8' | 0 | SC | moist | 10 YR 4/6 | 0-2" same as above | 0935 Subsurface soil sample collected 5-8' |
| | (58") | 0 | CL | moist | 10 YR 5/1 | 2-58" sandy clay (CL), gray (10 YR 5/1), moist, firm, some fine to medium sand, extra recovery due to sloughing | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 8 ft bgs | |
| 10 | | | | | | | |

| PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S07-DP22 |
|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 0940 END : 1010 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(36") | 0<br>0<br>0 | SP | moist<br>wet | 10 YR 6/8 | 0-12" topsoil<br>12-36" medium sand (SP), brownish yellow (10 YR 6/8), moist to wet at 26", medium dense, medium sand | 1005 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(30") | 0<br>0<br>0 | SP<br>CL | wet<br>wet | 10 YR 6/8<br>10 YR 6/8 | 0-21" same as above<br>21-30" sandy clay (CL), brownish yellow (10 YR 6/8), wet, soft, fine to medium sand | 1010 Subsurface soil sample collected 5-8' |
| | | | | | | End of Boring at 8 ft bgs | |
| 10 | | | | | | | |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S07-DP23 |
|---|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1015 END : 1040 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(27") | 0<br>0<br>0 | SP | moist | 10 YR 6/8 | 0-4" topsoil<br>4-27" medium sand with some subrounded gravel (SP), brownish yellow (10 YR 6/8), moist, dense, fine to medium sand, subrounded gravel | 1025 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(37") | 0<br>0<br>0<br>0 | SP | moist | 10 YR 6/8 | 0-37" same as above, medium dense at bottom | 1030 Subsurface soil sample collected (MS/MSD) 5-8' |
| 10 | | | | | | End of Boring at 8 ft bgs | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S07-DP24 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1045 END : 1110 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(48") | 0<br>0<br>0<br>0 | CL<br>SM | moist<br>moist | 10 YR 5/8<br>10 YR 5/8 | 0-12" topsoil<br>12-40" sandy clay (CL), yellowish brown (10 YR 5/8), moist, firm , some fine to medium sand<br>40-48" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | 1105 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(24") | 0<br>0 | SM | moist | 10 YR 5/8 | 0-24" same as above | 1110 Subsurface soil sample collected 5-8' |
| 10 | | | | | | End of Boring at 8 ft bgs | |

| PROJECT NUMBER | Boring Number: |
|---|---|
| 692409CH.SI.DR | CBD-S07-DP25 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1115 END : 1140 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(36") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-14" topsoil<br>14-36" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | 1125 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(35") | 0<br>0<br>0 | SM<br>SM | moist<br>moist | 10 YR 5/8<br>10 YR 5/8<br>10 YR 6/6 | 0-8" same as above, some orginial material at bottom<br>8-35" same as above except color change to brownish yellow (10 YR 6/6)<br>End of Boring at 8 ft bgs | 1130 Subsurface soil sample collected 1135 (duplicate) 5-8' |
| 10 | | | | | | | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S07-DP26 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1145 END : 1200 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(31") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-7" topsoil<br>7-31" silty sand (SM), yellowish brown (10 YR 5/8), moist, medium dense, fine to medium sand | 1155 Surface soil sample collected 0-0.5' |
| 5 | 5 - 8'<br>(33") | 0<br>0<br>0 | SM | moist | 10 YR 5/8 | 0-33" same as above | 1200 Subsurface soil sample collected 5-8' |
| | | | | | | End of Boring at 8 ft bgs | |
| 10 | | | | | | | |

| PROJECT NUMBER | Boring Number: |
|---|---|
| 692409CH.SI.DR | CBD-S07-DP27 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1345 END : 1410 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-8" topsoil | 1405 Surface soil sample collected |
| | (32") | | SM | moist | 10 YR 6/6 | 8-32" silty sand (SM), color change from brownish yellow (10 YR 6/6) to dark yellowish brown (10 YR 3/4) at 16", moist, medium dense, fine to medium sand | 0-0.5' |
| | | 0 | | | | | |
| | | 0 | | | 10 YR 3/4 | | |
| 5 | | | | | | | |
| | 5 - 8' | 0 | SM | moist | 10 YR 3/4 | 0-20" same as above | 1410 Subsurface soil sample collected (MS/MSD) 5-8' |
| | (34") | | CL | wet | 10 YR 6/8 | 20"-34" sandy clay (CL), brownish yellow (10 YR 6/8), wet, firm to soft | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 8 ft bgs | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S09-DP05 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1115 END : 1150 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-0" asphalt and asphalt subbase | 1145 Surface soil sample collected |
| _ | (27") | | SM | moist | 10 YR 6/4 | 0-27": silty sand (SM), light yellowish brown (10 YR 6/4), moist, | (MS/MSD) 0-0.5' |
| | | 0 | | | | medium dense, fine to medium sand | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 5 __ | | | | | | | |
| | 5 - 10' | 0 | CL | moist | 10 YR 6/4 | 0-57" sandy clay (CL), light yellowish brown (10 YR 6/4) to yellowish | 1150 Subsurface soil sample |
| _ | (57") | | | | | brown (10 YR 5/8), moist, firm to hard at bottom | collected 8-10' |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| | | | | | 10 YR 5/8 | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

PROJECT NUMBER
692409CH.SI.DR

Boring Number: CBD-S09-DP06

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 0815 END : 0915 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-8" topsoil and decomposed concrete | 0855 Surface soil sample collected |
| _ | (23") | | SM | moist | 10 YR 7/8 | 8-23": silty sand (SM), yellow (10 YR 7/8), moist, medium dense, fine to medium sand | 0900 (duplicate) 0-0.5' |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 5 __ | | | | | | | |
| | 5 - 10' | 0 | Cl | wet | 10 YR 7/8 | 0-52" sandy clay (CL), yellow (10 YR 7/8), wet, firm | 0905 Subsurface soil sample collected 8-10' |
| _ | (52") | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | End of Boring at 10 ft bgs | |
| | | 0 | | | | | |
| 10 | | | | | | | |

| | |
|---|---|
| PROJECT NUMBER 692409CH.SI.DR | Boring Number: CBD-S09-DP07 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 0910 END : 0935 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-7" topsoil | 0930 Surface soil sample collected 0-0.5' |
| | (40") | | SM | moist | 10 YR 5/8 | 7-40": silty sand (SM), yellowish brown (10 YR 5/8) to yellowish brown (10 YR 5/4) at 24", moist, medium dense, fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | 10 YR 5/4 | | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 5/4 | 0-15" same as above | 0935 Subsurface soil sample collected (MS/MSD) 8-10' |
| | (52") | | CL | moist | 10 YR 7/2 | 15-52" sandy clay (CL), mix of light gray (10 YR 7/2) and brownish yellow (10 YR 5/8), moist, firm, wet at bottom | |
| | | 0 | | | | | |
| | | | | | 10 YR 5/8 | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | | | | | End of Boring at 10 ft bgs | |
| | | 0 | | wet | | | |
| 10 | | | | | | | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S09-DP08 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 0940 END : 1005 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-12" topsoil | 1000 Surface soil sample collected 0-0.5' |
| | (24") | | SM | moist | 10 YR 6/8 | 12-24": silty sand (SM), brownish yellow (10 YR 6/8), moist, dense, fine to medium sand | |
| | | 0 | | | | | |
| 5 | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 6/8 | 0-9" same as above except loose | 1005 Subsurface soil sample collected 8-10' |
| | (50") | | CL | moist | 10 YR 6/8 | 9-50" sandy clay (CL), brownish yellow (10 YR 6/8), moist, firm | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 10 | | | | | | End of Boring at 10 ft bgs | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S09-DP09 |
| | SOIL BORING LOG | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1010 END : 1035 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5' | 0 | | | | 0-10" topsoil | 1030 Surface soil sample collected 0-0.5' |
| _ | (33") | | SM | moist | 10 YR 6/4 | 10-33": silty sand (SM), light yellowish brown (10 YR 6/4), moist, dense, fine to medium sand | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | | |
| _ | | | | | | | |
| 5 __ | | | | | | | |
| | 5 - 10' | 0 | SM | moist | 10 YR 6/4 | 0-5" same as above, some organic matter at bottom | 1035 Subsurface soil sample collected 8-10' |
| _ | (57") | | CL | moist | 10 YR 6/4 | 5-57" sandy clay (CL), light yellowish brown (10 YR 6/4), moist, firm, streaks of yellowish brown (10 YR 5/8) | |
| | | 0 | | | | | |
| _ | | | | | | | |
| | | 0 | | | 10 YR 5/8 | | |
| _ | | | | | | | |
| | | 0 | | | | | |
| _ | | | | | | End of Boring at 10 ft bgs | |
| | | 0 | | | | | |
| 10 | | | | | | | |

| | | | |
|---|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: | CBD-S09-DP10 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT
WATER LEVELS : START : 1040 END : 1115 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(25") | 0<br>0<br>0 | SM | moist | 10 YR 6/4 | 0-7" topsoil<br>7-25": silty sand (SM), light yellowish brown (10 YR 6/4), moist, medium dense, fine to medium sand | 1105 Surface soil sample collected 0-0.5' |
| 5 | 5 - 10'<br>(52") | 0<br>0<br>0<br>0<br>0 | SM<br>CL | moist<br>moist | 10 YR 6/4<br>10 YR 6/4 | 0-15" same as above<br>15-52" sandy clay (CL), light yellowish brown (10 YR 6/4), moist, firm to hard at bottom<br>End of Boring at 10 ft bgs | 1110 Subsurface soil sample collected 1115 (duplicate) 8-10' |
| 10 | | | | | | | |

PROJECT NUMBER

692409CH.SI.DR

**Boring Number:** CBD-S03-MW03

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS :
START : 1000
END : 1200
LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(34") | 0<br>0<br>0 | SM | moist | 10 YR 7/8 | 0-1" topsoil<br>1-34" silty sand (SM), yellow (10 YR 7/8), moist, medium dense, some fine to medium sand | |
| 5 | 5 - 10'<br>(41") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 7/8 | 0-41" same as above except trace clay at bottom | |
| 10 | 10 - 15'<br>(29") | 0<br>0 | SM<br>CL | moist<br>moist | 10 YR 7/8<br>10 YR 7/4 | 0-22" same as above<br>22-29" sandy clay (CL), very pale brown (10 YR 7/4) with brown mottling, moist, firm, low plasticity, fine to medium sand | |
| 15 | 15 - 20'<br>(18") | 0<br>0 | CL<br>CL | moist<br>moist | 10 YR 7/4<br>gley 1 4/2 | 0-10" same as above<br>10-18" sandy clay (CL), greyish green (gley 1 4/2), moist, firm, low plasticity, fine sand | |
| 20 | 20 - 25'<br>(38") | 0<br>0<br>0<br>0 | CL | very moist<br>moist | gley 1 4/2 | 0-38" same as above except 0-6" very moist, medium plasticity before becoming moist with low plasticity | |
| 25 | 25 - 30'<br>(57") | 0<br>0<br>0<br>0<br>0 | CL | wet<br>moist | gley 1 4/2 | 0-57" same as above, wet from 0-18", medium plasticity from 0-18", saturated | 25' is top of water table |
| 30 | 30 - 35'<br>(57") | 0<br>0<br>0<br>0 | CL | wet<br>moist | gley 1 4/2 | 0-57" same as above, wet from 0-20", medium plasticity from 0-20", saturated | |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-SO3-MW03 |
|---|---|---|
| | **SOIL BORING LOG** | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD

ELEVATION : DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT and HSA

WATER LEVELS : START : 1000 END : 1200 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0 | | | | | |
| 35 | | | | | | End of Boring at 35 ft bgs<br>Well Screened from 24 ft bgs to 34 ft bgs | |
| 40 | | | | | | | |

| PROJECT NUMBER | Boring Number: |
|---|---|
| 692409CH.SI.DR | CBD-S04-MW02 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD — LOCATION : Chesapeake Beach, MD

ELEVATION : — DRILLING CONTRACTOR : Geologic Exploration

DRILLING METHOD AND EQUIPMENT USED : DPT and HSA

WATER LEVELS : — START : 1355 — END : 1525 — LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
|  | 0 - 5'<br>(N/A) |  |  |  |  | Hand Augered (Topsoil) |  |
| 5 | 5 - 10'<br>(9") | 0 | SM | moist | 10 YR 6/8 | 0-9" silty sand (SM), brownish yellow (10 YR 6/8), moist, medium dense, fine to medium sand |  |
| 10 | 10 - 15'<br>(21") | 0<br>0 | SM | moist | 10 YR 6/8 | 0-21" same as above except gravelly landfill debris from 4"-6" |  |
| 15 | 15 - 20'<br>(34") | 0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-34" same as above except wet at 7" | top of water table at 16 ft bgs |
| 20 | 20 - 25'<br>(37") | 0<br>0<br>0<br>0 | SM<br>CL | moist<br>moist | 10 YR 6/8<br>gley 1 4/2 | 0-15" same as above except more clay<br>15-37" sandy clay (CL), greyish green (gley 1 4/2), moist, firm, some fine sand, low plasticity |  |
| 25 | 25 - 30'<br>(57") | 0<br>0<br>0<br>0<br>0 | CL | wet<br>wet | gley 1 4/2 | 0-44" slough, wet<br>44-57" same as above |  |
| 30 | 30 - 35'<br>(57") | 0<br>0<br>0<br>0 | CL | moist to wet<br>wet | gley 1 4/2 | 0-26" slough, moist to wet<br>26-57" same as above except medium plasticity and soft, some brown mottling |  |

| PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-MW02 |
|---|---|

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 1355 END : 1525 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| 35 | | 0 | | | | End of Boring at 35 ft bgs<br>Well Screened from 15 ft bgs to 25 ft bgs | |
| 40 | | | | | | | |

|  |  |  |
|---|---|---|
| PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: | CBD-S04-MW03 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 1540 END : LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
|  | 0 - 5'<br>(N/A) |  |  |  |  | Hand Augered (Topsoil) |  |
| 5 | 5 - 10'<br>(30") | 0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-30" silty sand (SM), brownish yellow (10 YR 6/8), moist, medium dense, some fine to medium sand |  |
| 10 | 10 - 15'<br>(27") | 0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-27" same as above |  |
| 15 | 15 - 20'<br>(38") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-38" same as above |  |
| 20 | 20 - 25'<br>(4") | 0 | SM | moist | 10 YR 6/8 | 0-4" same as above |  |
| 25 | 25 - 30'<br>(57") | 0<br>0<br>0<br>0<br>0 | SM<br>SC | moist to wet<br>wet<br>moist | 10 YR 6/8<br>gley 1 4/2 | 0-32" same as above, except saturated at 16" and loose<br>32-57" clayey sand with silt (SC), grayish brown (gley 1 4/2), wet at top to moist, firm, low plasticity, some fine sand | water table at 26.5 ft bgs |
| 30 | 30 - 35'<br>(57") | 0<br>0<br>0<br>0 | CL | moist to wet<br>wet | gley 1 4/2 | 0-22" slough<br>22-57" same as above except grading to sandy clay at bottom |  |

| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S04-MW03 |
|---|---|---|
| | **SOIL BORING LOG** | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 1540 END : LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR<br>RELATIVE DENSITY<br>OR CONSISTENCY, SOIL STRUCTURE,<br>MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| 35 | | 0 | | | | End of Boring at 35 ft bgs<br>Well Screened from 25 ft bgs to 35 ft bgs | |
| 40 | | | | | | | |

| PROJECT NUMBER | | |
|---|---|---|
| 692409CH.SI.DR | Boring Number: | CBD-S05-MW01 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 0815 END : 1000 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT)<br>REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(N/A) | | | | | Hand Augered (Topsoil) | |
| 5 | 5 - 10'<br>(0") | | | | | No Recovery | |
| 10 | 10 - 15'<br>(46") | | CL | moist | 10 YR 6/8 | 0-17" sandy clay (CL), brownish yellow (10 YR 6/8), moist, firm, medium plasticity, fine sand, some water at top | |
| | | 0 | SM | moist | 10 YR 6/8 | 17-46" silty sand (SM), brownish yellow (10 YR 6/8), moist, medium dense, some fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 15 | 15 - 20'<br>(57") | 0 | CL<br>SM | moist<br>moist | 10 YR 6/8<br>10 YR 6/8 | 0-43" same as 0-17" for (10-15)<br>43-57" same as 17-46" for (10-15) | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 20 | 20 - 25'<br>(57") | 0 | | | | 0-18" same as 0-17" for (10-15) | |
| | | 0 | SP | moist | 10 YR 5/8 | 18-57" sand (SP), yellowish brom (10 YR 5/8), moist, medium dense, some fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 25 | 25 - 30'<br>(50") | 0 | | | | 0-19" slough | |
| | | 0 | SP | moist | 10 YR 5/8 | 19-50" same as above | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| 30 | 30 - 35'<br>(57") | 0 | | | | 0-7" slough | top of water table at 31 ft bgs |
| | | 0 | SM | wet | 10 YR 5/8 | 7-57" silty sand (SM), yellowish brown (10 YR 5/8), wet, low denisty, some fine to medium sand | |
| | | 0 | | | | | |
| | | 0 | | | | | |

PROJECT NUMBER

692409CH.SI.DR

Boring Number: CBD-S05-MW01

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 0815 END : 1000 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0 | | | | | |
| 35 | 35 - 40'<br>(57") | 0 | SC | wet | gley 1 4/2 | 0-7" slough<br>7-57" clayey sand (SC), greenish grey (gley 1 4/2), saturated, low density, some fine to medium sand, some clay | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 40 ft bgs<br>Well Screened from 30 ft bgs to 40 ft bgs | |
| 40 | | 0 | | | | | |

| | | |
|---|---|---|
| ch2m | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S05-MW02 |

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 1350 END : 1450 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(N/A) | | | | | Hand Augered (Topsoil) | |
| 5 | 5 - 10'<br>(0") | | | | | No Recovery | |
| 10 | 10 - 15'<br>(10") | 0 | CL | moist | 10 YR 6/8 | 0-10" sandy clay (CL), brownish yellow (10 YR 6/8), moist, firm, some fine to medium sand, low plasticity | |
| 15 | 15 - 20'<br>(32") | 0<br>0<br>0 | CL<br>SM | moist<br>moist | 10 YR 6/8<br>10 YR 6/8 | 0-9" same as above except burned material at bottom<br>9-32" silty sand (SM), brownish yellow (10 YR 6/8), moist, medium dense, some fine to medium sand | |
| 20 | 20 - 25'<br>(41") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-9" slough<br>9-41" same as above | |
| 25 | 25 - 30'<br>(52") | 0<br>0<br>0<br>0<br>0 | SM | wet | 10 YR 6/8 | 0-7" slough<br>7-52" same as above except wet | top of water table at 26 ft bgs |
| 30 | 30 - 35'<br>(57") | 0<br>0<br>0<br>0 | SM<br>SC | wet<br>wet | 10 YR 6/8<br>gley 1 4/2 | 0-17" same as above<br>17-57" clayey sand (SC), greenish grey (gley 1 4/2), wet, low density, some fine to medium sand | |

| | | |
|---|---|---|
| | PROJECT NUMBER<br>692409CH.SI.DR | Boring Number: CBD-S05-MW02 |
| | **SOIL BORING LOG** | |

PROJECT : ESI at NRL-CBD LOCATION : Chesapeake Beach, MD
ELEVATION : DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : START : 1350 END : 1450 LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0 | | | | | |
| 35 | 35 - 40'<br>(57") | 0 | SC | wet | gley 1 4/2 | 0-57" same as above except soft at 30", wet at top, moist at bottom | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | moist | | End of Boring at 40 ft bgs<br>Well Screened from 25 ft bgs to 35 ft bgs | |
| 40 | | 0 | | | | | |

PROJECT NUMBER 692409CH.SI.DR | Boring Number: CBD-S05-MW03

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD | LOCATION : Chesapeake Beach, MD
ELEVATION : | DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS : | START : 1000 | END : 1150 | LOGGER : J Clark

| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION: SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0 - 5'<br>(N/A) | | | | | Hand Augered (Topsoil) | |
| 5 | 5 - 10'<br>(40") | 0<br>0<br>0<br>0 | CL | moist | 10 YR 7/8 | 0-40" sandy clay (CL), yellow (10 YR 7/8), moist, firm, low plasticity, some fine to medium sand | |
| 10 | 10 - 15'<br>(50") | 0<br>0<br>0<br>0<br>0 | CL<br>SM | moist<br>moist | 10 YR 7/8<br>10 YR 6/8 | 0-15" same as above<br>15-50" silty sand (SM), brownish yellow (10 YR 6/8), moist, medium dense, some fine to medium sand | |
| 15 | 15 - 20'<br>(48") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-15" slough<br>15-48" same as above | |
| 20 | 20 - 25'<br>(43") | 0<br>0<br>0<br>0 | SM | moist | 10 YR 6/8 | 0-5" slough<br>5-43" same as above | |
| 25 | 25 - 30'<br>(55") | 0<br>0<br>0<br>0<br>0 | SM | wet | 10 YR 7/4 | 0-55" same as above except very pale brown (10 YR 7/4) and wet at 28" | top of water table at 28 ft bgs |
| 30 | 30 - 35'<br>(57") | 0<br>0<br>0<br>0 | SC | wet | gley 1 4/2 | 0-57" clayey sand (SC), greenish grey (gley 1 4/2), wet, low density, some fine to medium sand | |

PROJECT NUMBER

692409CH.SI.DR

**Boring Number:** CBD-S05-MW03

# SOIL BORING LOG

PROJECT : ESI at NRL-CBD
LOCATION : Chesapeake Beach, MD
ELEVATION :
DRILLING CONTRACTOR : Geologic Exploration
DRILLING METHOD AND EQUIPMENT USED : DPT and HSA
WATER LEVELS :
START : 1000
END : 1150
LOGGER : J Clark

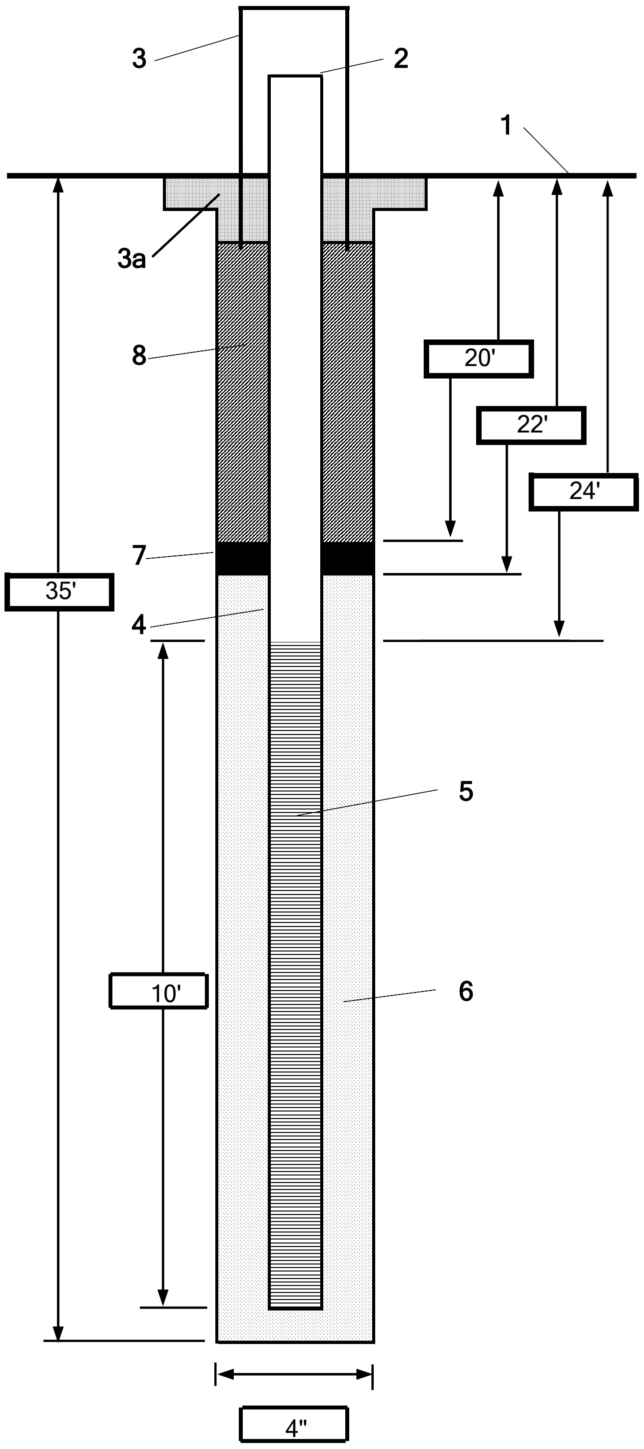
| DEPTH BELOW SURFACE (FT) | INTERVAL (FT) REC/BLOWS | PID(ppm) | USCS CODE | Moisture Content | Munsell Code | SOIL DESCRIPTION<br>SOIL NAME, COLOR RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY. | OTHER COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0 | | | | | |
| 35 | 35 - 40'<br>(41") | 0 | SC | wet | gley 1 4/2 | 0-57" same as above except some shells | |
| | | 0 | | | | | |
| | | 0 | | | | | |
| | | 0 | | | | End of Boring at 40 ft bgs | |
| | | | | | | Well Screened from 25 ft bgs to 35 ft bgs | |
| 40 | | | | | | | |

# Monitoring Well Construction Logs

| | | |
|---|---|---|
| PROJECT NUMBER | WELL NUMBER<br>CBD-SO3-MW03 | SHEET 1 OF 1 |

# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 3
DRILLING CONTRACTOR : Geologic Explorations
DRILLING METHOD AND EQUIPMENT U: HSA/DPT
WATER LEVELS : START : 4/9/2018 LOGGER : J. Clark

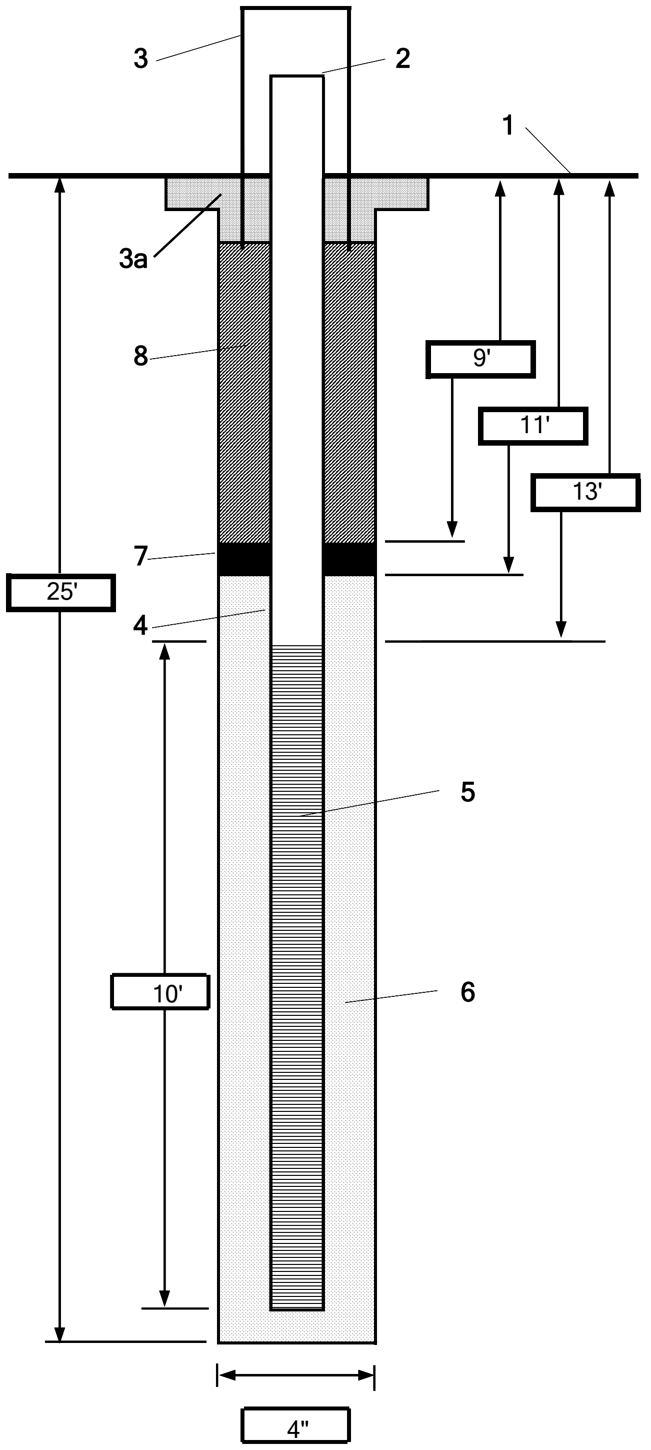


| | |
|---|---|
| 1- Ground elevation at well | N/a |
| 2- Top of casing elevation | N/a |
| 3- Wellhead protection cover type | 3' x 4" Steel stick-up surface casing with locking cover |
| a) concrete pad dimensions | 2' x 2' |
| 4- Dia./type of well casing | 2.0-inch Schedule 40 PVC |
| 5- Type/slot size of screen | 10 ft screen, 0.1 slotted |
| 6- Type screen filter | #1 Silica Sand |
| a) Quantity used | 5 bags |
| 7- Type of seal | Bentonite pellets |
| a) Quantity used | 1 bag |
| 8- Grout | Bentonite Grout |
| a) Grout mix used | |
| Development method | Surge and purge |
| Development time | N/a |
| Estimated purge volume | 30 gallons total purged |
| Comments | |

| | | |
|---|---|---|
| PROJECT NUMBER | WELL NUMBER<br>CBD-SO4-MW02 | SHEET 1 OF 1 |

# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 4
DRILLING CONTRACTOR : Geologic Explorations
DRILLING METHOD AND EQUIPMENT U HSA/DPT
WATER LEVELS : START : 4/9/2018 LOGGER : J. Clark



| | | |
|---|---|---|
| 1- | Ground elevation at well | N/a |
| 2- | Top of casing elevation | N/a |
| 3- | Wellhead protection cover type | 3' x 4" Steel stick-up surface casing with locking cover |
| | a) concrete pad dimensions | 2' x 2' |
| 4- | Dia./type of well casing | 2.0-inch Schedule 40 PVC |
| 5- | Type/slot size of screen | 10 ft screen, 0.1 slotted |
| 6- | Type screen filter | #1 Silica Sand |
| | a) Quantity used | 5 bags |
| 7- | Type of seal | Bentonite pellets |
| | a) Quantity used | 1 bag |
| 8- | Grout | Bentonite Grout |
| | a) Grout mix used | |
| | Development method | Surge and purge |
| | Development time | N/a |
| | Estimated purge volume | 5 gallons total purged |
| | Comments | |

| | PROJECT NUMBER | WELL NUMBER<br>CBD-SO4-MW03 SHEET 1 OF 1 |
|---|---|---|

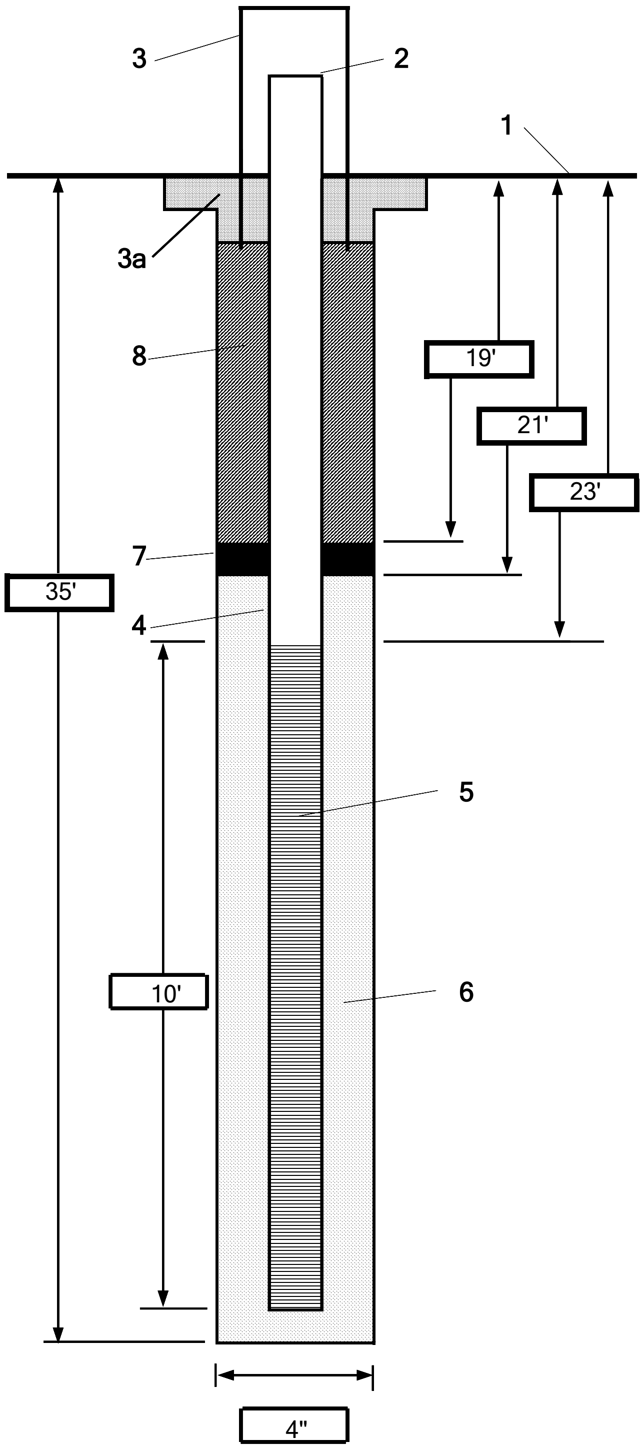
# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 4

DRILLING CONTRACTOR : Geologic Explorations

DRILLING METHOD AND EQUIPMENT U: HSA/DPT

WATER LEVELS : START : 4/9/2018 LOGGER : J. Clark



1- Ground elevation at well N/a

2- Top of casing elevation N/a

3- Wellhead protection cover type 3' x 4" Steel stick-up surface casing with locking cover

a) concrete pad dimensions 2' x 2'

4- Dia./type of well casing 2.0-inch Schedule 40 PVC

5- Type/slot size of screen 10 ft screen, 0.1 slotted

6- Type screen filter #1 Silica Sand

a) Quantity used 5 bags

7- Type of seal Bentonite pellets

a) Quantity used 1 bag

8- Grout Bentonite Grout

a) Grout mix used

Development method Surge and purge

Development time N/a

Estimated purge volume 10 gallons total purged

Comments

| PROJECT NUMBER | WELL NUMBER<br>CBD-SO5-MW01 | SHEET 1 | OF 1 |
|---|---|---|---|

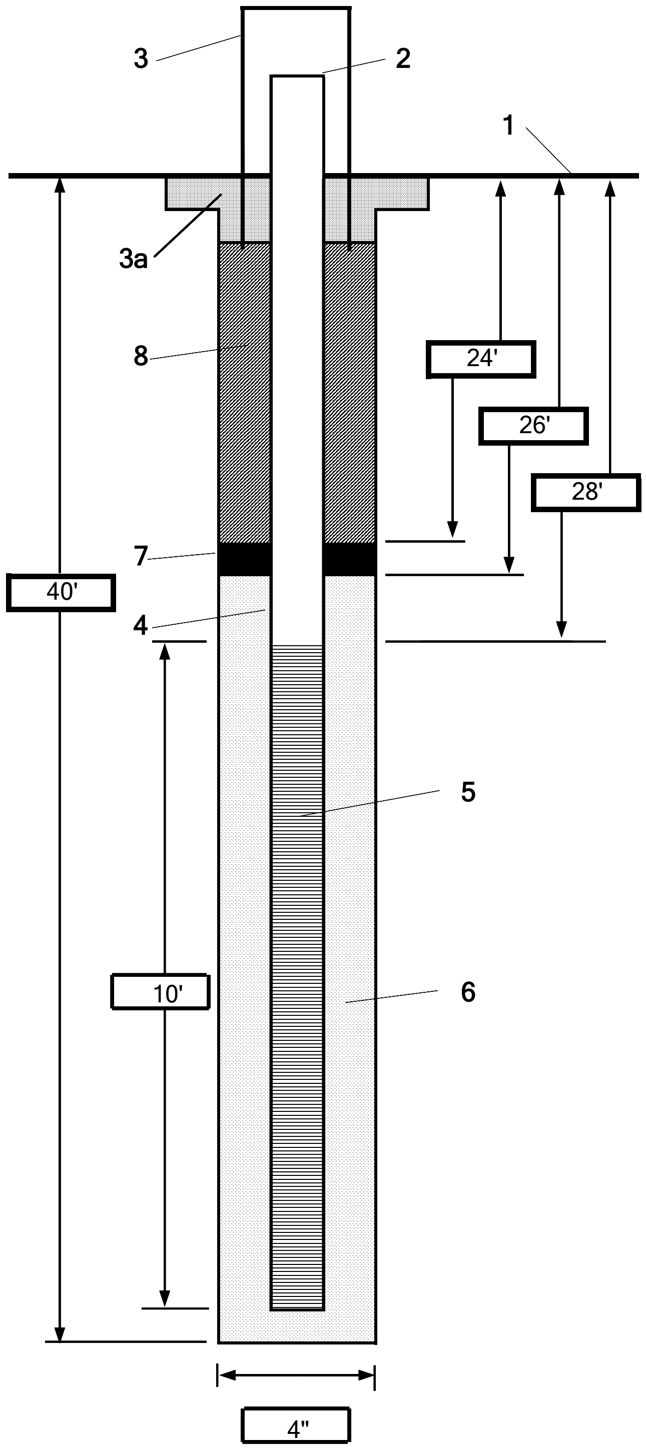
# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 4

DRILLING CONTRACTOR : Geologic Explorations

DRILLING METHOD AND EQUIPMENT U: HSA/DPT

WATER LEVELS : START : 4/10/2018 LOGGER : J. Clark



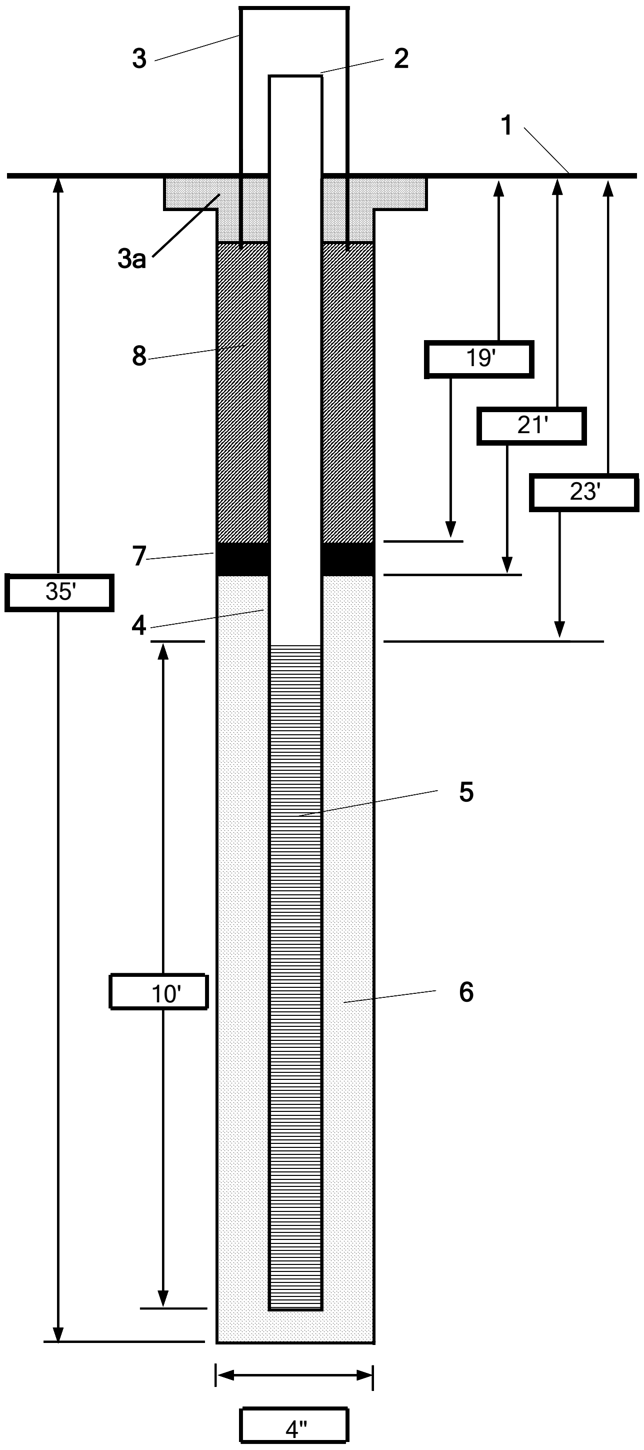
| | |
|---|---|
| 1- Ground elevation at well | N/a |
| 2- Top of casing elevation | N/a |
| 3- Wellhead protection cover type | 3' x 4" Steel stick-up surface casing with locking cover |
| a) concrete pad dimensions | 2' x 2' |
| 4- Dia./type of well casing | 2.0-inch Schedule 40 PVC |
| 5- Type/slot size of screen | 10 ft screen, 0.1 slotted |
| 6- Type screen filter | #1 Silica Sand |
| a) Quantity used | 5 bags |
| 7- Type of seal | Bentonite pellets |
| a) Quantity used | 1 bag |
| 8- Grout | Bentonite Grout |
| a) Grout mix used | |
| Development method | Surge and purge |
| Development time | N/a |
| Estimated purge volume | 8 gallons total purged |
| Comments | |

PROJECT NUMBER

WELL NUMBER
CBD-SO5-MW02 SHEET 1 OF 1

# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 4
DRILLING CONTRACTOR : Geologic Explorations
DRILLING METHOD AND EQUIPMENT U: HSA/DPT
WATER LEVELS : START : 4/10/2018 LOGGER : J. Clark



1- Ground elevation at well N/a
2- Top of casing elevation N/a
3- Wellhead protection cover type 3' x 4" Steel stick-up surface casing with locking cover
a) concrete pad dimensions 2' x 2'
4- Dia./type of well casing 2.0-inch Schedule 40 PVC
5- Type/slot size of screen 10 ft screen, 0.1 slotted
6- Type screen filter #1 Silica Sand
a) Quantity used 5 bags
7- Type of seal Bentonite pellets
a) Quantity used 1 bag
8- Grout Bentonite Grout
a) Grout mix used

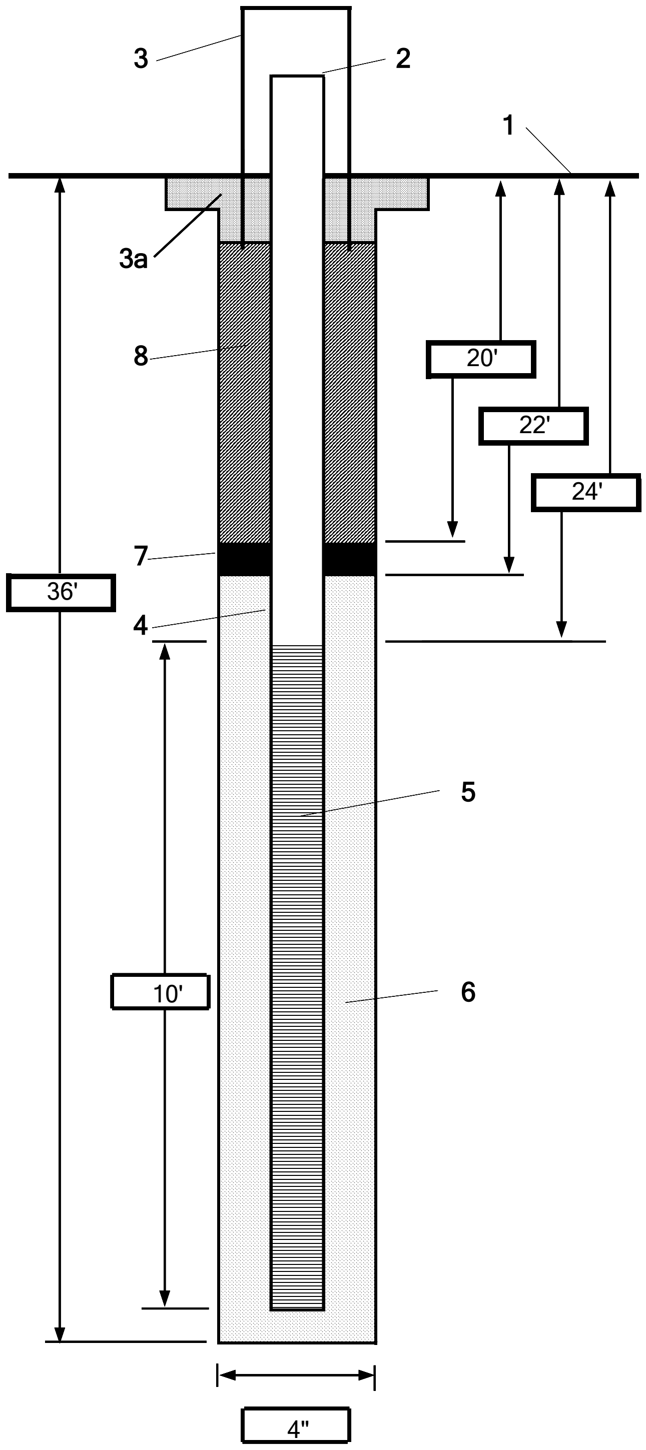
Development method Surge and purge
Development time N/a
Estimated purge volume 25 gallons total purged
Comments

PROJECT NUMBER

WELL NUMBER
CBD-SO5-MW03 SHEET 1 OF 1

# WELL COMPLETION DIAGRAM

PROJECT : NRL CBD ESI LOCATION : Site 4
DRILLING CONTRACTOR : Geologic Explorations
DRILLING METHOD AND EQUIPMENT U: HSA/DPT
WATER LEVELS : START : 4/10/2018 LOGGER : J. Clark



1- Ground elevation at well N/a
2- Top of casing elevation N/a
3- Wellhead protection cover type 3' x 4" Steel stick-up surface casing with locking cover
a) concrete pad dimensions 2' x 2'
4- Dia./type of well casing 2.0-inch Schedule 40 PVC
5- Type/slot size of screen 10 ft screen, 0.1 slotted
6- Type screen filter #1 Silica Sand
a) Quantity used 5 bags
7- Type of seal Bentonite pellets
a) Quantity used 1 bag
8- Grout Bentonite Grout
a) Grout mix used

Development method Surge and purge
Development time N/a
Estimated purge volume 30 gallons total purged
Comments

# Appendix C

# Monitoring Well Development Logs and Groundwater Purge Logs

# Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1020 Finish Time: 1105 **Well ID:** S03-MW03
Field Team: **Site:** Site 3
Weather/Temp: **Initial DTW (ft btoc):** 20.39'
Well Condition: PID (Well Casing): PID (BZ):
Pump Type (if applicable): Purge Method:
Portable Pump Depth: Purge Rate[1]:

**Field Parameters** (collect in 3 minute intervals)

| Time | DTW[2] | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
|---|---|---|---|---|---|---|---|---|---|
| 1025 | | ***Begin Pumping Well*** | | | | | | | |
| 1030 | | | 17.04 | 5.41 | 0.195 | >1000 | 0.80 | 132 | |
| 1035 | | | 16.67 | 5.33 | 0.171 | >1000 | 1.07 | 148 | |
| 1040 | | | 16.75 | 5.54 | 0.139 | >1000 | 3.77 | 148 | |
| 1045 | | | 16.93 | 5.61 | 0.153 | >1000 | 9.37 | 143 | |
| 1050 | | | 16.83 | 5.56 | 0.168 | >1000 | 11.25 | 157 | |
| 1052 | well | purged | dry | | | | | | |
| 1055 | | | 16.79 | 5.42 | 0.175 | >1000 | 11.45 | 134 | |
| 1057 | well | purged | dry | | | | | | |
| 1102 | | | 17.47 | 5.46 | 0.178 | >1000 | 11.74 | 166 | milky |
| Well | Developed | | at 1105 | | | | | | |
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| Stabilization Criteria[3] | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

[1] target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)

[2] DTW: depth to water measured from top of casing; total drawdown should not exceed 0.33 ft

[3] stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** **Sample Time:**
Field Filtered? ( Y / N ) If yes, for which analysis: Sampling Water Level:
Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,
*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175
QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split
QC ID : QC Sample Time:
QC analysis different from sample analysis? ( Y / N ) If yes, specify:
Decon: ( Y / N ) PID Meter ID:
Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID:
Total Purge Volume (GAL): WQ Meter Type and ID:
Comments:

# Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1110 Finish Time: 1145 **Well ID:** SO4-MW02
Field Team: ______ Site: site 4
Weather/Temp: ______ **Initial DTW (ft btoc):** 19.85'
Well Condition: ______ PID (Well Casing): ______ PID (BZ): ______
Pump Type (if applicable): ______ Purge Method: ______
Portable Pump Depth: ______ Purge Rate[1]: ______

| **Field Parameters** (collect in 3 minute intervals) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time | DTW[2] | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
| 1115 | | ***Begin Pumping Well*** | | | | | | | |
| 1120 | | | 16.27 | 5.76 | 0.096 | >1000 | 14.75 | 141 | |
| 1125 | well | purged | dry | | | | | | |
| 1130 | well | purged | dry | | | | | | |
| 11.35 | waiting | for | recharge | | | | | | |
| 1140 | | | 18.50 | 5.98 | 0.100 | >1000 | 11.50 | 173 | |
| 1142 | | | 16.04 | 6.17 | 0.090 | 199 | 11.92 | 184 | |
| 1144 | well | purged | dry. Well | Developed | | | | | milky |
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| Stabilization Criteria[3] | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

[1] target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)
[2] DTW: depth to water measured from top of casing; total drawdown should not exceed 0.33 ft
[3] stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** ______ **Sample Time:** ______
Field Filtered? ( Y / N ) If yes, for which analysis: ______ Sampling Water Level: ______
Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,
*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175
QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split
QC ID: ______ QC Sample Time: ______
QC analysis different from sample analysis? ( Y / N ) If yes, specify: ______
Decon: ( Y / N ) PID Meter ID: ______
Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID: ______
Total Purge Volume (GAL): ______ WQ Meter Type and ID: ______
Comments: ______

# Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1255 Finish Time: 1332 **Well ID:** S04-MW03

Field Team: ______ **Site:** site 4

Weather/Temp: ______ **Initial DTW (ft btoc):** 24.03

Well Condition: ______ PID (Well Casing): ______ PID (BZ): ______

Pump Type (if applicable): ______ Purge Method: ______

Portable Pump Depth: ______ Purge Rate[1]: ______

**Field Parameters** (collect in 3 minute intervals)

| Time | DTW[2] | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
|---|---|---|---|---|---|---|---|---|---|
| 1300 | | ***Begin Pumping Well*** | | | | | | | |
| 1305 | | | 19.86 | 6.58 | 0.328 | 949 | 11.95 | 216 | |
| 1310 | well purged dry. Leave for 5 min to recharge | | | | | | | | |
| 1315 | | | 19.72 | 7.00 | 0.719 | 273 | 10.40 | 156 | |
| 1317 | purged dry | | | | | | | | |
| 1325 | | | 18.50 | 6.85 | 0.252 | 1000 | 9.03 | 145 | |
| 1327 | | | 16.98 | 6.89 | 6.237 | 368 | 10.15 | 151 | |
| 1331 | purged dry. | | | | | | | | |
| 1332 | well Developed | | | | | | | | clear |
| last reading → 1330 | | | 17.73 | 6.87 | 0.726 | 313 | 10.28 | 184 | |
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| Stabilization Criteria[3] | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

[1] target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)

[2] DTW: depth to water measured from top of casing; total drawdown should not exceed 0.33 ft

[3] stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** ______ **Sample Time:** ______

Field Filtered? ( Y / N ) If yes, for which analysis: ______ Sampling Water Level: ______

Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,

*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175

QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split

QC ID : ______ QC Sample Time: ______

QC analysis different from sample analysis? ( Y / N ) If yes, specify: ______

Decon: ( Y / N ) PID Meter ID: ______

Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID: ______

Total Purge Volume (GAL): ______ WQ Meter Type and ID: ______

Comments: ______

## Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1340 Finish Time: 1407 **Well ID:** S05-MW01
Field Team: Site: Site 5
Weather/Temp: **Initial DTW (ft btoc):** 34.49
Well Condition: PID (Well Casing): PID (BZ):
Pump Type (if applicable): Purge Method:
Portable Pump Depth: Purge Rate¹:

| **Field Parameters** (collect in 3 minute intervals) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time | DTW² | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
| 1342 | | ***Begin Pumping Well*** | | | | | | | |
| 1345 | | | 17.51 | 7.08 | 0.680 | 561 | 12.26 | 162 | |
| 1350 | well | purged | dry | | | | | | |
| 1355 | | | 17.61 | 7.85 | 0.589 | 634 | 8.07 | 213 | |
| 1356 | well | purged | dry | | | | | | |
| 1405 | | | 16.74 | 7.94 | 0.692 | 110 | 11.49 | 234 | |
| 1406 | Well | Purged | Dry | | | | | | |
| 1407 | Well | Developed | | | | | | | Clear |
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| Stabilization Criteria³ | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

¹ target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)

² DTW: depth to water measured from top of casing; total drawdown should not exceed 0.33 ft

³ stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** **Sample Time:**
Field Filtered? ( Y / N ) If yes, for which analysis: Sampling Water Level:
Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,
*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175
QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split
QC ID : QC Sample Time:
QC analysis different from sample analysis? ( Y / N ) If yes, specify:
Decon: ( Y / N ) PID Meter ID:
Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID:
Total Purge Volume (GAL): WQ Meter Type and ID:
Comments:

# Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1410 Finish Time: 1427 **Well ID:** S05-MW02
Field Team: **Site:** Site 5
Weather/Temp: **Initial DTW (ft btoc):** 29.10'
Well Condition: PID (Well Casing): PID (BZ):
Pump Type (if applicable): Purge Method:
Portable Pump Depth: Purge Rate[1]:

| **Field Parameters** (collect in 3 minute intervals) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Time | DTW[2] | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
| 1415 | | ***Begin Pumping Well*** | | | | | | | |
| 1420 | | | 16.81 | 7.86 | 0.473 | 183 | 12.72 | 238 | |
| 1423 | | | 16.05 | 7.46 | 0.480 | 36.0 | 12.15 | 203 | |
| 1426 | | | 16.82 | 8.03 | 0.453 | 60.7 | 9.42 | 186 | |
| 1427 | well | developed | | | | | | | Clear |
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| Stabilization Criteria[3] | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

[1] target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)

[2] DTW: depth to water measured from top of casing; total drawdown should not exceed 0.33 ft

[3] stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** **Sample Time:**
Field Filtered? ( Y / N ) If yes, for which analysis: Sampling Water Level:
Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,
*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175
QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split
QC ID: QC Sample Time:
QC analysis different from sample analysis? ( Y / N ) If yes, specify:
Decon: ( Y / N ) PID Meter ID:
Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID:
Total Purge Volume (GAL): WQ Meter Type and ID:
Comments:

## Low Flow Groundwater Purging and Sampling Datasheet

Date: 4/12/2018 Start Time: 1430 Finish Time: 1446 **Well ID:** S05-MW03
Field Team: Site: site 5
Weather/Temp: **Initial DTW (ft btoc):** 27.59'
Well Condition: PID (Well Casing): PID (BZ):
Pump Type (if applicable): Purge Method:
Portable Pump Depth: Purge Rate[1]:

**Field Parameters** (collect in 3 minute intervals)

| Time | DTW[2] | Purge Vol. (mL) | Temp (°C) | pH | Sp. Cond. (µS/cm) | Turbidity (NTU) | DO (mg/L) | ORP (mV) | Note color, odor, sheen, particulate, etc. |
|---|---|---|---|---|---|---|---|---|---|
| 1430 | | ***Begin Pumping Well*** | | | | | | | |
| 1435 | | | 16.22 | 8.37 | 0.343 | 282 | 13.28 | 153 | |
| 1440 | | | 15.67 | 8.14 | 0.330 | 187 | 11.62 | 166 | |
| 1445 | | | 17.10 | 8.00 | 0.351 | 92.0 | 12.57 | 164 | |
| 1446 | Well | Developed | | | | | | | Clear |
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| Stabilization Criteria[3] | - | - | - | ± 0.1 units | ± 3% | ≤ 10 NTU or ± 10 % | ± 0.3 mg/L | ± 10 mV | - |

[1] target purge rate is 0.1 - 0.5 L/min (0.03 - 0.13 gal/min)

[2] DTW: depth to water measured from top of casing, total drawdown should not exceed 0.33 ft

[3] stabilization achieved once field parameters stabilize for 3 successive readings

**Sample ID:** **Sample Time:**
Field Filtered? ( Y / N ) If yes, for which analysis: Sampling Water Level:
Analyses: 8260B, 8260BSIM, 300, 314, 350.1, 376.2, 504.1, 1625C, 180.1, 6860, 2540C, 2510B, 2320B, 6010B, 6020, 7470A, 8015B,
*(Circle)* 8081A, 8082, 8141A, 8151A, 8270C, 8270CSIM, 8290, 8315A, 8321A, 9040B, 9040C, 9050, 9060, 3500Fe-D, RSK-175
QC SAMPLE (*circle*): FD MS/MSD EQ Blank Split
QC ID: QC Sample Time:
QC analysis different from sample analysis? ( Y / N ) If yes, specify:
Decon: ( Y / N ) PID Meter ID:
Alconox: ( Y / N ) DI Rinse: ( Y / N ) WL Indicator ID:
Total Purge Volume (GAL): WQ Meter Type and ID:
Comments:

# Groundwater Purging Logs

13 bottles

**CH2MHILL**

PROJECT NUMBER

WELL NUMBER S03MW01

SHEET 1 OF 1

# GROUNDWATER SAMPLING DATA SHEET

PROJECT: NRL CBD

DATE: 4/25/18

LOCATION: Site 3

WEATHER:

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: S. Dronfield

TOTAL DEPTH OF WELL: (FT BTOC)

INITIAL DEPTH OF WATER: 16.85 (FT BTOC)

WATER COLUMN: (FT)

INSIDE DIAMETER OF WELL: (IN)

WELL VOLUME: (GAL)

TOTAL PURGE VOLUME: 10 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 845

END TIME:

*WATER QUALITY INSTRUMENT MANUFACTURER & MODEL:*

*WATER QUALITY INSTRUMENT SERIAL #:*

*TURBIDITY METER MANUFACTURER & MODEL:*

*TURBIDITY METER SERIAL #:*

*WATER LEVEL INDICATOR SERIAL #:*

## WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ±0.10 mg/L or 10% of | +/- 0.1 SU | ±3% | ±10 mV | +/- 1.0 °C | -- | ±10% | 100-500 mL/min | -- |
| 850 | 16.92 | 8.24 | 4.76 | 0.140 | 260 | 14.46 | | 937 | <200mL | |
| 855 | 17.43 | 8.09 | 4.77 | 0.138 | 286 | 14.48 | | 542 | | |
| 900 | 17.58 | 7.26 | 4.78 | 0.125 | 307 | 14.41 | | 146 | | |
| 905 | 17.60 | 7.08 | 4.75 | 0.123 | 310 | 14.43 | | 109 | | |
| 910 | | 6.91 | 4.74 | 0.120 | 314 | 14.46 | | 84.0 | | |
| 915 | | 6.64 | 4.73 | 0.117 | 317 | 14.45 | | 56.7 | | |
| 920 | | 6.56 | 4.71 | 0.116 | 319 | 14.47 | | 47.8 | | |
| 925 | | 6.41 | 4.72 | 0.114 | 321 | 14.48 | | 41.9 | | |
| 930 | | 6.40 | 4.71 | 0.114 | 323 | 14.47 | | 35.5 | | |
| 935 | | 6.36 | 4.69 | 0.114 | 326 | 14.47 | | 29.0 | | |
| 940 | | 6.46 | 4.70 | 0.112 | 327 | 14.46 | | 19.8 | | |
| 945 | | 6.33 | 4.68 | 0.113 | 330 | 14.45 | | 15.5 | | |
| 950 | | 6.26 | 4.68 | 0.112 | 333 | 14.47 | | 12.6 | | |
| 955 | | 6.27 | 4.69 | 0.112 | 334 | 14.43 | | 9.8 | | |
| 1000 | | 6.25 | 4.68 | 0.112 | 335 | 14.42 | | 9.4 | | |
| 1005 | | 6.25 | 4.68 | 0.112 | 335 | 14.41 | | 8.8 | | 10 gal |
| 1010 | | Collect sample CBD-S03-GW01-0418 | | | | | | | | |
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## SAMPLE INFORMATION

Dilution:

Sodium Persulfate Reading:

NOTES:

**CH2MHILL**

PROJECT NUMBER: 692409.FI.FS

WELL NUMBER: CBD-S03-MW02

SHEET 1 OF 1

## GROUNDWATER SAMPLING DATA SHEET

PROJECT: NRL-CBD Expanded SI

DATE: 04/25/18

LOCATION: NRL, CBD - Chesapeake Beach MD

WEATHER: Rainy/overcast

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: E. Curbo

TOTAL DEPTH OF WELL: 28.27 (FT BTOC)

INITIAL DEPTH OF WATER: 21.94 (FT BTOC)

WATER COLUMN: 6.33 (FT)

INSIDE DIAMETER OF WELL: 2 (IN)

WELL VOLUME: 1.03 (GAL)

TOTAL PURGE VOLUME: 3.6 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 0810

END TIME:

WATER QUALITY INSTRUMENT MANUFACTURER & MODEL: ~~Heron Dipper T~~ Horiba U-52

WATER QUALITY INSTRUMENT SERIAL #: 10898

TURBIDITY METER MANUFACTURER & MODEL: —

TURBIDITY METER SERIAL #: —

WATER LEVEL INDICATOR SERIAL #: C-103084 Heron

### WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ± 0.10 mg/L or 10% of | +/- 0.1 SU | ± 3% | ± 10 mV | +/- 1.0 °C | -- | ± 10% | 100-500 mL/min | -- |
| 0830 | 22.63 | 2.52 | 6.78 | 0.348 | 165 | 13.40 | 0.28 | >1000 | 150mL/min | 0.1 |
| 0835 | 22.95 | 1.05 | 6.95 | 0.342 | 158 | 13.52 | 0.20 | >1000 | 125mL/min | 0.20 |
| 0840 | 23.18 | 0.78 | 6.99 | 0.341 | 151 | 13.33 | 0.20 | >1000 | 100 mL/min | 0.30 |
| 0845 | 23.71 | 0.89 | 6.89 | 0.332 | 151 | 13.72 | 0.20 | >1000 | " | 0.40 |
| 0850 | 24.35 | 0.96 | 6.76 | 0.335 | 154 | 14.07 | 0.20 | 721 | " | 0.50 |
| 0855 | 24.42 | 0.76 | 6.71 | 0.339 | 156 | 13.89 | 0.20 | 483 | " | 0.60 |
| 0900 | 25.01 | 0.41 | 6.65 | 0.341 | 155 | 13.94 | 0.20 | 681 | " | 0.70 |
| 0905 | 25.60 | 0.42 | 6.67 | 0.346 | 146 | 14.13 | 0.20 | 658 | " | 0.80 |
| 0910 | 26.01 | 0.00 | 6.72 | 0.350 | 110 | 14.08 | 0.20 | 674 | " | 0.90 |
| 0915 | 26.20 | 0.00 | 6.77 | 0.348 | 81 | 14.11 | 0.20 | 753 | " | 1.00 |
| 0920 | 26.45 | 0.00 | 6.87 | 0.346 | 56 | 14.09 | 0.20 | 735 | " | 1.10 |
| 0925 | 26.91 | 0.00 | 7.01 | 0.344 | 39 | 14.01 | 0.20 | 695 | " | 1.20 |

0927 - Well purged dry at 27'. Will let well recharge, then collect samples.

Returned following week (5/3/18 @ 830) to collect.

SAMPLE INFORMATION: CBD-S03-MW02-0418

Dilution: ____

Sodium Persulfate Reading: ____

NOTES: Pump set at 27'. Well purged dry at 27' @ 0927. Let well recharge, then collect samples.

**CH2MHILL**

PROJECT NUMBER: 692409. FI.FS

WELL NUMBER: S03-MW03

SHEET 1 OF 1

# GROUNDWATER SAMPLING DATA SHEET

PROJECT: ESI at NRL-CBD

DATE: 4/25/18

LOCATION: Chesapeake Beach, MD

WEATHER: cloudy

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: J. Clark, S. Pianfield, E. Lurbo

TOTAL DEPTH OF WELL: ______ (FT BTOC)

INITIAL DEPTH OF WATER: 20.65 (FT BTOC)

WATER COLUMN: ______ (FT)

INSIDE DIAMETER OF WELL: ______ (IN)

WELL VOLUME: ______ (GAL)

TOTAL PURGE VOLUME: 5 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 0835

END TIME: 1030

*WATER QUALITY INSTRUMENT MANUFACTURER & MODEL:* ______

*WATER QUALITY INSTRUMENT SERIAL #:* ______

*TURBIDITY METER MANUFACTURER & MODEL:* ______

*TURBIDITY METER SERIAL #:* ______

*WATER LEVEL INDICATOR SERIAL #:* ______

## WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ±0.10 mg/L or 10% of | +/-0.1 SU | ±3% | ±10 mV | +/-1.0 °C | – | ±10% | 100-500 mL/min | – |
| 840 | 21.95 | 0.87 | 4.56 | 0.139 | 188 | 16.08 | — | 986 | 100 | |
| 845 | 21.69 | 1.20 | 4.84 | 0.138 | 191 | 15.90 | — | 623 | 100 | |
| 850 | 21.74 | 0.05 | 4.74 | 0.136 | 200 | 16.04 | — | 428 | 100 | |
| 855 | 21.85 | 0.00 | 4.71 | 0.136 | 203 | 16.19 | — | 306 | 100 | |
| 900 | 21.92 | 0.00 | 4.74 | 0.136 | 205 | 16.29 | — | 139 | 100 | |
| 905 | 21.95 | 0.00 | 4.73 | 0.136 | 205 | 16.30 | — | 81.3 | 100 | |
| 910 | 21.96 | 0.00 | 4.79 | 0.136 | 205 | 16.28 | — | 53.1 | 100 | |
| 915 | 21.97 | 0.00 | 4.70 | 0.136 | 208 | 16.28 | — | 46.0 | 100 | |
| 920 | 21.97 | 0.00 | 4.65 | 0.136 | 208 | 16.38 | — | 36.0 | 100 | |
| 925 | 22.13 | 0.00 | 4.69 | 0.137 | 204 | 16.39 | — | 30.3 | 100 | |
| 930 | 22.15 | 0.00 | 4.62 | 0.136 | 207 | 16.37 | — | 23.0 | 100 | |
| 935 | 22.17 | 0.00 | 4.64 | 0.136 | 206 | 16.42 | — | 15.5 | 100 | |
| 940 | 22.11 | 0.00 | 4.69 | 0.136 | 203 | 16.33 | — | 10.0 | 100 | |
| 945 | 22.12 | 0.00 | 4.60 | 0.137 | 207 | 16.50 | — | 10.0 | 100 | |
| 950 | 22.10 | 0.00 | 4.65 | 0.137 | 204 | 16.46 | — | 9.6 | 100 | |
| 955 | sample collected | | | | | | | | | 5 gal |
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## SAMPLE INFORMATION

Dilution: ______

Sodium Persulfate Reading: ______

NOTES:

**CH2MHILL**

PROJECT NUMBER

WELL NUMBER S04-MW01

SHEET 1 OF 1

## GROUNDWATER SAMPLING DATA SHEET

PROJECT: NRC CBD

DATE: 5/3/18

LOCATION: Site 4

WEATHER:

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: S. Dronfield

TOTAL DEPTH OF WELL: ______ (FT BTOC)

INITIAL DEPTH OF WATER: 18.55 (FT BTOC)

WATER COLUMN: ______ (FT)

INSIDE DIAMETER OF WELL: ______ (IN)

WELL VOLUME: ______ (GAL)

TOTAL PURGE VOLUME: 3 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 1155

END TIME:

*WATER QUALITY INSTRUMENT MANUFACTURER & MODEL:*

*WATER QUALITY INSTRUMENT SERIAL #:*

*TURBIDITY METER MANUFACTURER & MODEL:*

*TURBIDITY METER SERIAL #:*

*WATER LEVEL INDICATOR SERIAL #:*

### WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | < 0.5 ft | ±0.10 mg/L or 10% of | +/- 0.1 SU | ± 3% | ± 10 mV | +/- 1.0 °C | -- | ± 10% | 100-500 mL/min | -- |
| 1200 | 19.30 | 2.81 | 4.85 | 0.066 | 258 | 17.83 |  | >1000.0 | <200 |  |
| 1205 |  | 2.53 | 4.67 | 0.062 | 289 | 17.15 |  | 694 |  |  |
| 1210 |  | 3.11 | 4.66 | 0.057 | 293 | 17.19 |  | 558 |  |  |
| 1215 |  | 3.40 | 4.61 | 0.054 | 298 | 17.17 |  | 517 |  |  |
| 1220 | ↓ | 3.01 | 4.18 | 0.055 | 298 | 17.58 |  | 434 |  |  |
| 1225 | 21.10 | 2.37 | 4.77 | 0.057 | 288 | 19.22 |  | 427 |  |  |
| 1230 | 21.15 | 2.35 | 4.75 | 0.050 | 285 | 18.67 |  | 391 |  |  |
| 1235 | 21.21 | 2.42 | 4.68 | 0.057 | 291 | 19.94 |  | 386 | ↓ | 3 gal |
| 1240 | Collect Sample CBD-S04-GW01-0518 |  |  |  |  |  |  |  |  |  |
|  |  |  | CBD-S04-GW01-0518-MS/SD |  |  |  |  |  |  |  |
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### SAMPLE INFORMATION

Dilution: ______

Sodium Persulfate Reading: ______

NOTES:

CH2MHILL

PROJECT NUMBER 692409. FI FS

WELL NUMBER CBD-S04-MW02

SHEET 1 OF 1

## GROUNDWATER SAMPLING DATA SHEET

PROJECT: NRL-CBD Expanded SI

DATE: 05/03/18

LOCATION: NRL-CBD-

WEATHER: Hot ~90°F

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: E. Curbo

TOTAL DEPTH OF WELL: 29.45 (FT BTOC)

INITIAL DEPTH OF WATER: 19.97 (FT BTOC)

WATER COLUMN: 8.48 (FT)

INSIDE DIAMETER OF WELL: 2 (IN)

WELL VOLUME: 1.38 (GAL)

TOTAL PURGE VOLUME: 2.50 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 05/01/18 1300

END TIME: 1515

WATER QUALITY INSTRUMENT MANUFACTURER & MODEL: Horiba U-52

WATER QUALITY INSTRUMENT SERIAL #: #24230

TURBIDITY METER MANUFACTURER & MODEL: —

TURBIDITY METER SERIAL #: —

WATER LEVEL INDICATOR SERIAL #: C-10

### WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ±0.10 mg/L or 10% of | +/-0.1 SU | ±3% | ±10 mV | +/-1.0 °C | -- | ±10% | 100-500 mL/min | -- |
| 1320 | 20.20 | 0.87 | 5.90 | 0.090 | 378 | 22.33 | 0 | 229 | 100 ml/min | 0.20 |
| 1325 | " | 0.39 | 5.91 | 0.091 | 382 | 22.33 | 0 | 151 | " | 0.30 |
| 1330 | " | 1.05 | 5.77 | 0.091 | 389 | 24.91 | 0 | 127 | " | 0.40 |
| 1335 | " | 0.91 | 5.89 | 0.080 | 382 | 25.31 | 0 | 127 | " | 0.50 |
| 1340 | " | 0.78 | 5.95 | 0.081 | 380 | 25.01 | 0 | 126 | " | 0.60 |
| 1345 | " | 0.69 | 5.92 | 0.082 | 387 | 24.83 | 0 | 125 | " | 0.70 |
| 1350 | " | 0.69 | 5.95 | 0.081 | 388 | 24.97 | 0 | 90.7 | " | 0.80 |
| 1355 | " | 0.80 | 5.95 | 0.081 | 392 | 24.98 | 0 | 88.5 | " | 0.90 |
| 1400 | " | 0.81 | 5.94 | 0.080 | 395 | 25.09 | 0 | 61.3 | " | 1.0 |
| 1405 | " | 0.75 | 5.95 | 0.079 | 398 | 25.12 | 0 | 58.7 | " | 1.10 |
| 1410 | " | 0.69 | 5.97 | 0.078 | 401 | 25.17 | 0 | 35.4 | " | 1.20 |
| 1415 | " | 0.73 | 5.98 | 0.081 | 404 | 25.34 | 0 | 18.5 | " | 1.30 |
| 1420 | " | 0.75 | 5.99 | 0.082 | 407 | 25.80 | 0 | 20.2 | " | 1.40 |
| 1425 | " | 0.74 | 6.00 | 0.080 | 408 | 25.95 | 0 | 19.9 | " | 1.50 |
| 1430 - collect CBD-S04-GW02-0518 | | | | | | | | | | |
| 1435 - collect Dup - CBD S04-GW02P-0518 | | | | | | | | | | |
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### SAMPLE INFORMATION

Dilution: ________

Sodium Persulfate Reading: ________

NOTES: Set pump at 27'.
Collect parent at 1430
collect Dup at 1435'

**CH2MHILL**

PROJECT NUMBER

WELL NUMBER S04-MW03

SHEET 1 OF 1

## GROUNDWATER SAMPLING DATA SHEET

PROJECT:

DATE: 5/3/18

LOCATION:

WEATHER:

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

FIELD TEAM: S. Dronfield

TOTAL DEPTH OF WELL: ______ (FT BTOC)

INITIAL DEPTH OF WATER: 23.66 (FT BTOC)

WATER COLUMN: ______ (FT)

INSIDE DIAMETER OF WELL: ______ (IN)

WELL VOLUME: ______ (GAL)

TOTAL PURGE VOLUME: 4 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 1350

END TIME:

WATER QUALITY INSTRUMENT MANUFACTURER & MODEL.

WATER QUALITY INSTRUMENT SERIAL #:

TURBIDITY METER MANUFACTURER & MODEL:

TURBIDITY METER SERIAL #:

WATER LEVEL INDICATOR SERIAL #:

### WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ±0.10 mg/L or 10% of | +/- 0.1 SU | ±3% | ±10 mV | +/- 1.0 °C | – | ±10% | 100-500 mL/min | – |
| 1355 | 25.10 | 0.75 | 6.71 | 0.311 | 134 | 19.69 | | 660 | <200 | |
| 1400 | ↓ | 0.25 | 6.53 | 0.311 | 129 | 20.49 | | 547 | ↓ | |
| 1405 | | 0.04 | 6.44 | 0.310 | 125 | 20.21 | | 469 | | |
| 1410 | | 0.00 | 6.40 | 6.309 | 123 | 20.24 | | 334 | | |
| 1415 | | 0.00 | 6.39 | 0.309 | 120 | 20.23 | | 248 | | |
| 1420 | | 0.00 | 6.32 | 0.295 | 127 | 20.56 | | 124 | | |
| 1425 | | 0.00 | 6.17 | 0.242 | 150 | 21.05 | | 42.2 | | |
| 1430 | | 0.00 | 6.10 | 0.224 | 160 | 20.85 | | 25.8 | | |
| 1435 | | 0.00 | 6.06 | 0.220 | 164 | 20.77 | | 24.7 | | |
| 1440 | | 0.00 | 6.09 | 0.218 | 168 | 20.68 | | 23.9 | | 4 gal |
| 1445 | Collect sample CBD-S04-GW03-0518 | | | | | | | | | |

### SAMPLE INFORMATION

Dilution: ______ Sodium Persulfate Reading ______

NOTES:

**CH2MHILL**

PROJECT NUMBER 692409.FI.FS

WELL NUMBER CBD-S05-MW01

SHEET 1 OF 1

## GROUNDWATER SAMPLING DATA SHEET

PROJECT: NRL-CBD Expanded SI
DATE: 04/25/18
LOCATION: NRL-CBD, Chesapeake Beach, MD
WEATHER: Overcast
PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:
PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC
FIELD TEAM: E. Curbo

TOTAL DEPTH OF WELL: 44.05 (FT BTOC)
INITIAL DEPTH OF WATER: 34.35 (FT BTOC)
WATER COLUMN: 9.70 (FT)
INSIDE DIAMETER OF WELL: 2 (IN)
WELL VOLUME: 1.58 (GAL)
TOTAL PURGE VOLUME: 2.75 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 1100
END TIME: 1250
WATER QUALITY INSTRUMENT MANUFACTURER & MODEL: Horiba U-52
WATER QUALITY INSTRUMENT SERIAL #: 16898
TURBIDITY METER MANUFACTURER & MODEL: —
TURBIDITY METER SERIAL #: —
WATER LEVEL INDICATOR SERIAL #: C-10384 Heron

### WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | < 0.5 ft | ± 0.10 mg/L or 10% of | +/- 0.1 SU | ± 3% | ± 10 mV | +/- 1.0 °C | -- | ± 10% | 100-500 mL/min | -- |
| 1130 | 34.75 | 1.77 | 7.16 | 0.718 | 118 | 13.53 | 0.3 | 191 | 100ml/min | 0.2 |
| 1135 | 34.83 | 0.12 | 6.89 | 0.720 | 112 | 13.73 | 0.3 | 179 | " | 0.30 |
| 1140 | 34.83 | 0 | 6.84 | 0.723 | 110 | 13.75 | 0.4 | 140 | " | 0.40 |
| 1145 | 34.83 | 0 | 6.80 | 0.725 | 111 | 13.70 | 0.4 | 102 | " | 0.50 |
| 1150 | 34.83 | 0 | 6.77 | 0.719 | 113 | 13.77 | 0.3 | 90.5 | " | 0.60 |
| 1155 | 34.83 | 0 | 6.82 | 0.710 | 114 | 14.05 | 0.3 | 67.5 | " | 0.70 |
| 1200 | 34.83 | 0 | 6.72 | 0.708 | 121 | 14.22 | 0.3 | 47.9 | " | 0.80 |
| 1205 | 34.83 | 0 | 6.74 | 0.700 | 125 | 14.18 | 0.3 | 24.6 | " | 0.90 |
| 1210 | 34.83 | 0 | 6.75 | 0.693 | 126 | 14.34 | 0.3 | 22.3 | " | 1.0 |
| 1215 | 34.83 | 0 | 6.82 | 0.689 | 125 | 14.48 | 0.3 | 22.5 | " | 1.20 |
| 1220 - | Collect | CBD-S05-GW01-0418 | | | | | | | | |
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### SAMPLE INFORMATION CBD-S05-GW01-0418

Dilution: ____________ Sodium Persulfate Reading: ____________

NOTES: Pump set at 42' Sample collected @ 1220

**CH2MHILL**

PROJECT NUMBER:

WELL NUMBER: 505MW02

SHEET 1 OF 1

# GROUNDWATER SAMPLING DATA SHEET

PROJECT:

DATE: 4/25/18

LOCATION:

WEATHER:

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

FIELD TEAM:

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

TOTAL DEPTH OF WELL: 39.45 (FT BTOC)

INITIAL DEPTH OF WATER: 29.13 (FT BTOC)

WATER COLUMN: (FT)

INSIDE DIAMETER OF WELL: (IN)

WELL VOLUME: (GAL)

TOTAL PURGE VOLUME: 5 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 1135

END TIME:

WATER QUALITY INSTRUMENT MANUFACTURER & MODEL:

WATER QUALITY INSTRUMENT SERIAL #:

TURBIDITY METER MANUFACTURER & MODEL:

TURBIDITY METER SERIAL #:

WATER LEVEL INDICATOR SERIAL #:

## WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ± 0.10 mg/L or 10% of | +/- 0.1 SU | ± 3% | ± 10 mV | +/- 1.0 °C | -- | ± 10% | 100-500 mL/min | -- |
| 1140 | 2920 | 5.65 | 6.83 | 0.357 | 205 | 14.69 | | 214 | <200 | |
| 1145 | | 5.26 | 6.78 | 0.375 | 189 | 14.73 | | 151 | | |
| 1150 | | 5.20 | 6.75 | 0.371 | 187 | 14.82 | | 133 | | |
| 1155 | | 5.18 | 6.74 | 0.367 | 187 | 14.96 | | 106 | | |
| 1200 | | 4.85 | 6.71 | 0.357 | 185 | 15.21 | | 48.3 | | |
| 1205 | | 4.65 | 6.65 | 0.353 | 185 | 15.23 | | 29.7 | | |
| 1210 | | 4.60 | 6.65 | 0.352 | 189 | 15.40 | | 16.8 | | |
| 1215 | | 4.44 | 6.65 | 0.351 | 189 | 15.51 | | 12.3 | | |
| 1220 | | 4.37 | 6.65 | 0.351 | 190 | 15.55 | | 8.1 | | |
| 1225 | | 4.32 | 6.69 | 0.349 | 190 | 15.71 | | 5.8 | | |
| 1230 | ↓ | 4.30 | 6.65 | 0.349 | 190 | 15.80 | | 5.5 | ↓ | 5 gal |
| 1239 | Collect | sample | CBD-505- | GW02- | 0418 | | | | | |
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## SAMPLE INFORMATION

Dilution:

Sodium Persulfate Reading:

NOTES:

**CH2MHILL**

PROJECT NUMBER 692409.FI.FS

WELL NUMBER 505-MW03

SHEET 1 OF 1

# GROUNDWATER SAMPLING DATA SHEET

PROJECT: ESI at NRL-CBD

DATE: 4/25/18

LOCATION: Chesapeake Beach, MD

WEATHER: Cloudy

PUMP TYPE (circle one): PERISTALTIC [✓ SUBMERSIBLE] OTHER:

FIELD TEAM: J. Clarke, S. Drentfeld, E. Curbo

PURGING/SAMPLING METHOD (circle one): [✓ LOW-FLOW] VOLUMETRIC

TOTAL DEPTH OF WELL: 39.53 (FT BTOC)

INITIAL DEPTH OF WATER: 27.47 (FT BTOC)

WATER COLUMN: ______ (FT)

INSIDE DIAMETER OF WELL: ______ (IN)

WELL VOLUME: ______ (GAL)

TOTAL PURGE VOLUME: 4.7 (GAL)

4" DIAMETER = 0.653 GAL/FT

START TIME: 1120

END TIME: 1245

WATER QUALITY INSTRUMENT MANUFACTURER & MODEL: ______

WATER QUALITY INSTRUMENT SERIAL #: ______

TURBIDITY METER MANUFACTURER & MODEL: ______

TURBIDITY METER SERIAL #: ______

WATER LEVEL INDICATOR SERIAL #: ______

## WATER QUALITY PARAMETERS

| Time | Depth to Water ft | DO mg/L | pH SU | Specific Conductivity mS/cm | ORP mV | Temp °C | Salinity | Turbidity NTU | Flow Rate mL/min | Cummulative Volume Purged gal |
|---|---|---|---|---|---|---|---|---|---|---|
| Stability Criterion: | <0.5 ft | ±0.10 mg/L or 10% of | +/- 0.1 SU | ±3% | ±10 mV | +/- 1.0 °C | -- | ±10% | 100-500 mL/min | -- |
| 1125 | 28.09 | 5.65 | 7.02 | 0.280 | 142 | 14.65 | — | 167 | 100 | |
| 1130 | 28.26 | 5.60 | 6.97 | 0.279 | 156 | 14.75 | — | 162 | 100 | |
| 1135 | 28.41 | 5.35 | 6.92 | 0.277 | 165 | 14.89 | — | 61.4 | 100 | |
| 1140 | 28.54 | 5.11 | 6.88 | 0.275 | 171 | 14.93 | — | 37.2 | 100 | |
| 1145 | 28.69 | 5.02 | 6.86 | 0.272 | 180 | 14.90 | — | 23.1 | 100 | |
| 1150 | 28.91 | 4.84 | 6.78 | 0.268 | 182 | 14.96 | — | 19.2 | 100 | |
| 1155 | 29.21 | 4.66 | 6.64 | 0.264 | 190 | 15.10 | — | 12.3 | 100 | |
| 1200 | 29.47 | 4.46 | 6.60 | 0.261 | 194 | 15.17 | — | 9.3 | 100 | |
| 1205 | 29.62 | 4.32 | 6.60 | 0.259 | 196 | 15.19 | — | 7.5 | 100 | |
| 1210 | 29.89 | 4.22 | 6.62 | 0.257 | 196 | 15.31 | — | 6.2 | 100 | |
| 1215 | sample collected | | | | | | | | | 4.7 gal |
| | | | | | | | | | | |
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## SAMPLE INFORMATION

Dilution: ______

Sodium Persulfate Reading: ______

NOTES:

1530 EB

1530 TB

# Appendix D
# Monitoring Well Survey Report

# Surveyors Report

# Monitoring Well Elevations and Positions

# CLEAN 9000 – CTO JU23

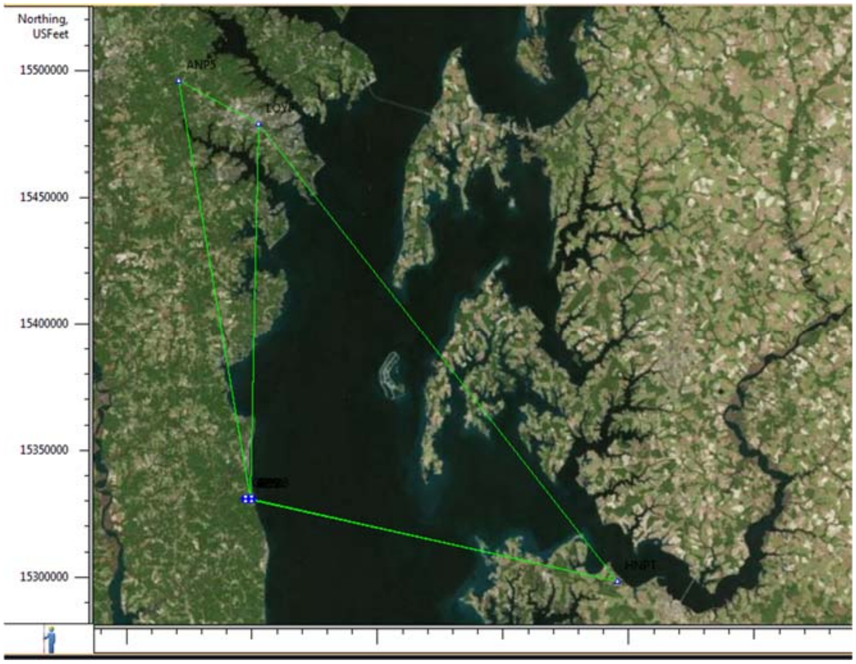
# Naval Research Laboratory – Chesapeake Bay Detachment

# Chesapeake Beach, Maryland

## 1) Initial Project Control

### Horizontal and Vertical datum

Bowman Consulting Group (BCG) performed horizontal and vertical location of new six (6) monitoring wells and one existing monitoring well for the project “CH2m-Navy Clean 9000-CTO JU23” at the address 5813 Bayside RD, Chesapeake RD, Chesapeake Beach MD, 20732 on April 25, 2018. This work is done based on the existing survey control established by Bowman on March 21-24, 2018. This control is on NAD83(2011) for horizontal and on NAVD88 vertical datum. The horizontal datum for GPS1 was calculated using OPUS Project (See data Sheet “5_Mark gps1.pdf attached) and vertical datum is based on the NGS monument on site J133 (For more details see the survey report titled “CH2m-Navy Clean N62470-16-D-9000”). Bowman did a verification of horizontal and vertical datum of existing surveying control. We used only Magnet Tools (Topcon) to post process all GPS Static Observations. GPS 1 is tied to CORS for horizontal and for vertical NGS Monument J133 is used as BM (See the picture below).



BCG performed static observations on two GPS control (GPS9 and GPS18), which we used for the location on both areas as shown on the picture below:

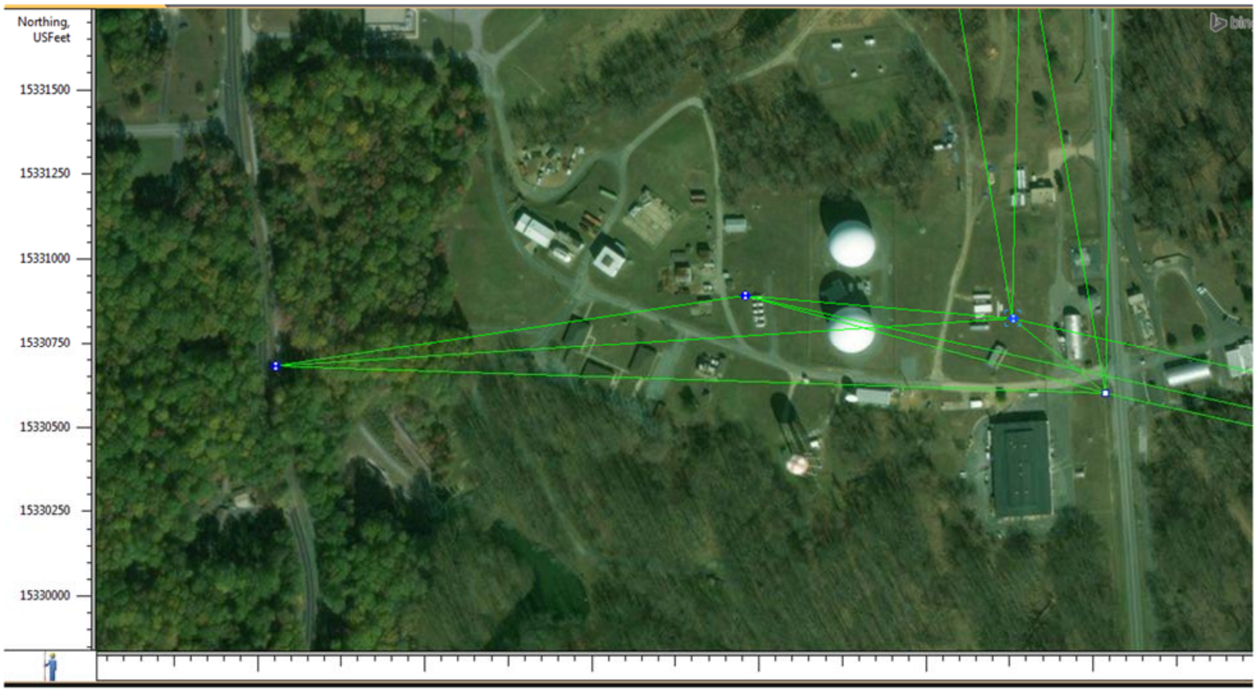


Table 2 below has the result of these verifications:

**Table 2**
**Diff=EX Control on Site – Verification (USft)**
**(NAD 1983(2011) & NAVD 1988)**

| ΔGrid Northing (USft) | ΔGrid Easting (USft) | ΔElevation (USft) | Name |
|---|---|---|---|
| | | | |
| 0.053 | 0.004 | 0.014 | J133(HV1569) |
| | | | |
| 0.014 | 0.014 | 0.001 | GPS18 |
| 0.008 | -0.009 | -0.027 | GPS9 |
| 0.033 | -0.009 | -0.015 | GPS1 |
| | | | |
| | | | |

Table 3 below has the existing control used:

**Table 3**
**Existing control on site used for horizontal and vertical locations(NAD83(2011) NAVD88**

| Name | North | East | ELV | CODE |
|---|---|---|---|---|
| 1 | 361481.1770 | 1446230.1160 | 125.7460 | BASE |
| 9 | 361361.5440 | 1444505.7600 | 155.0450 | GPS9 |
| 17 | 361406.9880 | 1445430.7160 | 118.3830 | GPS17 |
| 18 | 361532.1440 | 1445602.4650 | 121.4310 | GPS18 |

The vertical locations are on NAVD88 based on existing control. GPS 17 and GPS 9 are used as Benchmarks. We run digital level loop on all these wells and new temporary points set using total stations on each site. Table 4 has the first loop as you see below:

CH2M17 2018-04-25.DAT

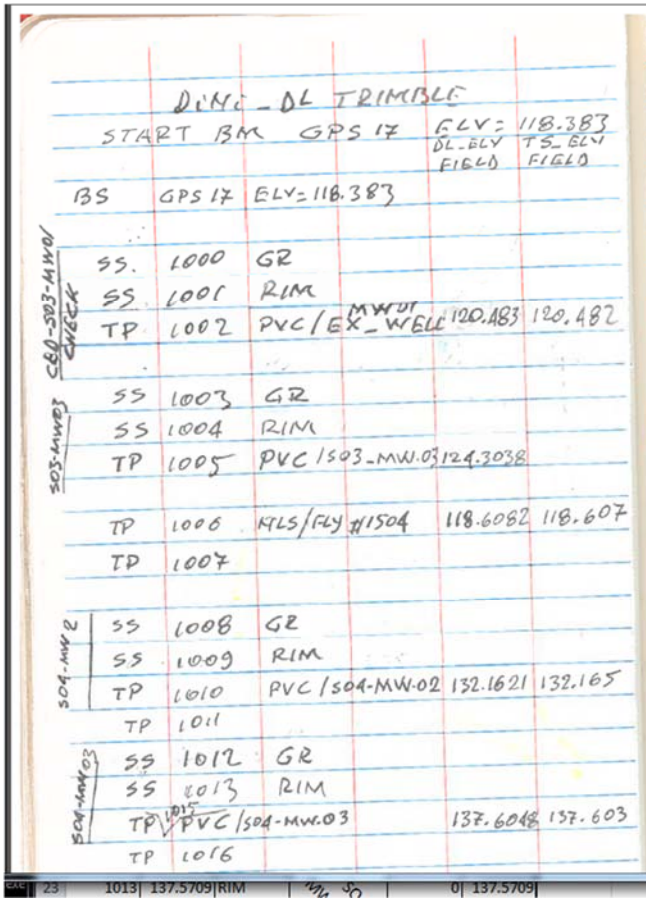
**Table 4**
**CH2M-Navy CLEAN 9000 CTO JU23 (DL-TRIMBLE) 2018-04-25**

| NAME | LOCAL ELV | DESC | NOTE | DIFF=NAVD88-LOCAL | ELV NAVD88(USFEET) | DIFF=RIM-PVC |
|---|---|---|---|---|---|---|
| 17 | 118.3830 | GPS17 | BM | 0 | 118.3830 | |
| | | | | | | |
| 1000 | 117.5224 | GR | CBD-SO3-MW01 | 0 | 117.5224 | |
| 1001 | 120.5694 | RIM | | 0 | 120.5694 | 0.0855 |
| 1002 | 120.4839 | PVC | | 0 | 120.4839 | |
| | | | | | | |
| 1003 | 121.2128 | GR | SO3-MW03 | 0 | 121.2128 | |
| 1004 | 124.2353 | RIM | | 0 | 124.2353 | -0.0685 |
| 1005 | 124.3038 | PVC | | 0 | 124.3038 | |
| | | | | | | |
| 1006 | 118.6082 | NLS | 1504 | 0 | 118.6082 | |
| | | | | | | |
| 1008 | 129.3192 | GR | SO4-MW02 | 0 | 129.3192 | |
| 1009 | 132.2493 | RIM | | 0 | 132.2493 | 0.0872 |
| 1010 | 132.1621 | PVC | | 0 | 132.1621 | |
| | | | | | | |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| 1012 | 134.4753 | GR | SO4-MW03 | 0 | 134.4753 |  |
| 1013 | 137.5709 | RIM |  | 0 | 137.5709 | -0.0339 |
| 1015 | 137.6048 | PVC |  | 0 | 137.6048 |  |
|  |  |  |  |  |  |  |
| 1018 | 118.3865 | CLOSE/17 |  | 0 | 118.3865 | -0.0035 |

| Average Distance back and forward |  |
|---|---|
| Db= | 523.37' |
| Df= | 549.24' |
|  |  |

**Field Notes:**



DiNi - DL TRIMBLE

|  |  |  |  |  |  |
|---|---|---|---|---|---|
|  | START BM | GPS 17 |  | ELV= 118.383 |  |
|  |  |  |  | DL-ELV FIELD | TS-ELV FIELD |
|  | BS | GPS 17 | ELV= 118.383 |  |  |
| CBD-SO3-MW01 CHECK | SS. | 1000 | GR |  |  |
|  | SS | 1001 | RIM |  |  |
|  | TP | 1002 | PVC / EX_WELL MW01 | 120.483 | 120.482 |
| SO3-MW03 | SS | 1003 | GR |  |  |
|  | SS | 1004 | RIM |  |  |
|  | TP | 1005 | PVC / SO3_MW.03 | 124.3038 |  |
|  | TP | 1006 | KTLS/FLY #1504 | 118.6082 | 118.607 |
|  | TP | 1007 |  |  |  |
| SO4-MW2 | SS | 1008 | GR |  |  |
|  | SS | 1009 | RIM |  |  |
|  | TP | 1010 | PVC / SO4-MW-02 | 132.1621 | 132.165 |
|  | TP | 1011 |  |  |  |
| SO4-MW03 | SS | 1012 | GR |  |  |
|  | SS | 1013 | RIM |  |  |
|  | TP | 1015 | PVC / SO4-MW.03 | 137.6048 | 137.603 |
|  | TP | 1016 |  |  |  |

CHEM
2018-04-25
P STOJA, TISLAM
CLOUDY,
PS: NOT TO SCALE

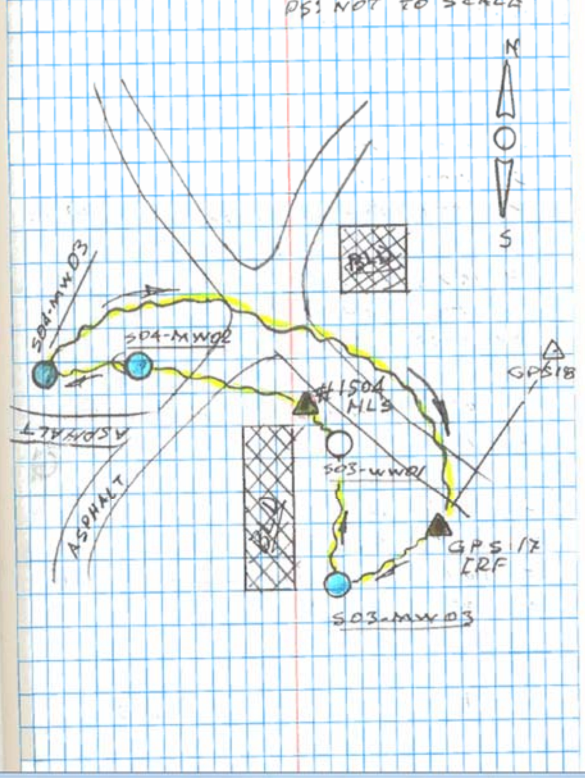


Table 5 has the digital level loop for the second site:

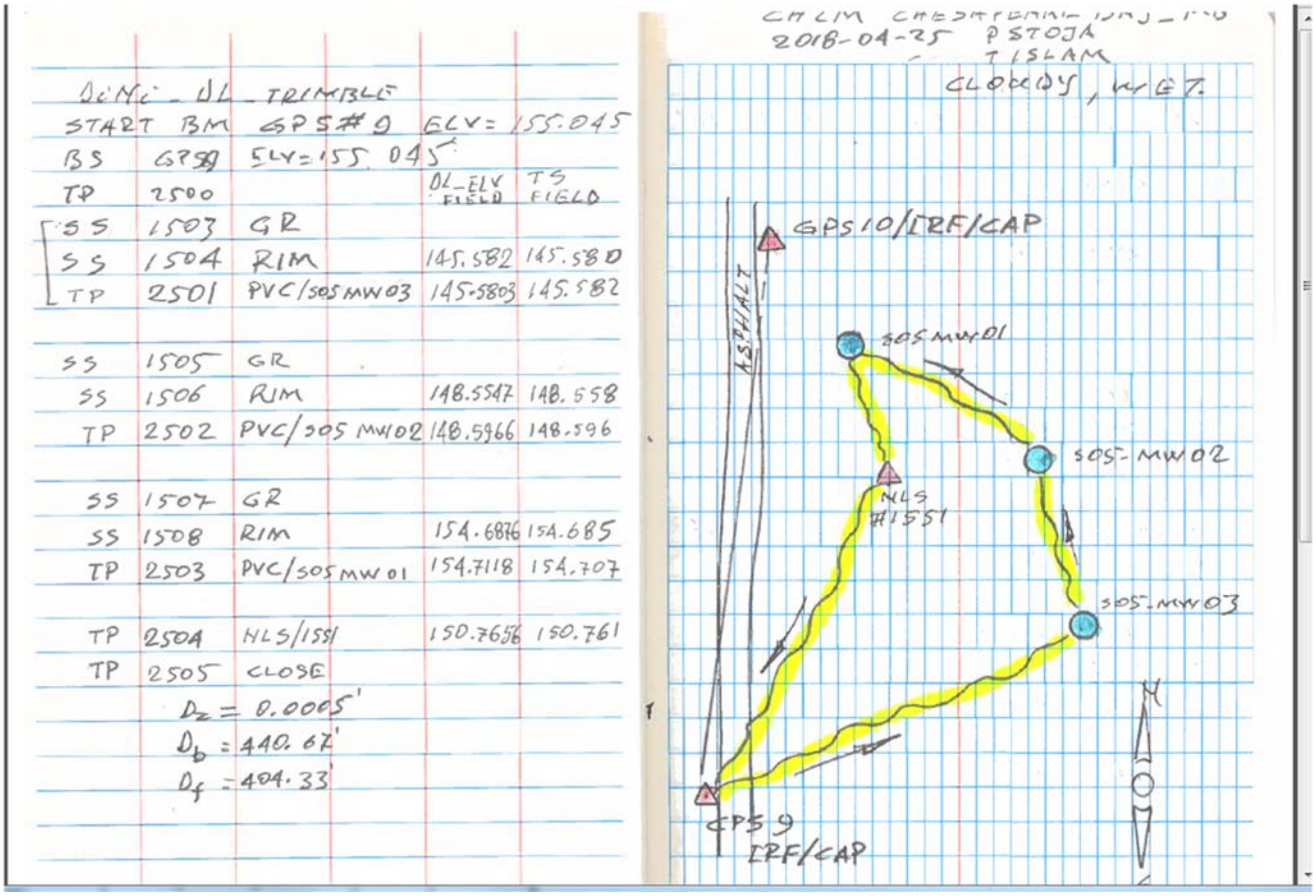
GPS9 2018-04-25.DAT

**Table 5**

CH2M-Navy CLEAN 9000 CTO JU23 (DL-TRIMBLE) 2018-04-25

| NAME | LOCAL ELV | DESC | NOTE | DIFF=NAVD88-LOCAL | ELV NAVD88(USFEET) | DIFF=RIM-PVC |
|---|---|---|---|---|---|---|
| 9 | 155.0450 | GPS9 | BM | 0 | 155.0450 | |
| | | | | | | |
| 1503 | 142.7071 | GR | SO5-MW03 | 0 | 142.7071 | |
| 1504 | 145.5820 | RIM | | 0 | 145.5820 | 0.0017 |
| 2501 | 145.5803 | PVC | | 0 | 145.5803 | |
| | | | | | | |
| 1505 | 145.7043 | GR | SO5-MW02 | 0 | 145.7043 | |
| 1506 | 148.5547 | RIM | | 0 | 148.5547 | -0.0419 |
| 2502 | 148.5966 | PVC | | 0 | 148.5966 | |
| | | | | | | |
| 1507 | 151.9588 | GR | SO5-MW01 | 0 | 151.9588 | |
| 1508 | 154.6876 | RIM | | 0 | 154.6876 | -0.0242 |
| 2503 | 154.7118 | PVC | | 0 | 154.7118 | |
| | | | | | | |
| 2504 | 150.7656 | NLS | 1551 | 0 | 150.7656 | |
| 2505 | 155.0445 | CLOSE | GPS9 | 0 | 155.0445 | 0.0005 |

| Average Distance back and forward | |
|---|---|
| Db= | 440.67 |
| Df= | 404.33 |



DiNi - DL - TRIMBLE
START BM GPS#9 ELV= 155.045

| | | | | |
|---|---|---|---|---|
| BS | GPS9 | ELV=155.045 | | |
| TP | 2500 | | DL-ELV FIELD | TS FIELD |
| SS | 1503 | GR | | |
| SS | 1504 | RIM | 145.582 | 145.580 |
| TP | 2501 | PVC/SOS MW03 | 145.5803 | 145.582 |
| SS | 1505 | GR | | |
| SS | 1506 | RIM | 148.5547 | 148.558 |
| TP | 2502 | PVC/SOS MW02 | 148.5966 | 148.596 |
| SS | 1507 | GR | | |
| SS | 1508 | RIM | 154.6876 | 154.685 |
| TP | 2503 | PVC/SOS MW 01 | 154.7118 | 154.707 |
| TP | 2504 | NLS/1551 | 150.7656 | 150.761 |
| TP | 2505 | CLOSE | | |

$D_z = 0.0005'$
$D_b = 440.67'$
$D_f = 404.33'$

CH2M CHESAPEAKE
2018-04-25 P STOJA
T ISLAM
CLOUDY, WET.

*BCG did not adjust these loops, because the miss closures are less than 0.01 usft.*

## 2) Methodology used for horizontal and vertical locations of monitoring wells

BCG used control base lines GPS-17-18 to locate wells on the site one (1) and control base lines GPS 9-10 for the location of the new monitoring wells on second site. See file 3_CH2M-NC-900-1196 2018-04-25.RW5. Total station Topcon PS103A was used for the horizontal locations of all wells. The picture below has the location and the base lines used for all wells. The vertical location of all wells and new temporary points set on site are based on the digital level loops using points GPS-17 and GPS-9 as benchmark.

The table below has all points on NAD83 (2011) and NAVD88 datum. The elevation of the top inner (plastic/ PVC) well casing with the well plastic cap removed is based on level loop, which are used as a turning points. The top of steel casing (RIM) with the cover of protective removed and ground shots are based on level loop as a side shots. Table 6 below has the final values of the text file for all locations on NAD83(2011) NAVD88:

**Table 6**

CH2M-Navy CLEAN 9000 CTO JU23 SPC83_NAVD88 2018-04-25.txt(Well elevations from DL)

| Name | North(usft | East(usft) | Elv(usft) | CODE | Note |
|---|---|---|---|---|---|
| 1500 | 361356.4900 | 1446128.7580 | 129.2490 | CHK | |
| 1501 | 361407.0330 | 1445430.7400 | 118.3510 | RTK /CHK IPF /GPS17 | |
| 1502 | 361532.1630 | 1445602.4500 | 121.4010 | RTK /CHKIPF | |
| 1503 | 361532.1260 | 1445602.4470 | 121.4280 | IPF /18 | |
| 1504 | 361494.9440 | 1445244.9960 | 118.6082 | NLS | ELV from DL_RUN |
| 1505 | 361406.9860 | 1445430.7190 | 118.3660 | CHK /17 | |
| 1506 | 361455.8480 | 1445297.1580 | 117.6580 | CON1 S | |
| 1507 | 361456.7630 | 1445294.9140 | 117.6440 | CON1 | |
| 1508 | 361459.0440 | 1445295.9310 | 117.6140 | CON1 REC E | |
| 1509 | 361460.4140 | 1445295.5610 | 117.4320 | BOL | |
| 1510 | 361458.6330 | 1445299.2040 | 117.3910 | BOL | |
| 1511 | 361454.5720 | 1445298.0220 | 117.5950 | BOL | |
| 1512 | 361455.9420 | 1445293.5670 | 117.7090 | BOL | |
| 1513 | 361458.8990 | 1445296.9420 | 117.4650 | GR | |
| 1514 | 361457.5240 | 1445296.3890 | 120.5694 | RIM /CBD-SO3-MW-01 | ELV from DL_RUN |
| 1515 | 361457.5050 | 1445296.4690 | 120.4839 | WELL/CBD-SO3-MW-01 PVC | ELV from DL_RUN |
| 1516 | 361390.6430 | 1445251.7960 | 121.2020 | CON2 S | |
| 1517 | 361388.9910 | 1445250.9640 | 121.2910 | CON2 | |
| 1518 | 361389.7850 | 1445249.2860 | 121.2720 | CON2 | |
| 1519 | 361391.3670 | 1445250.0700 | 121.2650 | CON2 C E | |
| 1520 | 361392.3650 | 1445249.9880 | 121.3040 | BOL | |

| | | | | | |
|---|---|---|---|---|---|
| 1521 | 361391.0590 | 1445252.6610 | 120.9290 | BOL | |
| 1522 | 361388.1750 | 1445251.3020 | 121.0930 | BOL | |
| 1523 | 361389.4750 | 1445248.6180 | 121.2900 | BOL | |
| 1524 | 361391.2620 | 1445250.9480 | 121.1830 | GR | |
| 1525 | 361390.3360 | 1445250.4870 | 124.2353 | RIM /SO3-MW-03 | ELV from DL_RUN |
| 1526 | 361390.2850 | 1445250.5660 | 124.3038 | WELL /SO3-MW-03 PVC | ELV from DL_RUN |
| 1527 | 361485.0350 | 1445076.5140 | 129.4310 | CON3 S | |
| 1528 | 361485.2030 | 1445074.6580 | 129.5090 | CON3 | |
| 1529 | 361487.0100 | 1445074.9400 | 129.4340 | CON3 REC E | |
| 1530 | 361487.4900 | 1445074.3590 | 129.3840 | BOL | |
| 1531 | 361487.2960 | 1445077.4060 | 129.2140 | BOL | |
| 1532 | 361484.5100 | 1445077.1750 | 129.3740 | BOL | |
| 1533 | 361484.4950 | 1445073.7670 | 129.5170 | BOL | |
| 1534 | 361487.1190 | 1445076.0680 | 129.3370 | GR | |
| 1535 | 361486.1120 | 1445075.6890 | 132.1621 | WELL /SO4-MW-02 PVC | ELV from DL_RUN |
| 1536 | 361486.1200 | 1445075.6180 | 132.2493 | RIM /SO4-MW-02 | ELV from DL_RUN |
| 1537 | 361471.1580 | 1444986.6990 | 134.5570 | CON4 S | |
| 1538 | 361471.2580 | 1444984.9140 | 134.6330 | CON4 | |
| 1539 | 361473.0910 | 1444985.0460 | 134.5670 | CON4 REC E | |
| 1540 | 361473.7550 | 1444984.6000 | 134.6580 | BOL | |
| 1541 | 361473.5270 | 1444987.5710 | 134.1900 | BOL | |
| 1542 | 361470.6950 | 1444987.7430 | 134.3780 | BOL | |
| 1543 | 361470.5040 | 1444984.3320 | 134.7440 | BOL | |
| 1544 | 361472.0410 | 1444985.8390 | 137.6048 | WELL /SO4 MW-03 PVC | ELV from DL_RUN |
| 1545 | 361472.0660 | 1444985.7440 | 137.5709 | RIM /SO4 MW-03 | ELV from DL_RUN |
| 1546 | 361473.1130 | 1444986.2080 | 134.4300 | GR | |
| 1547 | 361407.0080 | 1445430.7190 | 118.3710 | CHK /17 | |
| 1548 | 361361.5370 | 1444505.6830 | 155.0770 | CHK /9 | |
| 1549 | 361795.2570 | 1444471.1380 | 156.7160 | CHK /10 | |
| 1550 | 361795.1470 | 1444471.1580 | 156.6510 | CHK | |
| 1551 | 361671.8270 | 1444617.4190 | 150.7656 | NLS | ELV from DL_RUN |
| 1552 | 361361.5430 | 1444505.7590 | 155.0300 | CHK /GPS9 | |
| 1553 | 361699.8350 | 1444602.2370 | 151.8140 | BOL | |
| 1554 | 361701.0890 | 1444605.3830 | 151.6820 | BOL | |
| 1555 | 361704.0830 | 1444603.9790 | 151.8050 | BOL | |
| 1556 | 361702.5560 | 1444604.5570 | 151.8710 | GR | |
| 1557 | 361702.7680 | 1444601.0670 | 151.8610 | BOL | |
| 1558 | 361700.9450 | 1444602.6520 | 151.9190 | CON5 S | |
| 1559 | 361701.5980 | 1444604.3520 | 151.9330 | CON5 | |
| 1560 | 361703.3440 | 1444603.6030 | 151.9020 | CON5 REC E | |
| 1561 | 361702.1370 | 1444603.1380 | 154.7118 | WELL /SO5 MW-01 PVC | ELV from DL_RUN |

| | | | | | |
|---|---|---|---|---|---|
| 1562 | 361702.1670 | 1444603.2160 | 154.6876 | RIM /SO5 MW-01 | ELV from DL_RUN |
| 1563 | 361686.7430 | 1444657.4270 | 145.2650 | BOL | |
| 1564 | 361689.7710 | 1444657.4210 | 145.2900 | BOL | |
| 1565 | 361690.1410 | 1444654.3180 | 145.9400 | BOL | |
| 1566 | 361686.5700 | 1444654.3300 | 145.8780 | BOL | |
| 1567 | 361687.4550 | 1444654.6040 | 145.8470 | CON6 S | |
| 1568 | 361689.3040 | 1444654.6120 | 145.8000 | CON6 | |
| 1569 | 361689.3260 | 1444656.4040 | 145.6430 | CON6 REC E | |
| 1570 | 361688.4310 | 1444656.7490 | 145.5850 | GR | |
| 1571 | 361688.4660 | 1444655.3720 | 148.5966 | WELL /SO5 MW-02 PVC | ELV from DL_RUN |
| 1572 | 361688.5110 | 1444655.3830 | 148.5547 | RIM /SO5 MW-02 | ELV from DL_RUN |
| 1573 | 361653.3370 | 1444681.2810 | 142.9980 | BOL | |
| 1574 | 361655.9050 | 1444684.3930 | 142.1920 | BOL | |
| 1575 | 361653.5580 | 1444686.3410 | 142.2720 | BOL | |
| 1576 | 361651.0570 | 1444684.0190 | 142.6190 | BOL | |
| 1577 | 361652.3450 | 1444683.7820 | 142.7990 | CON7 S | |
| 1578 | 361653.6120 | 1444682.5580 | 142.8120 | CON7 | |
| 1579 | 361654.9220 | 1444683.8420 | 142.6440 | CON7 REC E | |
| 1580 | 361654.4480 | 1444684.7970 | 142.4720 | GR | |
| 1581 | 361653.7430 | 1444683.6810 | 145.5803 | WELL /SO5 MW-03 PVC | ELV from DL_RUN |
| 1582 | 361653.7930 | 1444683.6530 | 145.5820 | RIM /SO5 MW-03 | ELV from DL_RUN |
| 1583 | 361361.5540 | 1444505.7790 | 155.0390 | CHK /9 | |
| 1584 | 361361.5530 | 1444505.7670 | 155.0360 | CHK /9 | |

**Table 8**

**Hand Taped Measurements with lid removed**

| NAME | DIFF=RIM TO PVC | DIRECTION | DIFF=RIM TO CONC | DIRECTION |
|---|---|---|---|---|
| SO3-MW01 | 0.08 | DWN | 2.93 | DWN |
| SO3-MW03 | 0.07 | UP | 2.91 | DWN |
| SO4-MW02 | 0.09 | DWN | 2.72 | DWN |
| SO4-MW03 | 0.04 | UP | 2.92 | DWN |
| SO5-MW01 | 0.02 | UP | 2.69 | DWN |
| SO5-MW03 | 0 | EVEN | 2.7 | DWN |
| SO5-MW02 | 0.04 | UP | 2.68 | DWN |

Table 4 on CH2M-Navy CLEAN 9000 CTO JU23 2018-04-25. xlsx file has the quality check of the field work. There is a comparison between level loop elevations and total station locations. The picture below has all points Google map. All RAW data and field sketch are attached to the report.

Table 7 has the final locations of the six (6) new wells and one of existing well for checking:

### Monitoring Well Elevations and Positions
### CLEAN 9000 – CTO JU23
### Naval Research Laboratory – Chesapeake Bay Detachment
### Chesapeake Beach, Maryland

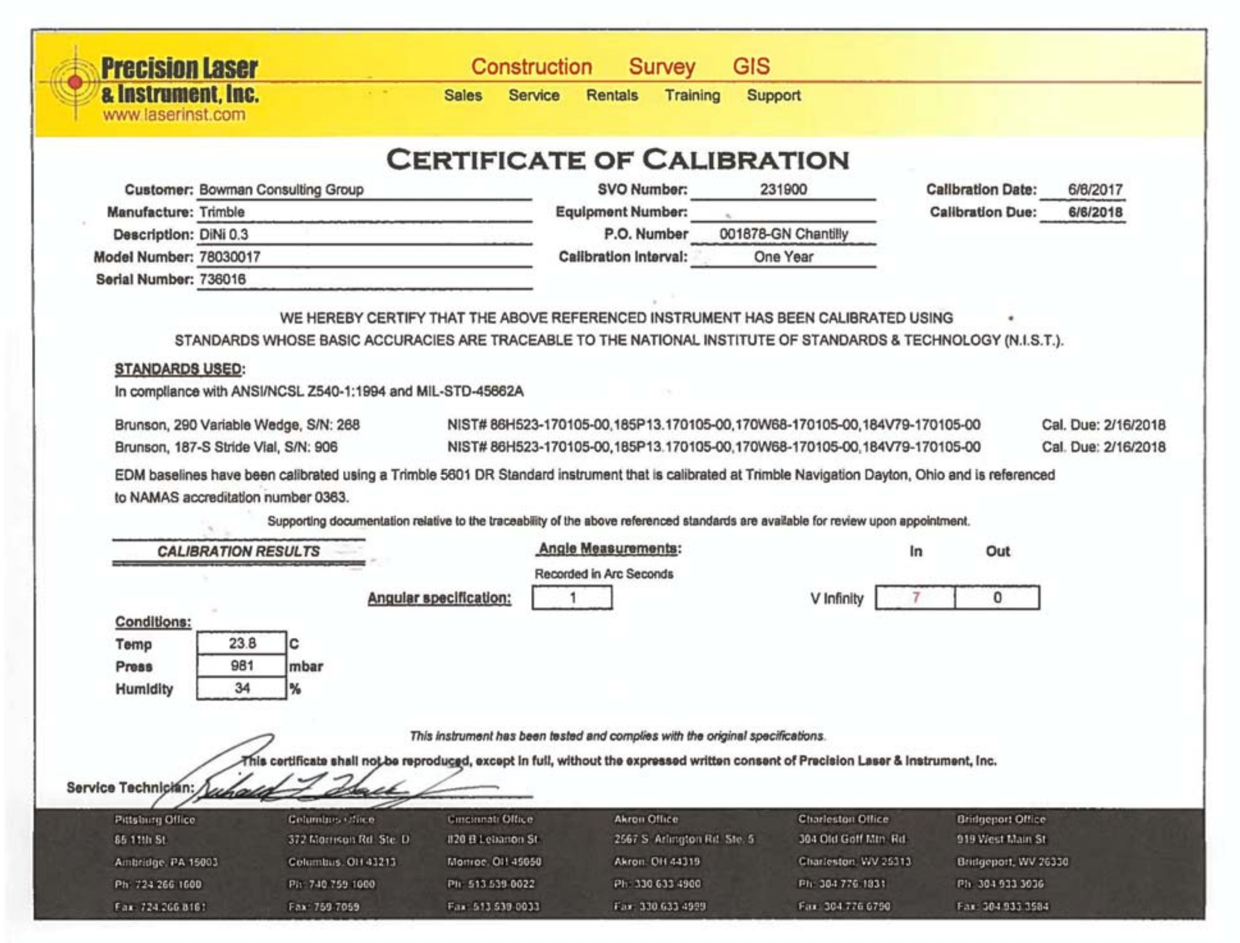
| Monitoring Well | Northing (SPC83(2011) Maryland, US Survey Feet) | Easting (SPC83(2011) Maryland, US Survey Feet) | Top of Inner PVC Casing Elevation (US Survey Feet) | Top of Outer Steel Casing Elevation (US Survey Feet) | Ground Surface Elevation NAVD88 (US Survey Feet) |
|---|---|---|---|---|---|
| CBD-SO3-MW-01 | 361457.505 | 1445296.469 | 120.4839 | 120.5694 | 117.465 |
| SO3-MW-03 | 361390.285 | 1445250.566 | 124.3038 | 124.2353 | 121.183 |
| SO4-MW-02 | 361486.112 | 1445075.689 | 132.1621 | 132.2493 | 129.337 |
| SO4 MW-03 | 361472.041 | 1444985.839 | 137.6048 | 137.5709 | 134.43 |
| SO5 MW-01 | 361702.137 | 1444603.138 | 154.7118 | 154.6876 | 151.871 |

| | | | | | |
|---|---|---|---|---|---|
| SO5 MW-02 | 361688.466 | 1444655.372 | 148.5966 | 148.5547 | 145.585 |
| SO5 MW-03 | 361653.743 | 1444683.681 | 145.5803 | 145.582 | 142.472 |

Ground surface elevations and top of inner casing elevations of permanent monitoring wells were surveyed by Bowman on April 25, 2018.

## 3) Equipment used

BCG used GPS receivers GR5 and GR3 for static observations. The receivers are apdated to recent Firmware provided from Topcon Support. We used 3 seconds Robotic Total Station (PS103) to do our stake out. We used Trimble Electronic Level DiNi to run level loop on site to set new control. The certificate of calibration is attached for this instrument.



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### CERTIFICATE OF CALIBRATION

**Customer:** Bowman Consulting Group
**Manufacture:** Trimble
**Description:** DiNi 0.3
**Model Number:** 78030017
**Serial Number:** 736016

**SVO Number:** 231900
**Equipment Number:**
**P.O. Number** 001878-GN Chantilly
**Calibration Interval:** One Year

**Calibration Date:** 6/6/2017
**Calibration Due:** 6/6/2018

WE HEREBY CERTIFY THAT THE ABOVE REFERENCED INSTRUMENT HAS BEEN CALIBRATED USING STANDARDS WHOSE BASIC ACCURACIES ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY (N.I.S.T.).

**STANDARDS USED:**
In compliance with ANSI/NCSL Z540-1:1994 and MIL-STD-45662A

| | | |
|---|---|---|
| Brunson, 290 Variable Wedge, S/N: 268 | NIST# 86H523-170105-00,185P13.170105-00,170W68-170105-00,184V79-170105-00 | Cal. Due: 2/16/2018 |
| Brunson, 187-S Stride Vial, S/N: 906 | NIST# 86H523-170105-00,185P13.170105-00,170W68-170105-00,184V79-170105-00 | Cal. Due: 2/16/2018 |

EDM baselines have been calibrated using a Trimble 5601 DR Standard instrument that is calibrated at Trimble Navigation Dayton, Ohio and is referenced to NAMAS accreditation number 0363.

Supporting documentation relative to the traceability of the above referenced standards are available for review upon appointment.

***CALIBRATION RESULTS***

**Angle Measurements:**
Recorded in Arc Seconds

**Angular specification:** 1

| | In | Out |
|---|---|---|
| V Infinity | 7 | 0 |

**Conditions:**

| | | |
|---|---|---|
| Temp | 23.8 | C |
| Press | 981 | mbar |
| Humidity | 34 | % |

*This instrument has been tested and complies with the original specifications.*

**This certificate shall not be reproduced, except in full, without the expressed written consent of Precision Laser & Instrument, Inc.**

**Service Technician:** Richard L. Hall

Pittsburg Office
85 11th St
Ambridge, PA 15003
Ph: 724 266 1600
Fax: 724.266.8161

Columbus Office
372 Morrison Rd. Ste. D
Columbus, OH 43213
Ph: 740.759.1000
Fax: 759.7059

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Fax: 330.633.4999

Charleston Office
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Charleston, WV 25313
Ph: 304.776.1831
Fax: 304.776.6790

Bridgeport Office
919 West Main St
Bridgeport, WV 26330
Ph: 304.933.3036
Fax: 304.933.3584

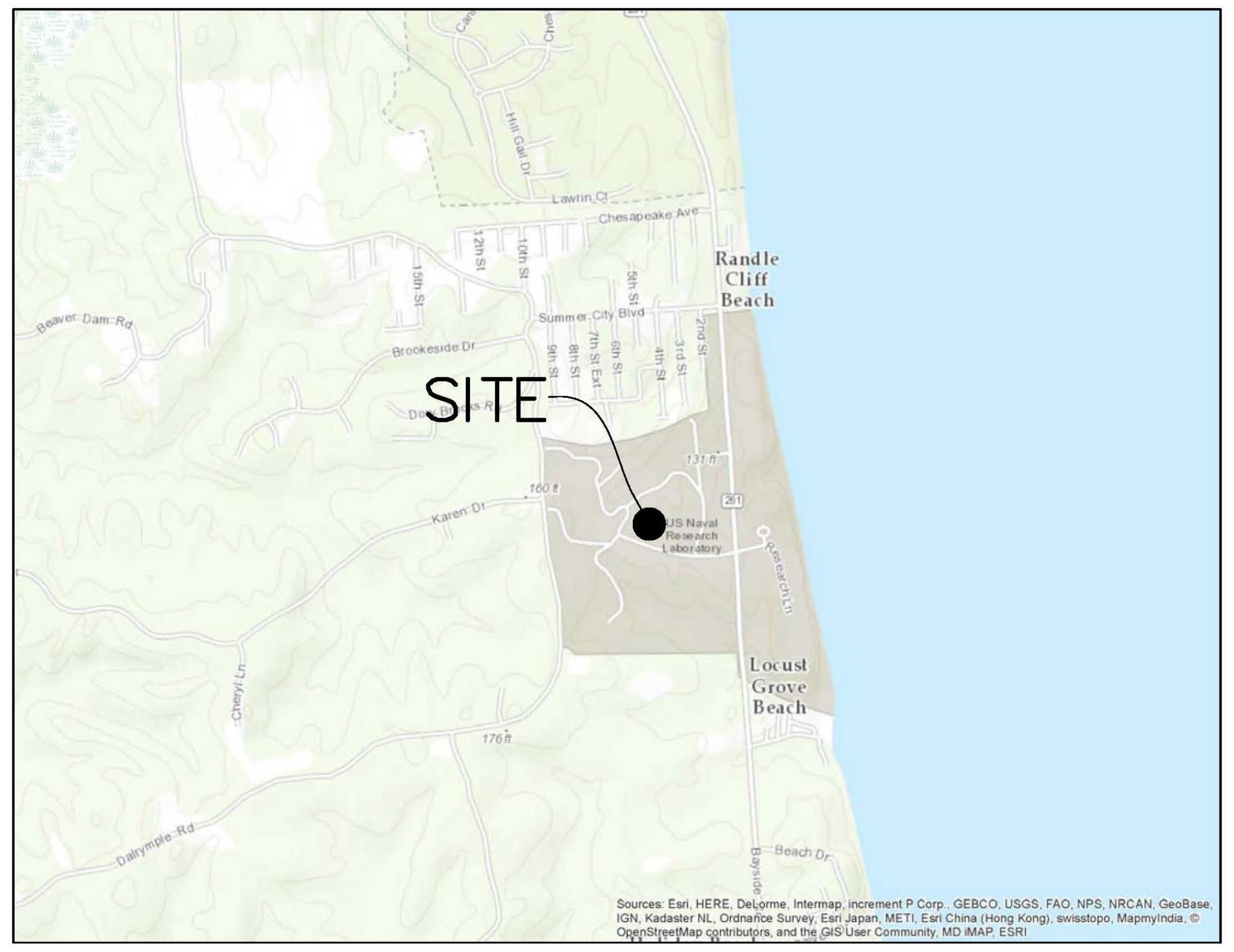
## *Surveyor's Certification*

*THIS AS BUILT SURVEY WAS PREPARED BY ME, TRISTAN STEWART FROM AN ACTUAL GROUND SURVEY MADE UNDER MY SUPERVISION ON APRIL 25, 2018. I HEREBY CERTIFY THAT THE ACCURACY OF THIS SURVEY MEETS THE ACCURACY REQUIREMENTS OF THE CH2M STATEMENT OF WORK AND THAT THE PLAN SHOWN ON THE MAP PROVIDED WITH THIS REPORT IS ACCURATE, AND THAT I WAS IN RESPONSIBLE CHARGE OVER ITS PREPARATION IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN THE STATEMENT OF WORK AND IN COMAR 09.13.06.03.*

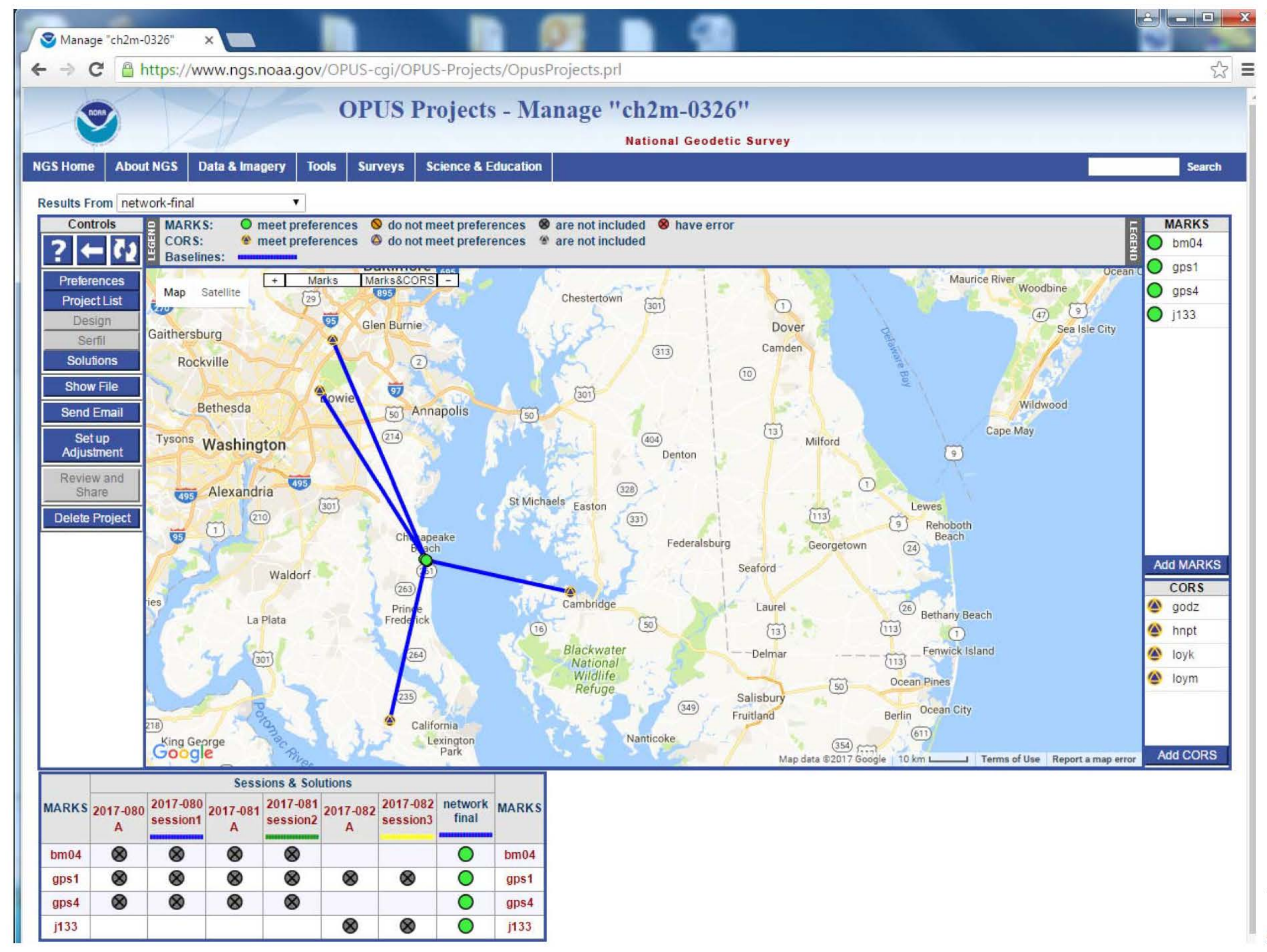
---

*BOWMAN CONSULTING GROUP* *DATE*
*BY: TRISTAN STEWART*
*PROFESSIONAL LAND SURVEYOR*
*MD REG. NO. 21306*
*RENEWAL DATE: 06/26/2018*

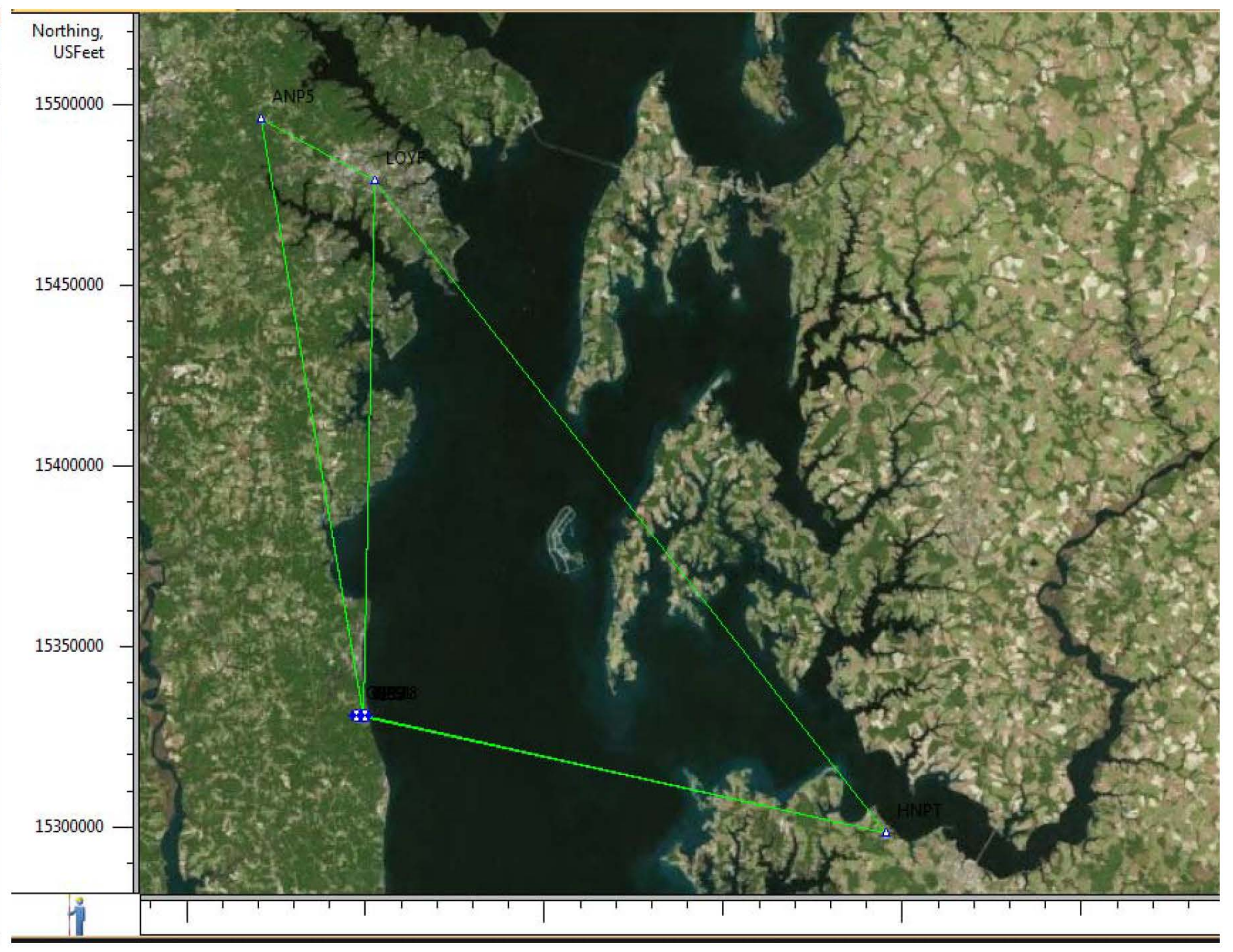
TRISTAN STEWART
21306



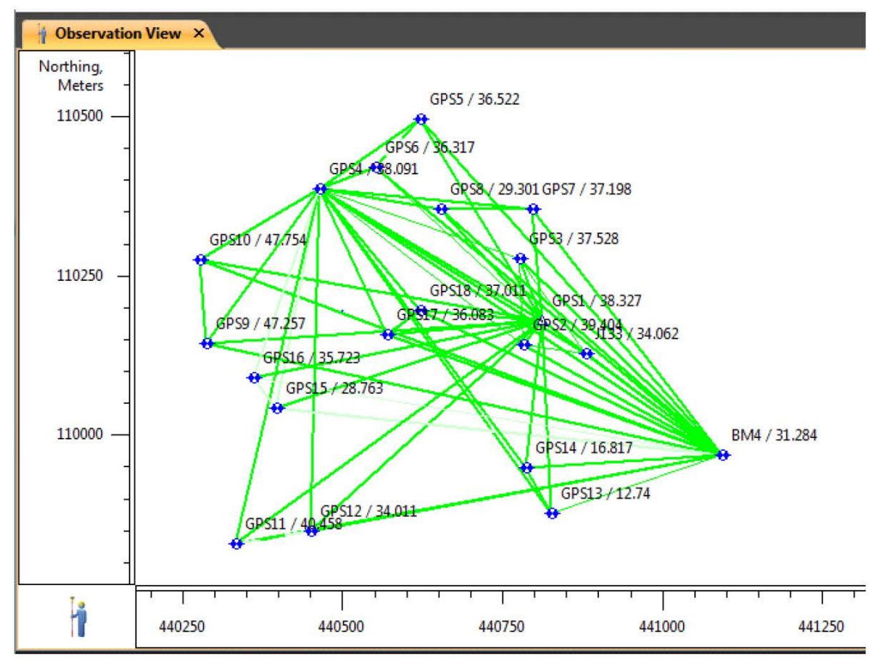
VICINITY MAP
-NOT TO SCALE-



OPUS GPS MANAGE ch2m-0326
-NOT TO SCALE-



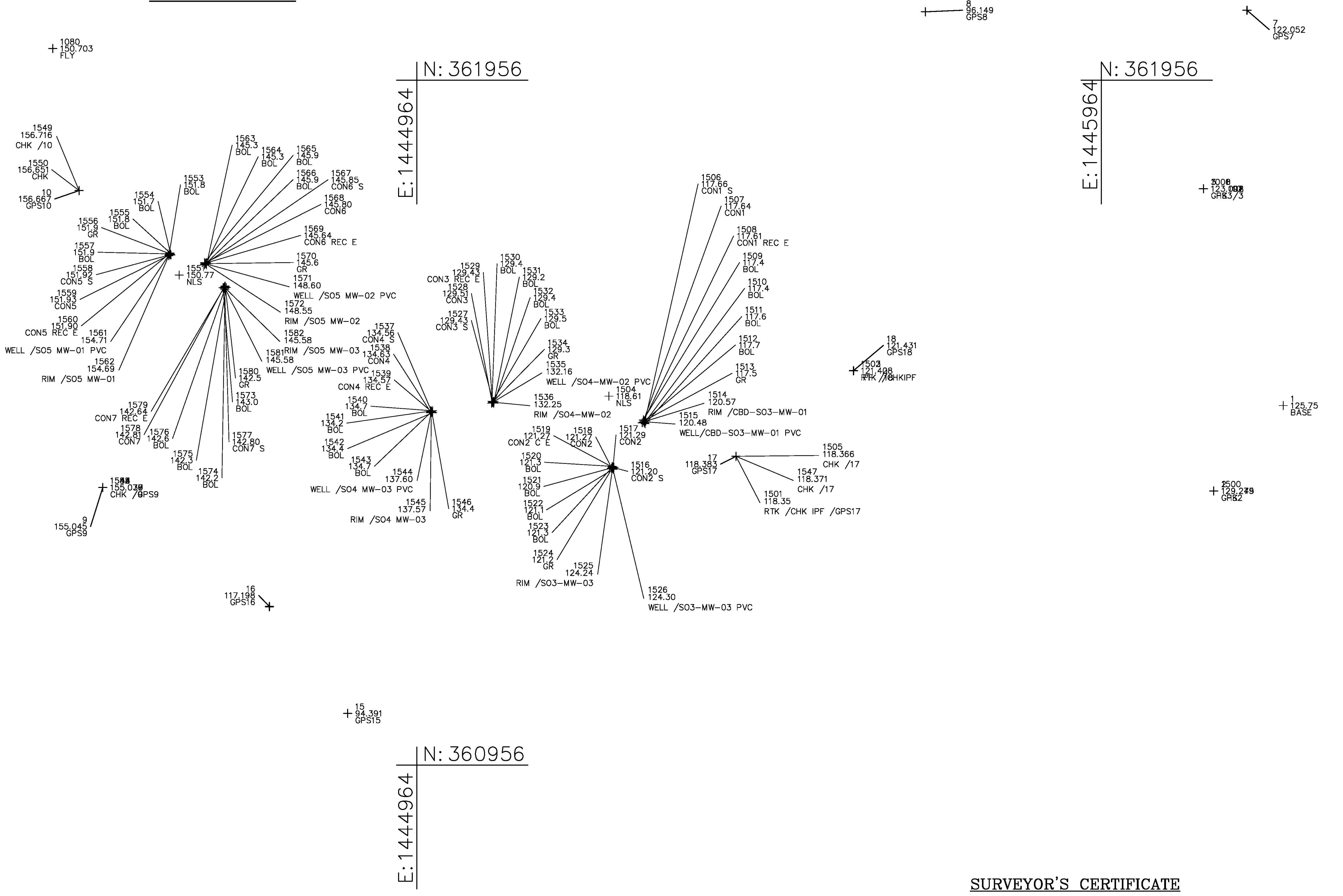
GPS 1 TIED TO CORS. CORS (ANP5, LOYF AND HNPT HELD FOR HORIZONTAL (NAD83(2011))
-NOT TO SCALE-



LOCAL GPS NETWORK
-NOT TO SCALE-

MARYLAND STATE GRID NAD 83/91

N



## NOTES:

1. NORTH MERIDIAN INFORMATION AS SHOWN HEREON IS MARYLAND STATE PLANE NAD 83/91, AND HAS BEEN PROCESSED THROUGH THE USE OF MAGNET TOOLS

   CONTROL POINT 1 (BASE)
   N: 361481.17700 E: 1446230.11600 ELEVATION 125.746 (FEET)
   REBAR & CAP SET (R/C)

   CONTROL POINT9 GPS9
   N: 361361.54400 E: 1444505.76000 ELEVATION 155.045 R/C SET

   CONTROL POINT17 GPS17
   N: 361406.98800 E: 1445430.71600 ELEVATION 118.383 R/C SET

   CONTROL POINT18 GPS 18
   N: 361532.14400 E: 1445602.46500 ELEVATION 121.431 R/C

2. VERTICAL DATUM SHOWN HEREON IS NAVD 88 AND IS BASED ON THE CONTROL POINTS DESCRIBED IN NOTE 1.

3. THIS SURVEY HAS BEEN PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT. THE PROPERTY SHOWN HEREON MAY BE SUBJECT TO EASEMENTS, GRANTS, RIGHTS-OF-WAY AND BUILDING RESTRICTION LINES NOT OTHERWISE SHOWN.

4. FIELD WORK WAS PERFORMED APRIL 25, 2018

MONITORING WELL LOCATIONS
NAVY CLEAN 9000 CTO JU23
ON THE PROPERTY OF
**CHESAPEAKE DETACHMENT CHESAPEAKE BEACH MARYLAND**
CALVERT COUNTY, MARYLAND

SCALE: 1"=100' DATE: APRIL, 2017

| REVISION | | Bowman CONSULTING | | | |
|---|---|---|---|---|---|
| | | Bowman Consulting Group, Ltd.<br>185 Admiral Cochran Drive, Suite 215<br>Annapolis, Maryland 21401 | Phone: (410) 224-7590<br>Fax: (410) 224-7592<br>www.bowmanconsulting.com | | |
| © Bowman Consulting Group, Ltd. | | | | | |
| DWG: | | | BY: TMS | CHK: T.S. | QC: |
| BCG PROJECT NO: 8740-01-001 | TASK: ? | COUNTY REF NO: ? | | SHEET 1 OF 1 | |

PREPARED FOR
CH2M
5701 CLEVELAND STREET SUITE 200
VIRGINIA BEACH, VIRGINIA 23462
OFFICE: 757-671-6258

100 0 100 200
GRAPHIC SCALE

### SURVEYOR'S CERTIFICATE

THIS STAKEOUT SURVEY WAS PREPARED BY ME, TRISTAN STEWART FROM AN ACTUAL GROUND SURVEY MADE UNDER MY SUPERVISION ON APRIL 25, 2018 I HEREBY CERTIFY THAT THE PLAT SHOWN HEREON IS ACCURATE, AND THAT I WAS IN RESPONSIBLE CHARGE OVER ITS PREPARATION IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN COMAR 09.13.06.03.

Tristan Stewart 05/03/18
BOWMAN CONSULTING GROUP DATE
BY: TRISTAN STEWART
PROFESSIONAL LAND SURVEYOR
MD REG. NO. 21306
RENEWAL DATE: 06/26/2018

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MARK gps1 ▼ Project Marks, Project CORS Published Marks,

## MARK gps1 ▼ Datasheet Mock-up

Upload A Photo | Save Description

**Description**

| | |
|---|---|
| PID | |
| stamping* | Bowman Traverse |
| name* | GPS1 |
| type* | R = Rod ▼<br>I = Metal rod ▼<br>Rod Depth*: 1.8 ● Feet ○ Meters |
| setting* | 15 = A metal rod driven into ground. Describe below. ▼<br>specific setting: A metal rod with plastic cap is driven flash to the ground surfa |
| description*<br>103 chars<br>(500 chars max) | GPS 1 primary control for the GPS geodetic network. The elevation of this points is based on BM "J 133" |
| stability | C = May hold, commonly subject to ground movement ▼ |
| magnetic | I = Marker is a steel rod ▼ |
| application | O = Other special application, see descriptive text ▼ |
| condition | ● Good condition ○ Poor, disturbed, mutilated, requires maintenance |

* required fields

Close-up View

Horizon View

## MARK gps1 ▼ Occupations

Manage Data Files | Save Occupations

| DATA FILE | SPAN | HARDWARE |
|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| gps1080o.17o | Start | 2017-03-21T14:20:00 GPS | Antenna | Model: | TPSGR5 NONE ▼ | S/N: | | Height (m): | 2.000 |
| | End | 2017-03-21T20:19:00 GPS | Receiver | Model: | Topcon | S/N: | U00040U9R82 | Firmware: | |
| gps1081l.17o | Start | 2017-03-22T11:48:00 GPS | Antenna | Model: | TPSGR5 NONE ▼ | S/N: | | Height (m): | 2.000 |
| | End | 2017-03-22T20:30:00 GPS | Receiver | Model: | Topcon | S/N: | U00040U9R82 | Firmware: | |
| gps1082q.17o | Start | 2017-03-23T16:08:00 GPS | Antenna | Model: | TPSGR5 NONE ▼ | S/N: | | Height (m): | 2.000 |
| | End | 2017-03-23T20:36:00 GPS | Receiver | Model: | Topcon | S/N: | U00040U9R82 | Firmware: | |

# MARK gps1 ▼ Processing Results From network-final ▼

Manage Coordinates

Scale uncertainties by 1.0x (68.3%) ▼.

Coordinate Source: network-final

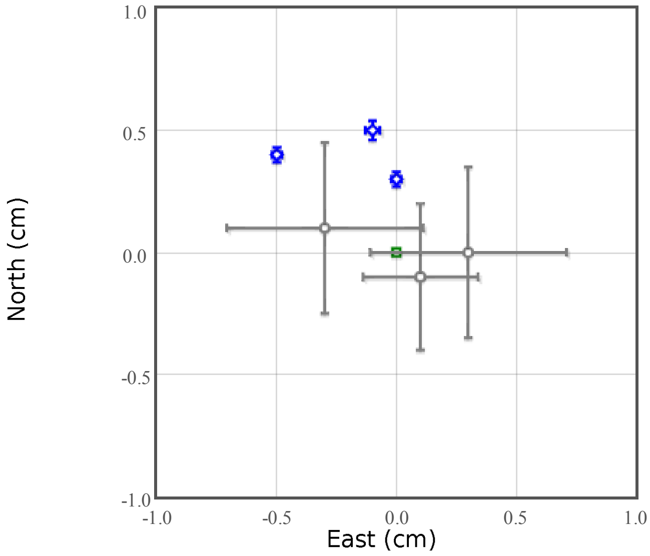
| | | | | | |
|---|---|---|---|---|---|
| **REF FRAME:** | **IGS08 (2017.2208)** | **NAD_83(2011) (2010.0000)** | **COORDINATE SYSTEM:** | **SPC 1900 MD** | **UTM 18** |
| **LAT:** | N38:39:29.90149 ±0.000 m | N38:39:29.87040 ±0.000 m | **NORTHING:** | 110179.683 m | 4279970.649 m |
| **EAST LON:** | E283:28:08.01889 ±0.000 m | E283:28:08.03953 ±0.000 m | **EASTING:** | 440811.821 m | 366780.514 m |
| **WEST LON:** | W076:31:51.98111 ±0.000 m | W076:31:51.96047 ±0.000 m | **CONVERGENCE:** | 0.29429756° | -0.95657970° |
| **EL HGT:** | 3.275 ±0.002 m | 4.574 ±0.002 m | **POINT SCALE:** | 0.99995702 | 0.99981855 |
| **X:** | 1161585.630 ±0.000 m | 1161586.491 ±0.000 m | **COMBINED FACTOR:** | 0.99995630 | 0.99981783 |
| **Y:** | -4849950.370 ±0.001 m | -4849951.823 ±0.001 m | **U.S. NATIONAL GRID:** | 18SUH6678079970 | |
| **Z:** | 3962769.196 ±0.001 m | 3962769.259 ±0.001 m | | | |

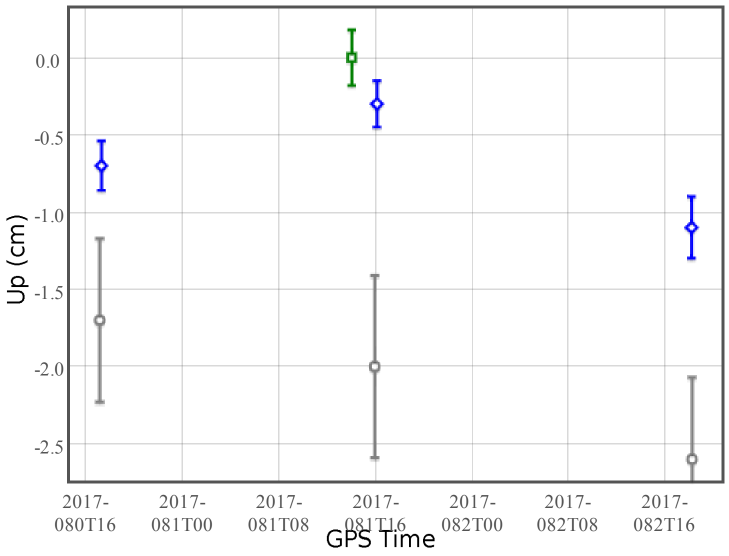
**ORTHO HGT:** 38.315 ±0.016 m (H = h - N WHERE N = GEOID12B HGT)

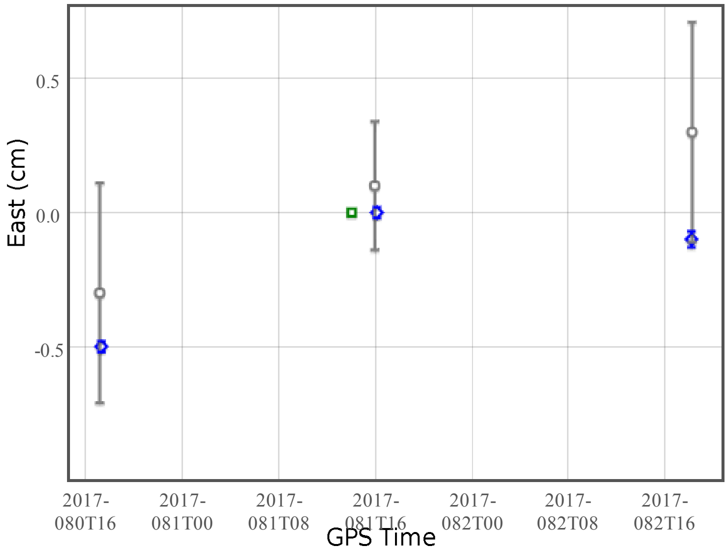
| DATA FILE | ANTENNA | HEIGHT (m) | EPH TYPE | OBS (%) | FIXED (%) | RMS (m) | LAT (m) | LON (m) | HGT (m) | SOLUTION |
|---|---|---|---|---|---|---|---|---|---|---|
| **gps1080o.17o** | TPSGR5 NONE | 2.000 | rapid | 97.1 | 99.7 | — | 0.000 | 0.000 | 0.002 | network-final |
| **gps1081l.17o** | TPSGR5 NONE | 2.000 | rapid | 97.1 | 99.7 | — | 0.000 | 0.000 | 0.002 | network-final |
| **gps1082q.17o** | TPSGR5 NONE | 2.000 | rapid | 97.1 | 99.7 | — | 0.000 | 0.000 | 0.002 | network-final |
| Preferences | | | Best Available | ≥80.0 | ≥80.0 | ≤0.025 | ≤0.020 | ≤0.020 | ≤0.040 | Preferences |

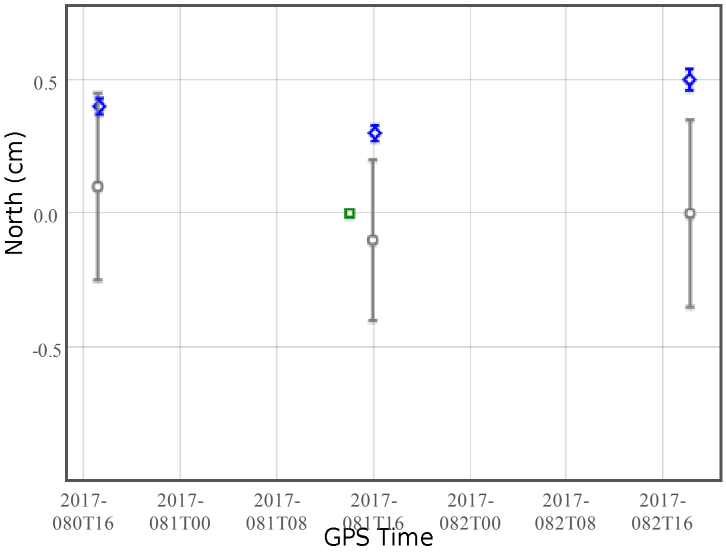
# MARK gps1 ▼ Processing Results Plots

Scale uncertainties by 1.0x (68.3%) ▼. Show ▨ preferences ☐ network ◇ session ○ OPUS △ published.
The "zero" point coordinates, N38:39:29.90150, W076:31:51.98112, 3.275 m el. height, are the mean of all network adjustments.









# MARK gps1 ▼ Processing Results Table

Scale uncertainties by 1.0x (68.3%) ▼. Show 🟧 preferences ☐ network ◇ session ○ OPUS △ published.
The "zero" point coordinates, N38:39:29.90150, W076:31:51.98112, 3.275 m el. height, are the mean of all network adjustments.

| ○ OPUS SOLUTIONS | NORTH (cm) | EAST (cm) | UP (cm) | REFERENCE FRAME | EPOCH (GPS) |
|---|---|---|---|---|---|
| gps1080o.17o | 0.1 ±0.4 | -0.3 ±0.4 | -1.7 ±0.5 | IGS08 | 2017-03-21T17:11:02 |
| gps1081l.17o | -0.1 ±0.3 | 0.1 ±0.2 | -2.0 ±0.6 | IGS08 | 2017-03-22T15:57:36 |
| gps1082q.17o | 0.0 ±0.4 | 0.3 ±0.4 | -2.6 ±0.5 | IGS08 | 2017-03-23T18:14:23 |
| ◇ SESSION SOLUTIONS | NORTH (cm) | EAST (cm) | UP (cm) | REFERENCE FRAME | EPOCH (GPS) |
| 2017-080-session1 | 0.4 ±0.0 | -0.5 ±0.0 | -0.7 ±0.2 | IGS08 | 2017-03-21T17:19:41 |
| 2017-081-session2 | 0.3 ±0.0 | 0.0 ±0.0 | -0.3 ±0.2 | IGS08 | 2017-03-22T16:08:53 |
| 2017-082-session3 | 0.5 ±0.0 | -0.1 ±0.0 | -1.1 ±0.2 | IGS08 | 2017-03-23T18:11:52 |
| ☐ NETWORK SOLUTIONS | NORTH (cm) | EAST (cm) | UP (cm) | REFERENCE FRAME | EPOCH (GPS) |
| network-final | 0.0 ±0.0 | 0.0 ±0.0 | 0.0 ±0.2 | IGS08 | 2017-03-22T14:03:21 |

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# Appendix E

# Validated Analytical Data (Base-Wide Site Inspection and Expanded Site Inspection)

| Station ID | CBD-S03-DP01 | | | CBD-S03-DP02 | | CBD-S03-DP03 | | CBD-S03-DP04 | | CBD-S03-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS01-1012 | CBD-S03-SB01-1315 | CBD-S03-SB01P-1315 | CBD-S03-SS02-1012 | CBD-S03-SB02-2022 | CBD-S03-SS03-1012 | CBD-S03-SB03-2022 | CBD-S03-SS04-1012 | CBD-S03-SB04-1820 | CBD-S03-SS05-1012 | CBD-S03-SB05-1315 |
| **Sample Date** | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,1,2,2-Tetrachloroethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,1,2-Trichloroethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,1-Dichloroethane | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| 1,1-Dichloroethene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2,3-Trichlorobenzene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2,4-Trichlorobenzene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2-Dibromo-3-chloropropane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2-Dibromoethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2-Dichlorobenzene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2-Dichloroethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,2-Dichloropropane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| 1,3-Dichlorobenzene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| 1,4-Dichlorobenzene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| 2-Butanone | 1.1 B | 0.9 U | 0.56 U | 1.7 B | 0.77 U | 0.55 U | 0.67 U | 1.6 B | 2.9 B | 1.4 B | 0.47 UJ |
| 2-Hexanone | 0.42 UJ | 0.9 UJ | 0.56 UJ | 0.5 UJ | 0.77 UJ | 0.55 UJ | 0.67 UJ | 0.44 UJ | 0.65 UJ | 0.44 UJ | 0.47 UJ |
| 4-Methyl-2-pentanone | 0.42 UJ | 0.9 UJ | 0.56 UJ | 0.5 UJ | 0.77 UJ | 3 J | 0.67 UJ | 0.44 UJ | 0.65 UJ | 0.44 UJ | 0.47 UJ |
| Acetone | 41 B | 9 U | 5.6 U | 71 B | 9.1 B | 31 B | 9.5 B | 62 B | 29 B | 65 J | 7.6 B |
| Benzene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.38 J | 0.44 U | 0.47 U |
| Bromochloromethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Bromodichloromethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Bromoform | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Bromomethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Carbon disulfide | 0.66 B | 0.7 B | 0.44 B | 0.45 B | 0.72 B | 0.47 B | 0.59 B | 0.42 B | 0.86 B | 0.4 B | 0.36 B |
| Carbon tetrachloride | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Chlorobenzene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Chloroethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Chloroform | 0.21 U | 0.45 U | 0.22 B | 0.25 U | 0.49 B | 0.28 U | 0.24 B | 0.18 B | 0.33 U | 0.14 J | 0.23 U |
| Chloromethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| cis-1,2-Dichloroethene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| cis-1,3-Dichloropropene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Cyclohexane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Dibromochloromethane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Dichlorodifluoromethane (Freon-12) | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Ethylbenzene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.22 J | 0.44 U | 0.47 U |
| Isopropylbenzene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| m- and p-Xylene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.43 J | 0.44 U | 0.47 U |
| Methyl acetate | 1.5 B | 1.7 B | 1.1 B | 2.6 B | 1.7 B | 2.4 B | 1.6 B | 1.3 B | 2.7 B | 1.6 B | 1.2 B |
| Methylcyclohexane | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.18 J | 0.44 U | 0.47 U |
| Methylene chloride | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.49 B | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 18 |
| Methyl-tert-butyl ether (MTBE) | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| o-Xylene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Styrene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Tetrachloroethene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Toluene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 1.1 J | 0.44 U | 0.47 U |
| trans-1,2-Dichloroethene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| trans-1,3-Dichloropropene | 0.42 U | 0.9 U | 0.56 U | 0.5 U | 0.77 U | 0.55 U | 0.67 U | 0.44 U | 0.65 U | 0.44 U | 0.47 U |
| Trichloroethene | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Trichlorofluoromethane (Freon-11) | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 1.5 J | 0.28 J | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| Vinyl chloride | 0.21 U | 0.45 U | 0.28 U | 0.25 U | 0.38 U | 0.28 U | 0.33 U | 0.22 U | 0.33 U | 0.22 U | 0.23 U |
| | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1-Biphenyl | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 1,2,4,5-Tetrachlorobenzene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| 2,2'-Oxybis(1-chloropropane) | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2,3,4,6-Tetrachlorophenol | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2,4,5-Trichlorophenol | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 2,4,6-Trichlorophenol | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2,4-Dichlorophenol | 3.6 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.6 U | 4.8 U | 3.6 U | 4.9 U | 3.6 U | 4 U |
| 2,4-Dimethylphenol | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |
| 2,4-Dinitrophenol | 180 U | 200 U | 190 U | 180 U | 290 U | 180 U | 240 U | 180 U | 250 U | 180 U | 200 U |
| 2,4-Dinitrotoluene | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 2,6-Dinitrotoluene | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2-Chloronaphthalene | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2-Chlorophenol | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 2-Methylnaphthalene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| 2-Methylphenol | 7.3 U | 7.8 U | 7.4 U | 7.2 U | 11 U | 7.3 U | 9.5 U | 7.2 U | 9.8 U | 7.2 U | 8 U |
| 2-Nitroaniline | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 2-Nitrophenol | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 3,3'-Dichlorobenzidine | 370 U | 390 U | 370 U | 360 U | 570 U | 370 U | 480 U | 360 U | 490 U | 370 U | 400 U |
| 3-Nitroaniline | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |
| 4,6-Dinitro-2-methylphenol | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 4-Bromophenyl-phenylether | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| 4-Chloro-3-methylphenol | 7.3 U | 7.8 U | 7.4 U | 7.2 U | 11 U | 7.3 U | 9.5 U | 7.2 U | 9.8 U | 7.2 U | 8 U |
| 4-Chloroaniline | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| 4-Chlorophenyl-phenylether | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| 4-Methylphenol | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| 4-Nitroaniline | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |
| 4-Nitrophenol | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |

Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP01 | | | CBD-S03-DP02 | | CBD-S03-DP03 | | CBD-S03-DP04 | | CBD-S03-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS01-1012 | CBD-S03-SB01-1315 | CBD-S03-SB01P-1315 | CBD-S03-SS02-1012 | CBD-S03-SB02-2022 | CBD-S03-SS03-1012 | CBD-S03-SB03-2022 | CBD-S03-SS04-1012 | CBD-S03-SB04-1820 | CBD-S03-SS05-1012 | CBD-S03-SB05-1315 |
| **Sample Date** | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 |
| **Chemical Name** | | | | | | | | | | | |
| Acenaphthene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.5 J | 2.5 U | 1.8 U | 2 U |
| Acenaphthylene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Acetophenone | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| Anthracene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 4.8 B | 2.5 U | 1.1 B | 2 U |
| Atrazine | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| Benzaldehyde | 18 R | 20 R | 19 R | 18 R | 29 R | 18 R | 24 R | 18 R | 25 R | 18 R | 20 R |
| Benzo(a)anthracene | 1.8 U | 2 U | 1.9 U | 3 B | 2.9 U | 1.8 B | 2.4 U | 41 B | 2.5 U | 7.1 B | 2 U |
| Benzo(a)pyrene | 7.4 U | 4 U | 3.8 U | 3.7 U | 4.6 U | 40 | 3.9 U | 48 | 5 U | 2.9 U | 3.2 U |
| Benzo(b)fluoranthene | 2.3 B | 3.9 U | 3.7 U | 7.4 B | 5.7 U | 4 B | 4.8 U | 120 | 4.9 U | 23 B | 4 U |
| Benzo(g,h,i)perylene | 1.8 U | 2 U | 1.9 U | 3 B | 2.9 U | 1.8 B | 2.4 U | 42 | 2.5 U | 8.2 B | 2 U |
| Benzo(k)fluoranthene | 3.7 U | 3.9 U | 3.7 U | 3 B | 5.7 U | 2.6 B | 4.8 U | 58 | 4.9 U | 7.4 B | 4 U |
| bis(2-Chloroethoxy)methane | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| bis(2-Chloroethyl)ether | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| bis(2-Ethylhexyl)phthalate | 11 B | 6.3 B | 9.2 B | 8.5 B | 7.6 B | 9.2 B | 9.8 B | 46 B | 6.7 B | 9.7 B | 20 U |
| Butylbenzylphthalate | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| Caprolactam | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| Carbazole | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |
| Chrysene | 2.3 B | 2 U | 1.9 U | 3.7 B | 2.9 U | 2.2 B | 2.4 U | 45 B | 2.5 U | 9.7 B | 2 U |
| Dibenz(a,h)anthracene | 7.4 U | 4 U | 3.8 U | 3.7 U | 4.6 U | 4.5 J | 3.9 U | 7.4 J | 5 U | 2.9 U | 3.2 U |
| Dibenzofuran | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Diethylphthalate | 6.1 B | 8.3 B | 8.1 B | 7.4 B | 23 B | 6.6 B | 19 B | 10 B | 13 B | 5.9 B | 12 B |
| Dimethyl phthalate | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| Di-n-butylphthalate | 18 U | 20 U | 19 U | 18 U | 29 U | 18 U | 24 U | 18 U | 25 U | 18 U | 20 U |
| Di-n-octylphthalate | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Fluoranthene | 1.8 U | 2 U | 1.9 U | 3.7 B | 2.9 U | 3.3 B | 2.4 U | 39 | 2.5 U | 11 B | 2 U |
| Fluorene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.1 J | 2.5 U | 1.8 U | 2 U |
| Hexachlorobenzene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Hexachlorobutadiene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Hexachlorocyclopentadiene | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| Hexachloroethane | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Indeno(1,2,3-cd)pyrene | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 37 | 4.9 U | 7.1 B | 4 U |
| Isophorone | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Naphthalene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| n-Nitroso-di-n-propylamine | 3.7 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.7 U | 4.8 U | 3.6 U | 4.9 U | 3.7 U | 4 U |
| n-Nitrosodiphenylamine | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Nitrobenzene | 1.8 U | 2 U | 1.9 U | 1.8 U | 2.9 U | 1.8 U | 2.4 U | 1.8 U | 2.5 U | 1.8 U | 2 U |
| Pentachlorophenol | 37 U | 39 U | 37 U | 36 U | 57 U | 37 U | 48 U | 36 U | 49 U | 37 U | 40 U |
| Phenanthrene | 1.1 B | 2 U | 1.9 U | 1.9 B | 2.9 U | 2.2 B | 2.4 U | 21 | 2.5 U | 5.9 B | 2 U |
| Phenol | 3.6 U | 3.9 U | 3.7 U | 3.6 U | 5.7 U | 3.6 U | 4.8 U | 3.6 U | 4.9 U | 3.6 U | 4 U |
| Pyrene | 1.5 B | 3.9 U | 3.7 U | 4.5 B | 5.7 U | 3.7 B | 4.8 U | 68 | 4.9 U | 13 B | 4 U |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| 4,4'-DDD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDT | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-Chlordane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1016 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1221 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1232 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1242 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1248 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1254 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1260 | 120 | 15 U | 15 U | 41 | 22 U | 5,500 | 81 | 2,100 | 17 J | 150 | 16 U |
| Aroclor-1262 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| Aroclor-1268 | 14 U | 15 U | 15 U | 14 U | 22 U | 290 U | 19 U | 140 U | 19 U | 14 U | 16 U |
| beta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| delta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dieldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan I | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan II | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan sulfate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin aldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin ketone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| gamma-BHC (Lindane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor epoxide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methoxychlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toxaphene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 5,700 | 1,500 | 1,600 | 5,800 | 5,700 | 4,500 | 5,400 | 6,300 | 6,100 | 7,900 | 2,500 |
| Antimony | 0.12 | 0.071 J | 0.065 J | 0.35 | 0.18 | 0.9 | 0.083 J | 0.36 | 0.1 | 0.08 J | 0.081 J |
| Arsenic | 1.6 | 1.5 | 1.6 | 2.1 | 5.2 | 14 | 2.1 | 2.2 | 2.9 | 1.2 | 1.2 |
| Barium | 37 | 4.5 | 4.6 | 27 | 14 | 9.8 | 13 | 27 | 13 | 44 | 5 |
| Beryllium | 0.51 | 0.12 | 0.13 | 0.33 | 0.7 | 0.26 | 1.1 | 0.3 | 0.45 | 0.64 | 0.12 |
| Cadmium | 0.091 | 0.017 B | 0.018 B | 0.13 | 0.18 | 0.055 | 0.34 | 0.16 | 0.93 | 0.17 | 0.016 B |
| Calcium | 4,100 | 300 | 290 | 390 | 430 | 420 | 970 | 390 | 36,000 | 180 | 73 B |
| Chromium (hexavalent) | 0.15 J | 0.18 J | 0.58 | NA | NA | NA | NA | NA | NA | NA | NA |

## Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP01 | | | CBD-S03-DP02 | | CBD-S03-DP03 | | CBD-S03-DP04 | | CBD-S03-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS01-1012 | CBD-S03-SB01-1315 | CBD-S03-SB01P-1315 | CBD-S03-SS02-1012 | CBD-S03-SB02-2022 | CBD-S03-SS03-1012 | CBD-S03-SB03-2022 | CBD-S03-SS04-1012 | CBD-S03-SB04-1820 | CBD-S03-SS05-1012 | CBD-S03-SB05-1315 |
| **Sample Date** | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 |
| **Chemical Name** | | | | | | | | | | | |
| Chromium | 7.6 | 6.7 | 8.4 | 11 | 24 | 12 | 22 | 8.7 | 26 | 6.2 | 14 |
| Cobalt | 2.6 | 0.48 | 0.5 | 1.9 | 1.2 | 1.4 | 1.7 | 2.3 | 5 | 3.4 | 0.4 |
| Copper | 2.9 | 1 | 1.1 | 2.6 | 3.1 | 3.9 | 2.8 | 3 | 3 | 1.9 | 1.6 |
| Cyanide | 0.055 U | 0.059 U | 0.056 U | 0.055 U | 0.086 U | 0.055 U | 0.072 U | 0.054 U | 0.074 U | 0.043 J | 0.061 U |
| Iron | 5,600 | 2,300 | 2,600 | 6,400 | 18,000 | 8,100 | 9,700 | 8,400 | 13,000 | 5,600 | 4,400 |
| Lead | 5.9 | 1.4 | 1.8 | 7.2 | 5 | 2.9 | 3.7 | 11 | 4.4 | 4.3 | 1.9 |
| Magnesium | 1,400 | 390 | 460 | 660 | 1,700 | 480 | 1,800 | 630 | 19,000 | 630 | 530 |
| Manganese | 160 | 5.4 | 4.2 | 57 | 8.3 | 20 | 13 | 69 | 320 | 140 | 4 |
| Mercury | 0.012 J | 0.016 U | 0.01 J | 0.0095 J | 0.017 U | 0.017 U | 0.017 U | 0.011 J | 0.017 U | 0.0078 J | 0.017 U |
| Nickel | 10 | 0.62 | 0.67 | 5.7 | 2.5 | 2.3 | 4.4 | 4.5 | 18 | 6.2 | 0.86 |
| Potassium | 300 | 310 | 330 | 400 | 1,500 | 350 | 1,100 | 340 | 1,800 | 250 | 410 |
| Selenium | 0.25 | 0.098 B | 0.12 B | 0.18 B | 1.4 | 0.96 | 0.42 | 0.28 | 0.62 | 0.4 | 0.39 |
| Silver | 0.024 J | 0.033 J | 0.035 J | 0.031 J | 0.054 | 0.026 J | 0.047 J | 0.034 J | 0.072 | 0.024 J | 0.042 J |
| Sodium | 200 | 25 U | 13 B | 17 B | 77 B | 26 B | 46 B | 24 B | 200 | 15 B | 20 B |
| Thallium | 0.19 | 0.19 | 0.17 | 0.2 | 0.32 | 0.08 | 0.22 | 0.2 | 0.19 | 0.24 | 0.11 |
| Vanadium | 9 | 4.7 | 5.2 | 11 | 14 | 18 | 9.3 | 12 | 11 | 8.2 | 5.4 |
| Zinc | 35 | 6.6 | 7.5 | 20 B | 54 | 8.6 B | 51 | 30 | 45 | 45 | 8.4 |
| | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | |
| pH (ph) | 5.9 | NA | NA | 6.3 | NA | 6.6 | NA | 5.4 | NA | 5.7 | NA |
| Total organic carbon (TOC) (mg/kg) | 1,300 | NA | NA | 1,300 | NA | 1,100 U | NA | 6,800 | NA | 11,000 | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S03-DP06 | | CBD-S03-DP07 | | CBD-S03-DP08 | | CBD-S03-DP09 | | CBD-S03-DP10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS06-000H | CBD-S03-SB06-0810 | CBD-S03-SS07-000H | CBD-S03-SB07-0810 | CBD-S03-SS08-000H | CBD-S03-SB08-0810 | CBD-S03-SS09-000H | CBD-S03-SB09-0810 | CBD-S03-SS10-000H | CBD-S03-SB10-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1-Biphenyl | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

| **Station ID** | CBD-S03-DP06 | | CBD-S03-DP07 | | CBD-S03-DP08 | | CBD-S03-DP09 | | CBD-S03-DP10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS06-000H | CBD-S03-SB06-0810 | CBD-S03-SS07-000H | CBD-S03-SB07-0810 | CBD-S03-SS08-000H | CBD-S03-SB08-0810 | CBD-S03-SS09-000H | CBD-S03-SB09-0810 | CBD-S03-SS10-000H | CBD-S03-SB10-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | | |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetophenone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Atrazine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzaldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Caprolactam | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| 4,4'-DDE | 2.73 | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 7.94 J- | 0.226 U | 0.132 U | 0.131 U |
| 4,4'-DDT | 0.26 U | 0.271 U | 0.261 U | 0.266 U | 0.267 R | 0.484 U | 0.265 R | 0.453 U | 0.264 U | 0.262 U |
| Aldrin | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| alpha-BHC | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| alpha-Chlordane | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Aroclor-1016 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1221 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1232 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1242 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1248 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1254 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1260 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| delta-BHC | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Dieldrin | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Endosulfan I | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Endosulfan II | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Endosulfan sulfate | 0.26 U | 0.271 U | 0.261 U | 0.266 U | 0.267 R | 0.484 U | 0.265 R | 0.453 U | 0.264 U | 0.262 U |
| Endrin | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Endrin aldehyde | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Endrin ketone | 0.26 U | 0.271 U | 0.261 U | 0.266 U | 0.267 R | 0.484 U | 0.265 R | 0.453 U | 0.264 U | 0.262 U |
| gamma-BHC (Lindane) | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Heptachlor | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Heptachlor epoxide | 0.13 U | 0.136 U | 0.13 U | 0.133 U | 0.134 R | 0.242 U | 0.132 R | 0.226 U | 0.132 U | 0.131 U |
| Methoxychlor | 0.26 U | 0.271 U | 0.261 U | 0.266 U | 0.267 R | 0.484 U | 0.265 R | 0.453 U | 0.264 U | 0.262 U |
| Toxaphene | 13 U | 13.6 U | 13 U | 13.3 U | 13.4 R | 24.2 U | 13.2 R | 22.6 U | 13.2 U | 13.1 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

## Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP06 | | CBD-S03-DP07 | | CBD-S03-DP08 | | CBD-S03-DP09 | | CBD-S03-DP10 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS06-000H | CBD-S03-SB06-0810 | CBD-S03-SS07-000H | CBD-S03-SB07-0810 | CBD-S03-SS08-000H | CBD-S03-SB08-0810 | CBD-S03-SS09-000H | CBD-S03-SB09-0810 | CBD-S03-SS10-000H | CBD-S03-SB10-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | | |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP11 | | | CBD-S03-DP12 | | CBD-S03-DP13 | | CBD-S03-DP14 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS11-000H | CBD-S03-SS11P-000H | CBD-S03-SB11-0810 | CBD-S03-SS12-000H | CBD-S03-SB12-0810 | CBD-S03-SS13-000H | CBD-S03-SB13-0810 | CBD-S03-SS14-000H | CBD-S03-SB14-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,1-Biphenyl | 560 U | 410 UJ | 400 U | 640 U | 400 U | 500 U | 420 U | 460 U | 380 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2,4,6-Trichlorophenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2,4-Dichlorophenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2,4-Dimethylphenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2,4-Dinitrophenol | 1,860 U | 1,370 UJ | 1,340 U | 2,150 U | 1,340 U | 1,680 U | 1,420 U | 1,550 U | 1,260 U |
| 2,4-Dinitrotoluene | 371 U | 275 UJ | 269 U | 430 U | 269 U | 335 U | 283 U | 309 U | 252 U |
| 2,6-Dinitrotoluene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2-Chloronaphthalene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2-Chlorophenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2-Methylnaphthalene | 2.7 U | 2.3 U | 2 U | 3 U | 2.1 U | 2.3 U | 2.2 U | 2.3 U | 2.3 U |
| 2-Methylphenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 2-Nitroaniline | 371 U | 275 UJ | 269 U | 430 U | 269 U | 335 U | 283 U | 309 U | 252 U |
| 2-Nitrophenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 3,3'-Dichlorobenzidine | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 3-Nitroaniline | 370 U | 270 UJ | 270 U | 430 U | 270 U | 340 U | 280 U | 310 U | 250 U |
| 4,6-Dinitro-2-methylphenol | 1,860 U | 1,370 UJ | 1,340 U | 2,150 U | 1,340 U | 1,680 U | 1,420 U | 1,550 U | 1,260 U |
| 4-Bromophenyl-phenylether | 371 U | 275 UJ | 269 U | 430 U | 269 U | 335 U | 283 U | 309 U | 252 U |
| 4-Chloro-3-methylphenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 4-Chloroaniline | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 4-Chlorophenyl-phenylether | 371 U | 275 UJ | 269 U | 430 U | 269 U | 335 U | 283 U | 309 U | 252 U |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| 4-Nitrophenol | 370 U | 270 UJ | 270 U | 430 UJ | 270 UJ | 340 U | 280 U | 310 UJ | 250 UJ |

## Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP11 | | | CBD-S03-DP12 | | CBD-S03-DP13 | | CBD-S03-DP14 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS11-000H | CBD-S03-SS11P-000H | CBD-S03-SB11-0810 | CBD-S03-SS12-000H | CBD-S03-SB12-0810 | CBD-S03-SS13-000H | CBD-S03-SB13-0810 | CBD-S03-SS14-000H | CBD-S03-SB14-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| Acenaphthene | 1.3 U | 0.76 J | 1.1 U | 1.6 U | 0.58 J | 1.2 U | 1.2 U | 0.81 J | 1.2 U |
| Acenaphthylene | 0.49 J | 1.8 J | 1.1 U | 1.6 U | 1.1 U | 0.69 J | 1.2 U | 12 | 1.2 U |
| Acetophenone | 190 U | 140 UJ | 130 U | 210 U | 130 U | 170 U | 140 U | 150 U | 130 U |
| Anthracene | 5.1 U | 2.6 J | 4.3 U | 6.5 U | 1.7 J | 5 U | 4.8 U | 13 | 5 U |
| Atrazine | 560 U | 410 UJ | 400 U | 640 U | 400 U | 500 U | 420 U | 460 U | 380 U |
| Benzaldehyde | 560 UJ | 410 UJ | 400 UJ | 640 U | 400 U | 500 UJ | 420 UJ | 460 U | 380 U |
| Benzo(a)anthracene | 5.1 U | 15 | 4.3 U | 6.5 U | 11 | 7.5 U | 4.8 U | 29 | 5 U |
| Benzo(a)pyrene | 4 J | 20 J | 4.3 U | 2.9 J | 14 | 7.6 J | 4.8 U | 41 | 5 U |
| Benzo(b)fluoranthene | 9.8 UJ | 40 J | 6.7 U | 10 U | 26 | 15 | 7.4 U | 97 | 7.7 U |
| Benzo(g,h,i)perylene | 4.5 J | 19 J | 6.7 U | 10 U | 12 | 9.1 J | 7.4 U | 42 | 7.7 U |
| Benzo(k)fluoranthene | 5.1 U | 13 | 4.3 U | 6.5 U | 7.5 U | 8.9 U | 4.8 U | 30 | 5 U |
| bis(2-Chloroethoxy)methane | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| bis(2-Chloroethyl)ether | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| bis(2-Ethylhexyl)phthalate | 853 UJ | 434 UJ | 486 U | 215 U | 134 U | 785 U | 607 U | 155 U | 126 U |
| Butylbenzylphthalate | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Caprolactam | 4,600 UJ | 3,400 UJ | 3,400 UJ | 5,400 U | 3,400 U | 4,200 UJ | 3,500 UJ | 3,900 U | 3,200 U |
| Carbazole | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Chrysene | 5.1 UJ | 24 J | 4.3 U | 6.5 U | 16 | 10 U | 4.8 U | 47 | 5 U |
| Dibenz(a,h)anthracene | 7.8 U | 3.7 J | 6.7 U | 10 U | 3.2 J | 5.2 J | 7.4 U | 10 J | 7.7 U |
| Dibenzofuran | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Diethylphthalate | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Dimethyl phthalate | 370 U | 270 UJ | 270 U | 430 U | 270 U | 340 U | 280 U | 310 U | 250 U |
| Di-n-butylphthalate | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Di-n-octylphthalate | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Fluoranthene | 5.1 UJ | 29 J | 4.3 U | 6.6 U | 16 | 6.7 U | 4.8 U | 52 | 5 U |
| Fluorene | 3.1 U | 1.2 J | 2.7 U | 4 U | 2.8 U | 3.1 U | 3 U | 2.1 J | 3.1 U |
| Hexachlorobenzene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Hexachlorobutadiene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Hexachlorocyclopentadiene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Hexachloroethane | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Indeno(1,2,3-cd)pyrene | 5 J | 22 J | 6.7 U | 10 U | 15 | 10 J | 7.4 U | 51 | 7.7 U |
| Isophorone | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Naphthalene | 2.8 U | 2.3 U | 2 U | 3 U | 2.1 U | 2.3 U | 2.2 U | 2.3 U | 2.3 U |
| n-Nitroso-di-n-propylamine | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| n-Nitrosodiphenylamine | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Nitrobenzene | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Pentachlorophenol | 371 U | 275 UJ | 269 U | 430 U | 269 U | 335 U | 283 U | 309 U | 252 U |
| Phenanthrene | 7.8 U | 14 | 6.7 U | 6.6 J | 8.6 J | 7.7 U | 7.4 U | 13 | 7.7 U |
| Phenol | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| Pyrene | 4.5 J | 25 J | 6.7 U | 3.4 J | 13 | 5.9 J | 7.4 U | 48 | 7.7 U |
| Total cresols | 186 U | 137 UJ | 134 U | 215 U | 134 U | 168 U | 142 U | 155 U | 126 U |
| | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | |
| 4,4'-DDD | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| 4,4'-DDE | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| 4,4'-DDT | 0.599 U | 0.284 U | 0.256 U | 0.503 UJ | 0.264 U | 0.291 U | 0.263 U | 0.263 UJ | 0.252 U |
| Aldrin | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| alpha-BHC | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| alpha-Chlordane | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Aroclor-1016 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1221 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1232 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1242 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1248 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1254 | 15 UJ | 7.1 U | 6.4 U | 13 UJ | 6.6 U | 7.3 UJ | 6.6 U | 6.6 U | 6.3 U |
| Aroclor-1260 | 36 J | 70 J | 6.4 U | 51 J | 6.6 U | 1,200 | 6.6 U | 1,600 | 4.9 J |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| delta-BHC | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Dieldrin | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Endosulfan I | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Endosulfan II | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Endosulfan sulfate | 0.599 U | 0.284 U | 0.256 U | 0.503 UJ | 0.264 U | 0.291 U | 0.263 U | 0.263 UJ | 0.252 U |
| Endrin | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Endrin aldehyde | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Endrin ketone | 0.599 U | 0.284 U | 0.256 U | 0.503 UJ | 0.264 U | 0.291 U | 0.263 U | 0.263 UJ | 0.252 U |
| gamma-BHC (Lindane) | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Heptachlor | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Heptachlor epoxide | 0.299 U | 0.142 U | 0.128 U | 0.252 UJ | 0.132 U | 0.146 U | 0.131 U | 0.131 UJ | 0.126 U |
| Methoxychlor | 0.599 U | 0.284 U | 0.256 U | 0.503 UJ | 0.264 U | 0.291 U | 0.263 U | 0.263 UJ | 0.252 U |
| Toxaphene | 29.9 U | 14.2 U | 12.8 U | 25.2 UJ | 13.2 U | 14.6 U | 13.1 U | 13.1 UJ | 12.6 U |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 6,800 | 5,200 | 2,000 | 7,000 | 4,100 | 5,600 | 2,100 | 7,200 | 2,200 |
| Antimony | 0.15 J | 0.13 J | 0.14 U | 0.13 J | 0.11 J | 0.11 J | 0.1 J | 0.076 J | 0.099 J |
| Arsenic | 3.2 | 2.5 | 0.61 | 2.9 | 4.2 | 3.3 | 0.28 | 2.5 | 0.59 |
| Barium | 37 | 29 | 5.4 | 37 | 7.3 | 25 | 3.5 | 42 | 3.1 |
| Beryllium | 0.36 J | 0.31 J | 0.28 U | 0.52 J | 0.19 J | 0.37 J | 0.27 U | 0.57 J | 0.27 U |
| Cadmium | 0.25 J | 0.18 J | 0.14 U | 0.2 J | 0.16 U | 0.37 | 0.14 U | 0.24 J | 0.14 U |
| Calcium | 780,000 | 666,000 | 343 | 258 | 363 | 543 | 322 | 360 | 47.4 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA |

# Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP11 | | | CBD-S03-DP12 | | CBD-S03-DP13 | | CBD-S03-DP14 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S03-SS11-000H | CBD-S03-SS11P-000H | CBD-S03-SB11-0810 | CBD-S03-SS12-000H | CBD-S03-SB12-0810 | CBD-S03-SS13-000H | CBD-S03-SB13-0810 | CBD-S03-SS14-000H | CBD-S03-SB14-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| Chromium | 12 | 8.9 | 7.6 | 11 | 14 | 16 | 8.8 | 14 | 3.5 |
| Cobalt | 2.4 | 1.8 | 0.54 | 3.5 | 0.72 | 1.8 | 0.28 | 3.9 | 0.24 J |
| Copper | 6.1 | 6.6 | 1.1 | 6.8 | 3.3 | 5.1 | 1.2 | 5.8 | 1.4 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 9,800 | 7,600 | 1,800 | 9,800 | 7,300 | 10,000 | 1,900 | 9,800 | 2,300 |
| Lead | 15 | 12 | 1.6 | 11 | 2.6 | 17 | 1.7 | 17 | 2.1 |
| Magnesium | 797,000 | 625,000 | 435 | 735 | 655 | 789 | 437 | 662 | 180 |
| Manganese | 97 | 83 | 3 | 110 | 6.5 | 81 | 2.5 | 130 | 3.9 |
| Mercury | 0.18 U | 0.15 U | 0.14 U | 0.19 U | 0.16 U | 0.18 U | 0.14 U | 0.16 U | 0.14 U |
| Nickel | 8.1 | 6.1 | 0.87 | 8.7 | 1.2 | 5.1 | 0.59 | 8.8 | 0.62 |
| Potassium | 577,000 | 514,000 | 300 | 399 | 417 | 958 | 307 | 344 | 217 |
| Selenium | 0.87 | 0.95 | 0.3 J | 1.3 | 0.5 J | 0.75 | 0.27 U | 1.1 | 0.27 U |
| Silver | 0.18 U | 0.15 U | 0.14 U | 0.11 J | 0.076 J | 0.14 J | 0.077 J | 0.16 U | 0.064 J |
| Sodium | 215,000 J | 379,000 J | 4.8 U | 12.9 U | 6.6 U | 6.3 U | 5.3 U | 14.1 J+ | 6 U |
| Thallium | 0.2 J | 0.16 J | 0.066 J | 0.24 J | 0.12 J | 0.17 J | 0.13 J | 0.19 J | 0.14 U |
| Vanadium | 16 | 12 | 3.2 | 14 | 10 | 16 | 3.6 | 13 | 5.1 |
| Zinc | 48 | 41 | 6 | 43 | 9.9 | 29 | 3.3 | 43 | 2.6 |
| | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S03-DP15 | | |
|---|---|---|---|
| **Sample ID** | CBD-S03-SS15-000H | CBD-S03-SB15-0810 | CBD-S03-SB15P-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | |
| | | | |
| **Volatile Organic Compounds (UG/KG)** | | | |
| 1,1,1-Trichloroethane | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA |
| 2-Butanone | NA | NA | NA |
| 2-Hexanone | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA |
| Acetone | NA | NA | NA |
| Benzene | NA | NA | NA |
| Bromochloromethane | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA |
| Bromoform | NA | NA | NA |
| Bromomethane | NA | NA | NA |
| Carbon disulfide | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA |
| Chlorobenzene | NA | NA | NA |
| Chloroethane | NA | NA | NA |
| Chloroform | NA | NA | NA |
| Chloromethane | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA |
| Cyclohexane | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA |
| Ethylbenzene | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA |
| Methyl acetate | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA |
| Methylene chloride | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA |
| o-Xylene | NA | NA | NA |
| Styrene | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA |
| Toluene | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA |
| Trichloroethene | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA |
| Vinyl chloride | NA | NA | NA |
| | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | |
| 1,1-Biphenyl | 480 UJ | 420 U | 420 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 160 UJ | 139 U | 140 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA |
| 2,4,5-Trichlorophenol | 160 U | 139 U | 140 U |
| 2,4,6-Trichlorophenol | 160 U | 139 U | 140 U |
| 2,4-Dichlorophenol | 160 U | 139 U | 140 U |
| 2,4-Dimethylphenol | 160 U | 139 U | 140 U |
| 2,4-Dinitrophenol | 1,600 U | 1,390 U | 1,400 U |
| 2,4-Dinitrotoluene | 321 UJ | 278 U | 279 U |
| 2,6-Dinitrotoluene | 160 UJ | 139 U | 140 U |
| 2-Chloronaphthalene | 160 UJ | 139 U | 140 U |
| 2-Chlorophenol | 160 U | 139 U | 140 U |
| 2-Methylnaphthalene | 2.1 U | 2 U | 2.5 U |
| 2-Methylphenol | 160 U | 139 U | 140 U |
| 2-Nitroaniline | 321 UJ | 278 U | 279 U |
| 2-Nitrophenol | 160 U | 139 U | 140 U |
| 3,3'-Dichlorobenzidine | 160 UJ | 139 U | 140 U |
| 3-Nitroaniline | 320 UJ | 280 U | 280 U |
| 4,6-Dinitro-2-methylphenol | 1,600 U | 1,390 U | 1,400 U |
| 4-Bromophenyl-phenylether | 321 UJ | 278 U | 279 U |
| 4-Chloro-3-methylphenol | 160 U | 139 U | 140 U |
| 4-Chloroaniline | 160 UJ | 139 U | 140 U |
| 4-Chlorophenyl-phenylether | 321 UJ | 278 U | 279 U |
| 4-Methylphenol | NA | NA | NA |
| 4-Nitroaniline | 160 UJ | 139 U | 140 U |
| 4-Nitrophenol | 320 U | 280 U | 280 U |

## Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP15 | | |
|---|---|---|---|
| **Sample ID** | CBD-S03-SS15-000H | CBD-S03-SB15-0810 | CBD-S03-SB15P-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | |
| Acenaphthene | 1.1 U | 1.1 U | 1.3 U |
| Acenaphthylene | 1.1 U | 1.1 U | 1.3 U |
| Acetophenone | 160 UJ | 140 U | 140 U |
| Anthracene | 4.6 U | 4.4 U | 5.4 U |
| Atrazine | 480 UJ | 420 U | 420 U |
| Benzaldehyde | 480 UJ | 420 UJ | 420 UJ |
| Benzo(a)anthracene | 4.6 U | 4.4 U | 5.4 U |
| Benzo(a)pyrene | 4.6 U | 4.4 U | 5.4 U |
| Benzo(b)fluoranthene | 7.1 U | 6.8 U | 8.3 U |
| Benzo(g,h,i)perylene | 7.1 U | 6.8 U | 8.3 U |
| Benzo(k)fluoranthene | 4.6 U | 4.4 U | 5.4 U |
| bis(2-Chloroethoxy)methane | 160 UJ | 139 U | 140 U |
| bis(2-Chloroethyl)ether | 160 UJ | 139 U | 140 U |
| bis(2-Ethylhexyl)phthalate | 652 UJ | 621 U | 557 U |
| Butylbenzylphthalate | 160 UJ | 139 U | 140 U |
| Caprolactam | 4,000 UJ | 3,500 UJ | 3,500 UJ |
| Carbazole | 160 UJ | 139 U | 140 U |
| Chrysene | 4.6 U | 4.4 U | 5.4 U |
| Dibenz(a,h)anthracene | 7.1 U | 6.8 U | 8.3 U |
| Dibenzofuran | 160 UJ | 139 U | 140 U |
| Diethylphthalate | 160 UJ | 139 U | 140 U |
| Dimethyl phthalate | 320 UJ | 280 U | 280 U |
| Di-n-butylphthalate | 160 UJ | 139 U | 140 U |
| Di-n-octylphthalate | 160 UJ | 139 U | 140 U |
| Fluoranthene | 4.6 U | 4.4 U | 5.4 U |
| Fluorene | 2.8 U | 2.7 U | 3.3 U |
| Hexachlorobenzene | 160 UJ | 139 U | 140 U |
| Hexachlorobutadiene | 160 UJ | 139 U | 140 U |
| Hexachlorocyclopentadiene | 160 UJ | 139 U | 140 U |
| Hexachloroethane | 160 UJ | 139 U | 140 U |
| Indeno(1,2,3-cd)pyrene | 7.1 U | 6.8 U | 8.3 U |
| Isophorone | 160 UJ | 139 U | 140 U |
| Naphthalene | 2.1 U | 2 U | 2.5 U |
| n-Nitroso-di-n-propylamine | 160 UJ | 139 U | 140 U |
| n-Nitrosodiphenylamine | 160 UJ | 139 U | 140 U |
| Nitrobenzene | 160 UJ | 139 U | 140 U |
| Pentachlorophenol | 321 U | 278 U | 279 U |
| Phenanthrene | 7.1 U | 6.8 U | 8.3 U |
| Phenol | 160 U | 139 U | 140 U |
| Pyrene | 7.1 U | 6.8 U | 8.3 U |
| Total cresols | 160 U | 139 U | 140 U |
| | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | |
| 4,4'-DDD | 0.143 U | 0.137 U | 0.13 U |
| 4,4'-DDE | 13.5 | 0.137 U | 0.13 U |
| 4,4'-DDT | 0.286 U | 0.273 U | 0.26 U |
| Aldrin | 0.143 U | 0.137 U | 0.13 U |
| alpha-BHC | 0.143 U | 0.137 U | 0.13 U |
| alpha-Chlordane | 0.143 U | 0.137 U | 0.13 U |
| Aroclor-1016 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1221 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1232 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1242 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1248 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1254 | 7.2 U | 6.8 U | 6.5 U |
| Aroclor-1260 | 350 | 23 J | 6.5 UJ |
| Aroclor-1262 | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA |
| beta-BHC | 0.143 U | 0.137 U | 0.13 U |
| delta-BHC | 0.143 U | 0.137 U | 0.13 U |
| Dieldrin | 0.143 U | 0.137 U | 0.13 U |
| Endosulfan I | 0.143 U | 0.137 U | 0.13 U |
| Endosulfan II | 0.143 U | 0.137 U | 0.13 U |
| Endosulfan sulfate | 0.286 U | 0.273 U | 0.26 U |
| Endrin | 0.143 U | 0.137 U | 0.13 U |
| Endrin aldehyde | 0.143 U | 0.137 U | 0.13 U |
| Endrin ketone | 0.286 U | 0.273 U | 0.26 U |
| gamma-BHC (Lindane) | 0.143 U | 0.137 U | 0.13 U |
| Heptachlor | 0.143 U | 0.137 U | 0.13 U |
| Heptachlor epoxide | 0.143 U | 0.137 U | 0.13 U |
| Methoxychlor | 0.286 U | 0.273 U | 0.26 U |
| Toxaphene | 14.3 U | 13.7 U | 13 U |
| | | | |
| **Total Metals (MG/KG)** | | | |
| Aluminum | 4,800 | 3,500 | 4,300 |
| Antimony | 0.2 J | 0.17 U | 0.17 U |
| Arsenic | 3.8 | 1.9 J | 3.4 J |
| Barium | 27 | 4.8 | 6.7 |
| Beryllium | 0.24 J | 0.33 U | 0.33 U |
| Cadmium | 1.7 | 0.17 U | 0.17 U |
| Calcium | 935 | 453 | 491 |
| Chromium (hexavalent) | NA | NA | NA |

## Appendix D - Site 3 Soil Analytical Data

| **Station ID** | CBD-S03-DP15 | | |
|---|---|---|---|
| **Sample ID** | CBD-S03-SS15-000H | CBD-S03-SB15-0810 | CBD-S03-SB15P-0810 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | |
| Chromium | 11 | 15 | 15 |
| Cobalt | 1.9 | 0.32 J | 0.55 |
| Copper | 16 | 1.5 | 1.8 |
| Cyanide | NA | NA | NA |
| Iron | 9,200 | 4,900 | 6,200 |
| Lead | 95 | 2.2 | 2.4 |
| Magnesium | 607 | 521 | 579 |
| Manganese | 100 | 2.3 J | 6.9 J |
| Mercury | 0.14 U | 0.17 U | 0.17 U |
| Nickel | 7.4 | 0.65 J | 1.2 |
| Potassium | 414 | 401 | 424 |
| Selenium | 0.76 | 0.33 U | 0.34 J |
| Silver | 0.12 J | 0.17 U | 0.17 U |
| Sodium | 22.4 J+ | 21 J+ | 18.3 J+ |
| Thallium | 0.12 J | 0.17 U | 0.17 U |
| Vanadium | 13 | 6 | 8.5 |
| Zinc | 70 | 6.8 | 6.4 |
| | | | |
| **Wet Chemistry** | | | |
| pH (ph) | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA |

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**Notes:**

| ▨ Shading indicates detections |
|---|

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

# Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP01 | | | CBD-S04-DP02 | | CBD-S04-DP03 | | CBD-S04-DP04 | | CBD-S04-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS01-1012 | CBD-S04-SS01P-1012 | CBD-S04-SB01-1820 | CBD-S04-SS02-1012 | CBD-S04-SB02-1618 | CBD-S04-SS03-1012 | CBD-S04-SB03-1416 | CBD-S04-SS04-1012 | CBD-S04-SB04-1012 | CBD-S04-SS05-1012 | CBD-S04-SB05-1315 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,1,2,2-Tetrachloroethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,1,2-Trichloroethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,1-Dichloroethane | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| 1,1-Dichloroethene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2,3-Trichlorobenzene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2,4-Trichlorobenzene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2-Dibromo-3-chloropropane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2-Dibromoethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2-Dichlorobenzene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2-Dichloroethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,2-Dichloropropane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| 1,3-Dichlorobenzene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| 1,4-Dichlorobenzene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| 2-Butanone | 0.42 UJ | 0.42 UJ | 0.6 U | 0.57 UJ | 0.69 UJ | 3.8 B | 0.56 UJ | 1.3 B | 0.52 UJ | 3.1 B | 1.2 U |
| 2-Hexanone | 0.42 UJ | 0.42 UJ | 0.6 U | 0.57 UJ | 0.69 UJ | 0.44 UJ | 0.56 UJ | 0.55 UJ | 0.52 UJ | 0.43 U | 1.2 U |
| 4-Methyl-2-pentanone | 0.42 UJ | 0.42 UJ | 0.6 U | 0.57 UJ | 0.69 UJ | 0.44 UJ | 0.56 UJ | 0.55 UJ | 0.52 UJ | 0.43 U | 1.2 U |
| Acetone | 50 J | 7.4 J | 23 | 22 J | 28 J | 100 J | 5.6 UJ | 57 J | 5.2 UJ | 100 | 12 U |
| Benzene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.18 J | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Bromochloromethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Bromodichloromethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Bromoform | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Bromomethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Carbon disulfide | 0.31 B | 0.33 B | 0.41 B | 0.4 B | 0.5 B | 0.36 B | 0.4 B | 0.63 B | 0.38 B | 0.38 B | 0.87 B |
| Carbon tetrachloride | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Chlorobenzene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Chloroethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Chloroform | 0.21 U | 0.21 U | 0.3 U | 0.23 B | 0.35 U | 0.18 B | 0.25 B | 0.17 B | 0.23 B | 0.21 U | 0.62 U |
| Chloromethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| cis-1,2-Dichloroethene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| cis-1,3-Dichloropropene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Cyclohexane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Dibromochloromethane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Dichlorodifluoromethane (Freon-12) | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Ethylbenzene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Isopropylbenzene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| m- and p-Xylene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Methyl acetate | 6.3 B | 0.99 B | 1.8 B | 1.3 B | 1.5 B | 1.8 B | 1.2 B | 1.6 B | 1 B | 1.8 B | 8.4 B |
| Methylcyclohexane | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Methylene chloride | 3.7 B | 0.42 U | 0.6 U | 0.57 U | 1.8 B | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Methyl-tert-butyl ether (MTBE) | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| o-Xylene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Styrene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Tetrachloroethene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Toluene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.2 J | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| trans-1,2-Dichloroethene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| trans-1,3-Dichloropropene | 0.42 U | 0.42 U | 0.6 U | 0.57 U | 0.69 U | 0.44 U | 0.56 U | 0.55 U | 0.52 U | 0.43 U | 1.2 U |
| Trichloroethene | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Trichlorofluoromethane (Freon-11) | 0.26 J | 0.21 U | 0.3 U | 0.29 U | 0.32 J | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| Vinyl chloride | 0.21 U | 0.21 U | 0.3 U | 0.29 U | 0.35 U | 0.22 U | 0.28 U | 0.27 U | 0.26 U | 0.21 U | 0.62 U |
| | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1-Biphenyl | 19 U | 19 U | 20 U | 19 U | 19 U | 13 J | 19 U | 18 U | 19 U | 19 U | 20 U |
| 1,2,4,5-Tetrachlorobenzene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| 2,2'-Oxybis(1-chloropropane) | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2,3,4,6-Tetrachlorophenol | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2,4,5-Trichlorophenol | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| 2,4,6-Trichlorophenol | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2,4-Dichlorophenol | 3.7 U | 3.7 U | 3.9 U | 3.8 U | 3.7 U | 3.6 U | 3.7 U | 3.6 U | 3.7 U | 3.7 U | 3.9 U |
| 2,4-Dimethylphenol | 38 U | 37 U | 40 U | 38 U | 38 U | 37 U | 37 U | 37 U | 38 U | 38 U | 40 U |
| 2,4-Dinitrophenol | 190 U | 190 U | 200 U | 190 U | 190 U | 180 U | 190 U | 180 U | 190 U | 190 U | 200 U |
| 2,4-Dinitrotoluene | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| 2,6-Dinitrotoluene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2-Chloronaphthalene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2-Chlorophenol | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 2-Methylnaphthalene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 32 | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| 2-Methylphenol | 7.5 U | 7.4 U | 7.9 U | 7.6 U | 7.5 U | 7.3 U | 7.3 U | 7.2 U | 7.5 U | 7.4 U | 7.9 U |
| 2-Nitroaniline | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| 2-Nitrophenol | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 3,3'-Dichlorobenzidine | 380 U | 370 U | 400 U | 380 U | 380 U | 370 U | 370 U | 370 U | 380 U | 380 U | 400 U |
| 3-Nitroaniline | 38 U | 37 U | 40 U | 38 U | 38 U | 37 U | 37 U | 37 U | 38 U | 38 U | 40 U |
| 4,6-Dinitro-2-methylphenol | 19 U | 19 U | 20 U | 23 J | 19 U | 18 U | 19 U | 18 U | 22 J | 19 U | 20 U |
| 4-Bromophenyl-phenylether | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| 4-Chloro-3-methylphenol | 7.5 U | 7.4 U | 7.9 U | 7.6 U | 7.5 U | 7.3 U | 7.3 U | 7.2 U | 7.5 U | 7.4 U | 7.9 U |
| 4-Chloroaniline | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 18 J | 19 U | 20 U |
| 4-Chlorophenyl-phenylether | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| 4-Methylphenol | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| 4-Nitroaniline | 38 U | 37 U | 40 U | 38 U | 38 U | 37 U | 37 U | 37 U | 38 U | 38 U | 40 U |
| 4-Nitrophenol | 38 U | 37 U | 40 U | 38 U | 38 U | 37 U | 37 U | 37 U | 38 U | 38 U | 40 U |

## Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP01 | | | CBD-S04-DP02 | | CBD-S04-DP03 | | CBD-S04-DP04 | | CBD-S04-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS01-1012 | CBD-S04-SS01P-1012 | CBD-S04-SB01-1820 | CBD-S04-SS02-1012 | CBD-S04-SB02-1618 | CBD-S04-SS03-1012 | CBD-S04-SB03-1416 | CBD-S04-SS04-1012 | CBD-S04-SB04-1012 | CBD-S04-SS05-1012 | CBD-S04-SB05-1315 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 |
| **Chemical Name** | | | | | | | | | | | |
| Acenaphthene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 310 | 1.9 U | 5.6 J | 1.9 U | 1.9 U | 2 U |
| Acenaphthylene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 3.4 J | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Acetophenone | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| Anthracene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 580 | 1.9 U | 13 J | 1.9 U | 1.9 U | 2 U |
| Atrazine | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| Benzaldehyde | 19 R | 19 R | 20 R | 19 R | 19 R | 18 R | 19 R | 18 R | 47 L | 19 R | 20 R |
| Benzo(a)anthracene | 1.9 U | 1.9 U | 2 U | 1.9 J | 1.9 U | 3,100 | 1.9 U | 58 | 1.9 U | 1.9 U | 2 U |
| Benzo(a)pyrene | 0.76 U | 3.7 U | 0.8 U | 0.77 U | 0.76 U | 3,500 | 3.7 U | 71 | 0.76 U | 3.8 U | 0.8 U |
| Benzo(b)fluoranthene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3,900 | 3.7 U | 80 | 3.8 U | 3.8 U | 4 U |
| Benzo(g,h,i)perylene | 1.9 U | 1.9 U | 2 U | 1.2 J | 1.9 U | 800 | 1.9 U | 29 J | 1.9 U | 1.9 U | 2 U |
| Benzo(k)fluoranthene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 730 | 3.7 U | 41 | 3.8 U | 3.8 U | 4 U |
| bis(2-Chloroethoxy)methane | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| bis(2-Chloroethyl)ether | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| bis(2-Ethylhexyl)phthalate | 5 B | 5.7 B | 6.1 B | 5 B | 7.4 B | 16 B | 4.6 B | 8.2 B | 6.6 B | 5.7 B | 13 B |
| Butylbenzylphthalate | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| Caprolactam | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| Carbazole | 38 U | 37 U | 40 U | 38 U | 38 U | 380 | 37 U | 37 U | 38 U | 38 U | 40 U |
| Chrysene | 1.9 U | 1.9 U | 2 U | 1.5 J | 1.9 U | 2,600 | 1.5 J | 56 | 1.9 U | 1.9 U | 2 U |
| Dibenz(a,h)anthracene | 0.76 U | 3.7 U | 0.8 U | 0.77 U | 0.76 U | 230 J | 3.7 U | 5.4 J | 0.76 U | 3.8 U | 0.8 U |
| Dibenzofuran | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 170 | 1.9 U | 2.2 J | 1.9 U | 1.9 U | 2 U |
| Diethylphthalate | 3.1 B | 3.1 B | 3.7 B | 4.2 B | 3.9 B | 8.7 B | 13 B | 7.8 B | 8.5 B | 3.8 U | 3.7 B |
| Dimethyl phthalate | 3.8 U | 3.7 U | 4 U | 2.3 J | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 2.4 J |
| Di-n-butylphthalate | 19 U | 19 U | 20 U | 19 U | 19 U | 18 U | 19 U | 18 U | 19 U | 19 U | 20 U |
| Di-n-octylphthalate | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Fluoranthene | 1.2 J | 1.1 J | 2 U | 3.1 J | 1.9 U | 4,800 | 2.7 J | 97 | 1.9 U | 1.9 U | 2 U |
| Fluorene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 210 | 1.9 U | 4.1 J | 1.9 U | 1.9 U | 2 U |
| Hexachlorobenzene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Hexachlorobutadiene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Hexachlorocyclopentadiene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 3.8 U | 3.8 U | 4 U |
| Hexachloroethane | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Indeno(1,2,3-cd)pyrene | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 830 | 3.7 U | 28 J | 3.8 U | 3.8 U | 4 U |
| Isophorone | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Naphthalene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 84 | 1.9 U | 2.2 J | 1.9 U | 1.9 U | 2 U |
| n-Nitroso-di-n-propylamine | 3.8 U | 3.7 U | 4 U | 3.8 U | 3.8 U | 3.7 U | 3.7 U | 3.7 U | 49 | 3.8 U | 4 U |
| n-Nitrosodiphenylamine | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Nitrobenzene | 1.9 U | 1.9 U | 2 U | 1.9 U | 1.9 U | 1.8 U | 1.9 U | 1.8 U | 1.9 U | 1.9 U | 2 U |
| Pentachlorophenol | 38 U | 37 U | 40 U | 38 U | 38 U | 37 U | 37 U | 37 U | 38 U | 38 U | 40 U |
| Phenanthrene | 1.2 J | 1.1 J | 2 U | 1.9 J | 1.2 J | 3,500 | 2.3 J | 57 | 1.9 U | 1.9 U | 2 U |
| Phenol | 3.7 U | 3.7 U | 3.9 U | 3.8 U | 3.7 U | 3.6 U | 3.7 U | 3.6 U | 1.9 J | 3.7 U | 3.9 U |
| Pyrene | 3.7 U | 3.7 U | 3.9 U | 2.3 J | 3.7 U | 4,500 | 1.9 J | 89 | 3.7 U | 3.7 U | 3.9 U |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| 4,4'-DDD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDT | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-Chlordane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1016 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1221 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1232 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1242 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1248 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1254 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1260 | 15 U | 14 U | 15 U | 7.2 J | 15 U | 260 | 14 U | 23 | 15 U | 15 U | 15 U |
| Aroclor-1262 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| Aroclor-1268 | 15 U | 14 U | 15 U | 15 U | 15 U | 14 U | 14 U | 14 U | 15 U | 15 U | 15 U |
| beta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| delta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dieldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan I | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan II | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan sulfate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin aldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin ketone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| gamma-BHC (Lindane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor epoxide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methoxychlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toxaphene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 8,000 J | 10,000 J | 2,400 | 7,100 | 1,600 | 6,400 | 2,100 | 6,900 | 1,700 | 15,000 | 1,700 |
| Antimony | 0.25 | 0.26 | 0.13 B | 0.16 | 0.097 J | 0.16 | 0.17 | 2.1 | 0.34 | 0.25 | 0.055 B |
| Arsenic | 5.2 | 5.1 | 1.8 | 3.2 | 1.6 | 2.2 | 3.5 | 3.3 | 4.1 | 5.1 | 1.6 |
| Barium | 15 J | 23 J | 6.7 | 12 | 4.1 | 29 | 5.3 | 40 | 5.6 | 43 | 11 |
| Beryllium | 0.34 | 0.37 | 0.5 | 0.29 | 1.1 | 0.39 | 0.25 | 0.48 | 0.12 | 0.58 | 0.99 |
| Cadmium | 0.048 J | 0.062 | 0.027 J | 0.2 | 0.058 | 0.044 J | 0.034 J | 0.12 | 0.039 J | 0.054 | 0.048 J |
| Calcium | 480 | 590 | 62 | 210 | 38 J | 240 | 110 | 650 | 350 | 580 | 120 |
| Chromium (hexavalent) | 0.22 U | 0.35 J | 1.5 | NA | NA | NA | NA | NA | NA | NA | NA |

# Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP01 | | | CBD-S04-DP02 | | CBD-S04-DP03 | | CBD-S04-DP04 | | CBD-S04-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS01-1012 | CBD-S04-SS01P-1012 | CBD-S04-SB01-1820 | CBD-S04-SS02-1012 | CBD-S04-SB02-1618 | CBD-S04-SS03-1012 | CBD-S04-SB03-1416 | CBD-S04-SS04-1012 | CBD-S04-SB04-1012 | CBD-S04-SS05-1012 | CBD-S04-SB05-1315 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 |
| **Chemical Name** | | | | | | | | | | | |
| Chromium | 16 | 15 | 9.1 | 11 | 7.5 | 7.8 | 12 | 10 | 7 | 20 | 6.5 |
| Cobalt | 0.96 | 1.2 | 2 | 1.4 | 1.7 | 2.8 | 0.75 | 2.7 | 0.58 | 4 | 0.65 |
| Copper | 6.3 | 6.4 | 1.5 | 4.6 | 1.1 | 3 | 1.4 | 13 | 1.9 | 6.4 | 0.83 |
| Cyanide | 0.056 U | 0.056 U | 0.06 U | 0.057 U | 0.057 U | 0.055 U | 0.056 U | 0.055 U | 0.062 J | 0.056 U | 0.059 U |
| Iron | 17,000 | 17,000 | 4,200 | 11,000 | 3,500 | 8,200 | 6,300 | 10,000 | 4,800 | 21,000 | 5,000 |
| Lead | 16 | 11 | 2.6 | 8.6 | 2.2 | 5.8 | 1.7 | 59 | 1.7 | 8.8 | 1.9 |
| Magnesium | 940 | 1,100 | 540 | 790 | 360 | 590 | 500 | 700 | 490 | 1,400 | 480 |
| Manganese | 24 | 25 | 24 | 33 | 13 | 78 | 5.2 | 78 | 3.2 | 120 | 4.6 |
| Mercury | 0.018 J | 0.022 J | 0.017 U | 0.0064 J | 0.017 U | 0.017 U | 0.017 U | 0.084 | 0.011 J | 0.027 J | 0.017 U |
| Nickel | 1.8 | 2.6 | 2.5 | 2.9 | 0.98 | 4.2 | 1.9 | 5.4 | 0.99 | 7.7 | 1.1 |
| Potassium | 850 | 930 | 410 | 590 | 310 | 360 | 340 | 440 | 340 | 810 | 380 |
| Selenium | 0.41 | 0.39 | 0.12 B | 0.25 | 0.13 B | 0.24 | 0.18 | 0.38 | 0.14 B | 0.32 | 0.1 U |
| Silver | 0.08 | 0.052 | 0.033 J | 0.033 J | 0.03 J | 0.037 J | 0.038 J | 0.94 | 0.029 J | 0.045 J | 0.026 J |
| Sodium | 16 B | 21 B | 12 B | 13 B | 8.2 B | 13 B | 9.8 B | 19 B | 15 B | 23 B | 14 B |
| Thallium | 0.12 | 0.13 | 0.093 | 0.12 | 0.12 | 0.23 | 0.29 | 0.18 | 0.16 | 0.27 | 0.07 |
| Vanadium | 18 | 21 | 4.9 | 16 | 3.5 | 14 | 7.5 | 16 | 4.2 | 31 | 3.5 |
| Zinc | 15 B | 23 B | 13 B | 19 B | 23 B | 22 B | 18 B | 66 | 13 B | 32 | 7.2 |
| | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | |
| pH (ph) | 5.5 | NA | NA | 5.7 | NA | 5.8 | NA | 6.1 | NA | 5.2 | NA |
| Total organic carbon (TOC) (mg/kg) | 10,000 | NA | NA | 1,500 | NA | 3,300 | NA | 4,300 | NA | 2,400 | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP07 | | CBD-S04-DP08 | | CBD-S04-DP09 | | CBD-S04-DP10 | | CBD-S04-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS07-000H | CBD-S04-SB07-0810 | CBD-S04-SS08-000H | CBD-S04-SB08-0810 | CBD-S04-SS09-000H | CBD-S04-SB09-0810 | CBD-S04-SS10-000H | CBD-S04-SB10-0810 | CBD-S04-SS11-000H | CBD-S04-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1-Biphenyl | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP07 | | CBD-S04-DP08 | | CBD-S04-DP09 | | CBD-S04-DP10 | | CBD-S04-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS07-000H | CBD-S04-SB07-0810 | CBD-S04-SS08-000H | CBD-S04-SB08-0810 | CBD-S04-SS09-000H | CBD-S04-SB09-0810 | CBD-S04-SS10-000H | CBD-S04-SB10-0810 | CBD-S04-SS11-000H | CBD-S04-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetophenone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Atrazine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzaldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Caprolactam | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| 4,4'-DDE | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.519 | 0.13 U | 0.223 U | 0.127 U |
| 4,4'-DDT | 0.457 U | 0.248 U | 0.269 U | 0.245 U | 0.262 U | 0.28 UJ | 0.31 U | 0.261 U | 0.447 U | 0.255 U |
| Aldrin | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| alpha-BHC | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| alpha-Chlordane | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Aroclor-1016 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1221 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1232 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1242 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1248 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1254 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1260 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| delta-BHC | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Dieldrin | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Endosulfan I | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Endosulfan II | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Endosulfan sulfate | 0.457 U | 0.248 U | 0.269 U | 0.245 U | 0.262 U | 0.28 UJ | 0.31 U | 0.261 U | 0.447 U | 0.255 U |
| Endrin | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Endrin aldehyde | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Endrin ketone | 0.457 U | 0.248 U | 0.269 U | 0.245 U | 0.262 U | 0.28 UJ | 0.31 U | 0.261 U | 0.447 U | 0.255 U |
| gamma-BHC (Lindane) | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Heptachlor | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Heptachlor epoxide | 0.229 U | 0.124 U | 0.134 U | 0.123 U | 0.131 U | 0.14 UJ | 0.155 U | 0.13 U | 0.223 U | 0.127 U |
| Methoxychlor | 0.457 U | 0.248 U | 0.269 U | 0.245 U | 0.262 U | 0.28 UJ | 0.31 U | 0.261 U | 0.447 U | 0.255 U |
| Toxaphene | 22.9 U | 12.4 U | 13.4 U | 12.3 U | 13.1 U | 14 UJ | 15.5 U | 13 U | 22.3 U | 12.7 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP07 | | CBD-S04-DP08 | | CBD-S04-DP09 | | CBD-S04-DP10 | | CBD-S04-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS07-000H | CBD-S04-SB07-0810 | CBD-S04-SS08-000H | CBD-S04-SB08-0810 | CBD-S04-SS09-000H | CBD-S04-SB09-0810 | CBD-S04-SS10-000H | CBD-S04-SB10-0810 | CBD-S04-SS11-000H | CBD-S04-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU2

**Notes:**

- ▨ Shading indicates detections
- NA - Not analyzed
- B - Analyte not detected above the level reported in blanks
- J - Analyte present, value may or may not be accurate or precise
- J- - Analyte present, value may be biased low, actual value may be higher
- J+ - Analyte present, value may be biased high, actual value may be lower
- L - Analyte present, value may be biased low, actual value may be higher
- R - Unreliable Result
- U - The material was analyzed for, but not detected
- UJ - Analyte not detected, quantitation limit may be inaccurate
- MG/KG - Milligrams per kilogram
- PH - pH units
- UG/KG - Micrograms per kilogram

## Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP12 | | | CBD-S04-DP13 | | | CBD-S04-DP14 | | CBD-S04-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS12-000H | CBD-S04-SB12-0810 | CBD-S04-SB12P-0810 | CBD-S04-SS13-000H | CBD-S04-SS13P-000H | CBD-S04-SB13-0810 | CBD-S04-SS14-000H | CBD-S04-SB14-0810 | CBD-S04-SS15-000H | CBD-S04-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1-Biphenyl | 580 U | 650 U | 680 U | 610 U | 740 U | 380 U | 430 U | 400 U | 470 U | 410 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2,4,6-Trichlorophenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2,4-Dichlorophenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2,4-Dimethylphenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2,4-Dinitrophenol | 1,940 U | 2,180 U | 2,260 U | 2,040 U | 2,470 U | 1,260 U | 1,440 U | 1,320 U | 1,570 U | 1,370 U |
| 2,4-Dinitrotoluene | 388 U | 436 U | 452 U | 408 U | 494 U | 251 U | 288 U | 265 U | 315 U | 275 U |
| 2,6-Dinitrotoluene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2-Chloronaphthalene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2-Chlorophenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2-Methylnaphthalene | 2.2 U | 2 U | 2.2 U | 2.3 U | 2.3 U | 2.1 U | 2.1 U | 2.3 U | 2.3 U | 2.2 U |
| 2-Methylphenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 2-Nitroaniline | 388 U | 436 U | 452 U | 408 U | 494 U | 251 U | 288 U | 265 U | 315 U | 275 U |
| 2-Nitrophenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 3,3'-Dichlorobenzidine | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 3-Nitroaniline | 390 U | 440 U | 450 U | 410 U | 490 U | 250 U | 290 U | 260 U | 310 U | 270 U |
| 4,6-Dinitro-2-methylphenol | 1,940 U | 2,180 U | 2,260 U | 2,040 U | 2,470 U | 1,260 U | 1,440 U | 1,320 U | 1,570 U | 1,370 U |
| 4-Bromophenyl-phenylether | 388 U | 436 U | 452 U | 408 U | 494 U | 251 U | 288 U | 265 U | 315 U | 275 U |
| 4-Chloro-3-methylphenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 4-Chloroaniline | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 4-Chlorophenyl-phenylether | 388 U | 436 U | 452 U | 408 U | 494 U | 251 U | 288 U | 265 U | 315 U | 275 U |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| 4-Nitrophenol | 390 U | 440 U | 450 U | 410 U | 490 U | 250 U | 290 U | 260 U | 310 U | 270 U |

Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP12 | | | CBD-S04-DP13 | | | CBD-S04-DP14 | | CBD-S04-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS12-000H | CBD-S04-SB12-0810 | CBD-S04-SB12P-0810 | CBD-S04-SS13-000H | CBD-S04-SS13P-000H | CBD-S04-SB13-0810 | CBD-S04-SS14-000H | CBD-S04-SB14-0810 | CBD-S04-SS15-000H | CBD-S04-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Acenaphthene | 1.1 U | 1.1 U | 1.1 U | 1.2 U | 1.2 U | 1.1 U | 0.85 J | 1.2 U | 3.9 J | 1.2 U |
| Acenaphthylene | 1.6 J | 1.1 U | 1.1 U | 1.2 U | 1.2 U | 1.1 U | 1.1 J | 1.2 U | 4.5 J | 1.2 U |
| Acetophenone | 190 U | 220 U | 230 U | 200 U | 250 U | 130 U | 140 U | 130 U | 160 U | 140 U |
| Anthracene | 1.6 J | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 2.9 J | 5 U | 13 | 4.8 U |
| Atrazine | 580 U | 650 U | 680 U | 610 U | 740 U | 380 U | 430 U | 400 U | 470 U | 410 U |
| Benzaldehyde | 580 U | 650 U | 680 U | 610 U | 740 U | 380 U | 430 U | 400 U | 470 U | 410 U |
| Benzo(a)anthracene | 8.2 J | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 19 | 5 U | 150 J | 4.8 U |
| Benzo(a)pyrene | 8 J | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 21 | 5 U | 180 J | 4.8 U |
| Benzo(b)fluoranthene | 15 | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 42 | 7.6 U | 270 J | 7.4 U |
| Benzo(g,h,i)perylene | 5.3 J | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 17 | 7.6 U | 130 J | 7.4 U |
| Benzo(k)fluoranthene | 5.3 J | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 14 | 5 U | 94 J | 4.8 U |
| bis(2-Chloroethoxy)methane | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| bis(2-Chloroethyl)ether | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| bis(2-Ethylhexyl)phthalate | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Butylbenzylphthalate | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Caprolactam | 4,900 U | 5,400 U | 5,600 U | 5,100 U | 6,200 U | 3,100 U | 3,600 U | 3,300 U | 3,900 U | 3,400 U |
| Carbazole | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Chrysene | 11 | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 28 | 5 U | 170 J | 4.8 U |
| Dibenz(a,h)anthracene | 7.2 U | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 3.8 J | 7.6 U | 34 J | 7.4 U |
| Dibenzofuran | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Diethylphthalate | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Dimethyl phthalate | 390 U | 440 U | 450 U | 410 U | 490 U | 250 U | 290 U | 260 U | 310 U | 270 U |
| Di-n-butylphthalate | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Di-n-octylphthalate | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Fluoranthene | 17 | 4.4 U | 4.3 U | 5.1 U | 5 U | 4.5 U | 43 | 5 U | 210 J | 4.8 U |
| Fluorene | 2.9 U | 2.7 U | 2.6 U | 3.1 U | 3.1 U | 2.7 U | 2.8 U | 3.1 U | 3.2 J | 2.9 U |
| Hexachlorobenzene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Hexachlorobutadiene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Hexachlorocyclopentadiene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Hexachloroethane | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Indeno(1,2,3-cd)pyrene | 6.7 J | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 20 | 7.6 U | 160 J | 7.4 U |
| Isophorone | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Naphthalene | 2.2 U | 2 U | 4.2 U | 2.3 U | 2.3 U | 2.1 U | 2.1 U | 2.3 U | 2.3 U | 2.2 U |
| n-Nitroso-di-n-propylamine | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| n-Nitrosodiphenylamine | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Nitrobenzene | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Pentachlorophenol | 388 U | 436 U | 452 U | 408 U | 494 U | 251 U | 288 U | 265 U | 315 U | 275 U |
| Phenanthrene | 6.2 J | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 14 | 7.6 U | 49 J | 7.4 U |
| Phenol | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| Pyrene | 14 | 6.7 U | 6.6 U | 7.8 U | 7.7 U | 6.9 U | 36 | 7.6 U | 190 J | 7.4 U |
| Total cresols | 194 U | 218 U | 226 U | 204 U | 247 U | 126 U | 144 U | 132 U | 157 U | 137 U |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.136 U | 0.346 J | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| 4,4'-DDE | 0.136 U | 0.512 | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.188 J | 0.128 U | 0.138 U | 0.131 U |
| 4,4'-DDT | 0.273 U | 7.53 J | 0.491 UJ | 0.471 U | 0.311 U | 0.249 U | 0.261 U | 0.257 U | 0.275 U | 0.262 U |
| Aldrin | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| alpha-BHC | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| alpha-Chlordane | 0.136 U | 0.283 J | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Aroclor-1016 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1221 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1232 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1242 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1248 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1254 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1260 | 6.8 U | 12 U | 12 U | 12 U | 7.8 UJ | 6.2 U | 6.5 U | 6.4 U | 6.9 U | 6.6 U |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| delta-BHC | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Dieldrin | 0.136 U | 6.29 J | 0.245 UJ | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Endosulfan I | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Endosulfan II | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Endosulfan sulfate | 0.273 U | 0.479 U | 0.491 U | 0.471 U | 0.311 U | 0.249 U | 0.261 U | 0.257 U | 0.275 U | 0.262 U |
| Endrin | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Endrin aldehyde | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Endrin ketone | 0.273 U | 0.479 U | 0.491 U | 0.471 U | 0.311 U | 0.249 U | 0.261 U | 0.257 U | 0.275 U | 0.262 U |
| gamma-BHC (Lindane) | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Heptachlor | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Heptachlor epoxide | 0.136 U | 0.24 U | 0.245 U | 0.236 U | 0.156 U | 0.125 U | 0.13 U | 0.128 U | 0.138 U | 0.131 U |
| Methoxychlor | 0.273 U | 0.479 U | 0.491 U | 0.471 U | 0.311 U | 0.249 U | 0.261 U | 0.257 U | 0.275 U | 0.262 U |
| Toxaphene | 13.6 U | 24 U | 24.5 U | 23.6 U | 15.6 U | 12.5 U | 13 U | 12.8 U | 13.8 U | 13.1 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | 8,500 J- | 3,200 | 3,100 | 7,700 J | 21,000 J | 2,200 J- | 8,100 J- | 2,900 | 6,400 | 2,700 J- |
| Antimony | 0.14 U | 0.23 J | 0.18 J | 0.17 U | 0.17 U | 0.054 J | 0.14 U | 0.078 J | 0.084 J | 0.14 U |
| Arsenic | 5.8 | 3.2 | 2.5 | 1.9 J | 7.7 J | 2.2 | 2.7 J | 2 J | 8.3 | 5.7 |
| Barium | 6.3 | 12 J | 5.7 J | 8.5 J | 13 J | 6.9 | 27 | 5.3 | 14 | 5.7 |
| Beryllium | 0.23 J | 0.74 | 0.33 J | 0.31 J | 0.8 | 0.56 | 0.47 J | 0.86 | 0.29 J | 0.35 J |
| Cadmium | 0.14 U | 0.48 | 0.18 U | 0.17 U | 0.17 U | 0.32 | 0.14 U | 0.14 U | 0.14 U | 0.14 U |
| Calcium | 229 | 31.3 | 19 | 405 J | 893 J | 22.7 | 389 | 40.8 | 314 | 305 |
| Chromium (hexavalent) | 0.11 J | 0.18 J | 0.24 J | NA | NA | NA | 0.11 J | 0.1 J | NA | NA |

# Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP12 | | | CBD-S04-DP13 | | | CBD-S04-DP14 | | CBD-S04-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-SS12-000H | CBD-S04-SB12-0810 | CBD-S04-SB12P-0810 | CBD-S04-SS13-000H | CBD-S04-SS13P-000H | CBD-S04-SB13-0810 | CBD-S04-SS14-000H | CBD-S04-SB14-0810 | CBD-S04-SS15-000H | CBD-S04-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Chromium | 15 | 8.6 | 6.7 | 11 J | 32 J | 7.4 | 11 | 10 | 14 | 11 |
| Cobalt | 0.55 | 13 J | 6.1 J | 0.68 J | 1.2 J | 10 | 2.2 | 2.1 | 0.93 | 0.92 |
| Copper | 3.1 | 3.2 J | 1.9 J | 2.5 J | 6.1 J | 2.4 | 2.9 | 1.7 | 2.8 | 2.2 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 22,000 | 16,000 J | 8,200 J | 12,000 J | 37,000 J | 8,200 | 11,000 | 5,100 | 8,600 | 6,600 |
| Lead | 4.9 | 1.5 J | 0.9 J | 5 J | 9.9 J | 1.3 | 6 | 2.3 | 3.2 | 1.5 |
| Magnesium | 796 | 498 | 476 | 621 J | 1,670 J | 438 | 677 | 542 | 987 | 661 |
| Manganese | 6.4 | 350 J | 64 J | 10 | 8.3 | 140 | 61 | 11 | 14 | 2.3 |
| Mercury | 0.14 U | 0.17 U | 0.18 U | 0.17 U | 0.17 U | 0.13 U | 0.14 U | 0.14 U | 0.14 U | 0.14 U |
| Nickel | 0.99 | 30 J | 11 J | 1.3 J | 2.1 J | 18 | 3.9 | 3.6 | 2.1 | 1.8 |
| Potassium | 693 | 390 | 330 | 560 J | 1,180 J | 291 | 432 | 345 | 444 | 319 |
| Selenium | 1.3 J- | 0.59 J | 0.47 J | 0.48 J- | 1.1 J- | 0.83 J- | 1.2 J | 0.79 J | 1.2 | 0.37 J- |
| Silver | 0.14 U | 0.078 J | 0.18 U | 0.17 U | 0.17 U | 0.13 U | 0.14 U | 0.088 J | 0.081 J | 0.14 U |
| Sodium | 8.5 U | 4.8 U | 4.2 U | 7.2 U | 18.9 J+ | 2.6 U | 10.4 U | 5.5 U | 6.7 U | 4 U |
| Thallium | 0.065 J | 0.17 J | 0.18 U | 0.17 U | 0.099 J | 0.074 J | 0.12 J | 0.14 U | 0.18 J | 0.083 J |
| Vanadium | 19 | 9.9 | 9.7 | 14 J | 32 J | 12 | 15 | 6.7 | 20 | 7.9 |
| Zinc | 25 | 23 J | 12 J | 7.8 J | 20 J | 21 | 17 J | 18 J | 15 | 19 |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S04-DP16 | | CBD-S04-SO06 |
|---|---|---|---|
| **Sample ID** | CBD-S04-SS16-000H | CBD-S04-SB16-0810 | CBD-S04-SS06-1012 |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/18/12 |
| **Chemical Name** | | | |
| | | | |
| **Volatile Organic Compounds (UG/KG)** | | | |
| 1,1,1-Trichloroethane | NA | NA | 0.53 U |
| 1,1,2,2-Tetrachloroethane | NA | NA | 0.53 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | 0.53 U |
| 1,1,2-Trichloroethane | NA | NA | 0.53 U |
| 1,1-Dichloroethane | NA | NA | 0.26 U |
| 1,1-Dichloroethene | NA | NA | 0.53 U |
| 1,2,3-Trichlorobenzene | NA | NA | 0.53 U |
| 1,2,4-Trichlorobenzene | NA | NA | 0.53 U |
| 1,2-Dibromo-3-chloropropane | NA | NA | 0.53 U |
| 1,2-Dibromoethane | NA | NA | 0.53 U |
| 1,2-Dichlorobenzene | NA | NA | 0.53 U |
| 1,2-Dichloroethane | NA | NA | 0.53 U |
| 1,2-Dichloropropane | NA | NA | 0.53 U |
| 1,3-Dichlorobenzene | NA | NA | 0.26 U |
| 1,4-Dichlorobenzene | NA | NA | 0.26 U |
| 2-Butanone | NA | NA | 0.53 UJ |
| 2-Hexanone | NA | NA | 0.53 UJ |
| 4-Methyl-2-pentanone | NA | NA | 0.53 UJ |
| Acetone | NA | NA | 41 J |
| Benzene | NA | NA | 0.53 U |
| Bromochloromethane | NA | NA | 0.53 U |
| Bromodichloromethane | NA | NA | 0.53 U |
| Bromoform | NA | NA | 0.26 U |
| Bromomethane | NA | NA | 0.53 U |
| Carbon disulfide | NA | NA | 0.45 B |
| Carbon tetrachloride | NA | NA | 0.26 U |
| Chlorobenzene | NA | NA | 0.26 U |
| Chloroethane | NA | NA | 0.53 U |
| Chloroform | NA | NA | 0.26 U |
| Chloromethane | NA | NA | 0.53 U |
| cis-1,2-Dichloroethene | NA | NA | 0.26 U |
| cis-1,3-Dichloropropene | NA | NA | 0.26 U |
| Cyclohexane | NA | NA | 0.53 U |
| Dibromochloromethane | NA | NA | 0.53 U |
| Dichlorodifluoromethane (Freon-12) | NA | NA | 0.53 U |
| Ethylbenzene | NA | NA | 0.53 U |
| Isopropylbenzene | NA | NA | 0.26 U |
| m- and p-Xylene | NA | NA | 0.53 U |
| Methyl acetate | NA | NA | 1.6 B |
| Methylcyclohexane | NA | NA | 0.53 U |
| Methylene chloride | NA | NA | 0.53 U |
| Methyl-tert-butyl ether (MTBE) | NA | NA | 0.53 U |
| o-Xylene | NA | NA | 0.26 U |
| Styrene | NA | NA | 0.26 U |
| Tetrachloroethene | NA | NA | 0.53 U |
| Toluene | NA | NA | 0.53 U |
| trans-1,2-Dichloroethene | NA | NA | 0.26 U |
| trans-1,3-Dichloropropene | NA | NA | 0.53 U |
| Trichloroethene | NA | NA | 0.26 U |
| Trichlorofluoromethane (Freon-11) | NA | NA | 0.26 U |
| Vinyl chloride | NA | NA | 0.26 U |
| | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | |
| 1,1-Biphenyl | 420 U | 480 U | 18 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | 1.8 U |
| 2,2'-Oxybis(1-chloropropane) | 141 U | 159 U | 3.5 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | 3.5 U |
| 2,4,5-Trichlorophenol | 141 U | 159 U | 18 U |
| 2,4,6-Trichlorophenol | 141 U | 159 U | 3.5 U |
| 2,4-Dichlorophenol | 141 U | 159 U | 3.5 U |
| 2,4-Dimethylphenol | 141 U | 159 U | 35 U |
| 2,4-Dinitrophenol | 1,410 U | 1,590 U | 180 U |
| 2,4-Dinitrotoluene | 282 U | 319 U | 18 U |
| 2,6-Dinitrotoluene | 141 U | 159 U | 3.5 U |
| 2-Chloronaphthalene | 141 U | 159 U | 3.5 U |
| 2-Chlorophenol | 141 U | 159 U | 3.5 U |
| 2-Methylnaphthalene | 2.3 U | 6.6 U | 1.8 U |
| 2-Methylphenol | 141 U | 159 U | 7 U |
| 2-Nitroaniline | 282 U | 319 U | 18 U |
| 2-Nitrophenol | 141 U | 159 U | 3.5 U |
| 3,3'-Dichlorobenzidine | 141 U | 159 U | 350 U |
| 3-Nitroaniline | 280 U | 320 U | 35 U |
| 4,6-Dinitro-2-methylphenol | 1,410 U | 1,590 U | 18 U |
| 4-Bromophenyl-phenylether | 282 U | 319 U | 1.8 U |
| 4-Chloro-3-methylphenol | 141 U | 159 U | 7 U |
| 4-Chloroaniline | 141 U | 159 U | 18 U |
| 4-Chlorophenyl-phenylether | 282 U | 319 U | 1.8 U |
| 4-Methylphenol | NA | NA | 3.5 U |
| 4-Nitroaniline | 141 U | 159 U | 35 U |
| 4-Nitrophenol | 280 U | 320 U | 35 U |

| **Station ID** | CBD-S04-DP16 | | CBD-S04-SO06 |
|---|---|---|---|
| **Sample ID** | CBD-S04-SS16-000H | CBD-S04-SB16-0810 | CBD-S04-SS06-1012 |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/18/12 |
| **Chemical Name** | | | |
| Acenaphthene | 0.58 J | 56 | 6.1 J |
| Acenaphthylene | 0.56 J | 5 J | 1.8 U |
| Acetophenone | 140 U | 160 U | 18 U |
| Anthracene | 2.4 J | 170 | 15 J |
| Atrazine | 420 U | 480 U | 18 U |
| Benzaldehyde | 420 U | 480 U | 18 R |
| Benzo(a)anthracene | 20 | 490 | 89 |
| Benzo(a)pyrene | 23 | 470 | 73 |
| Benzo(b)fluoranthene | 38 | 620 | 130 |
| Benzo(g,h,i)perylene | 21 | 340 | 48 |
| Benzo(k)fluoranthene | 13 | 230 | 50 |
| bis(2-Chloroethoxy)methane | 141 U | 159 U | 1.8 U |
| bis(2-Chloroethyl)ether | 141 U | 159 U | 1.8 U |
| bis(2-Ethylhexyl)phthalate | 141 U | 159 U | 8.6 B |
| Butylbenzylphthalate | 141 U | 159 U | 3.5 U |
| Caprolactam | 3,500 U | 4,000 U | 18 U |
| Carbazole | 141 U | 159 U | 35 U |
| Chrysene | 25 | 470 | 85 |
| Dibenz(a,h)anthracene | 5.1 J | 89 | 6.9 J |
| Dibenzofuran | 141 U | 159 U | 2.9 J |
| Diethylphthalate | 141 U | 159 U | 5.7 B |
| Dimethyl phthalate | 280 U | 320 U | 3.5 U |
| Di-n-butylphthalate | 141 U | 159 U | 18 U |
| Di-n-octylphthalate | 141 U | 159 U | 1.8 U |
| Fluoranthene | 25 | 850 | 140 |
| Fluorene | 3.1 U | 48 | 3.2 J |
| Hexachlorobenzene | 141 U | 159 U | 1.8 U |
| Hexachlorobutadiene | 141 U | 159 U | 1.8 U |
| Hexachlorocyclopentadiene | 141 U | 159 U | 3.5 U |
| Hexachloroethane | 141 U | 159 U | 1.8 U |
| Indeno(1,2,3-cd)pyrene | 24 | 420 | 43 |
| Isophorone | 141 U | 159 U | 1.8 U |
| Naphthalene | 2.5 U | 19 | 1.1 J |
| n-Nitroso-di-n-propylamine | 141 U | 159 U | 3.5 U |
| n-Nitrosodiphenylamine | 141 U | 159 U | 1.8 U |
| Nitrobenzene | 141 U | 159 U | 1.8 U |
| Pentachlorophenol | 282 U | 319 U | 35 U |
| Phenanthrene | 12 | 630 | 79 |
| Phenol | 141 U | 159 U | 3.5 U |
| Pyrene | 20 | 670 | 130 |
| Total cresols | 141 U | 159 U | NA |
| | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | |
| 4,4'-DDD | 0.13 U | 0.13 U | NA |
| 4,4'-DDE | 0.13 U | 8.31 | NA |
| 4,4'-DDT | 0.26 U | 0.26 U | NA |
| Aldrin | 0.13 U | 0.13 U | NA |
| alpha-BHC | 0.13 U | 0.13 U | NA |
| alpha-Chlordane | 0.13 U | 0.13 U | NA |
| Aroclor-1016 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1221 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1232 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1242 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1248 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1254 | 6.5 U | 6.5 U | 14 U |
| Aroclor-1260 | 6.5 U | 160 | 18 |
| Aroclor-1262 | NA | NA | 14 U |
| Aroclor-1268 | NA | NA | 14 U |
| beta-BHC | 0.13 U | 0.13 U | NA |
| delta-BHC | 0.13 U | 0.13 U | NA |
| Dieldrin | 0.13 U | 0.13 U | NA |
| Endosulfan I | 0.13 U | 0.13 U | NA |
| Endosulfan II | 0.13 U | 0.13 U | NA |
| Endosulfan sulfate | 0.26 U | 0.26 U | NA |
| Endrin | 0.13 U | 0.13 U | NA |
| Endrin aldehyde | 0.13 U | 0.13 U | NA |
| Endrin ketone | 0.26 U | 0.26 U | NA |
| gamma-BHC (Lindane) | 0.13 U | 0.13 U | NA |
| Heptachlor | 0.13 U | 0.13 U | NA |
| Heptachlor epoxide | 0.13 U | 0.13 U | NA |
| Methoxychlor | 0.26 U | 0.26 U | NA |
| Toxaphene | 13 U | 13 U | NA |
| | | | |
| **Total Metals (MG/KG)** | | | |
| Aluminum | 7,100 J- | 8,300 J- | 4,400 |
| Antimony | 0.29 | 0.79 | 1 |
| Arsenic | 3.5 J | 4.1 | 2.6 |
| Barium | 85 | 150 | 36 |
| Beryllium | 0.64 | 0.83 | 0.39 |
| Cadmium | 0.32 | 15 | 0.29 |
| Calcium | 477 | 3,700 | 750 |
| Chromium (hexavalent) | 0.05 J | 0.31 J | NA |

# Appendix D - Site 4 Soil Analytical Data

| **Station ID** | CBD-S04-DP16 | | CBD-S04-SO06 |
|---|---|---|---|
| **Sample ID** | CBD-S04-SS16-000H | CBD-S04-SB16-0810 | CBD-S04-SS06-1012 |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/18/12 |
| **Chemical Name** | | | |
| Chromium | 15 | 33 | 9.4 |
| Cobalt | 2.7 | 18 | 2.1 |
| Copper | 46 | 480 | 14 |
| Cyanide | NA | NA | 0.026 J |
| Iron | 10,000 | 46,000 | 7,600 |
| Lead | 160 | 690 | 53 |
| Magnesium | 670 | 1,420 | 490 |
| Manganese | 84 | 570 | 68 |
| Mercury | 0.18 J | 1.2 | 0.065 |
| Nickel | 11 | 48 | 5.5 |
| Potassium | 474 | 303 | 350 |
| Selenium | 1.1 J+ | 0.79 J- | 0.22 |
| Silver | 1.6 | 0.86 | 0.49 |
| Sodium | 9.8 U | 131 | 9.6 B |
| Thallium | 0.15 J | 0.07 J | 0.13 |
| Vanadium | 16 | 12 | 24 |
| Zinc | 170 J | 2,000 | 96 B |
| | | | |
| **Wet Chemistry** | | | |
| pH (ph) | NA | NA | 6.2 |
| Total organic carbon (TOC) (mg/kg) | NA | NA | 11,000 |

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**Notes:**

▨ Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

# Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP01 | | | | CBD-S05-DP02 | | CBD-S05-DP03 | | CBD-S05-DP04 | | CBD-S05-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS01-1012 | CBD-S05-SS01P-1012 | CBD-S05-SB01-2022 | CBD-S05-SB01P-2022 | CBD-S05-SS02-1012 | CBD-S05-SB02-2022 | CBD-S05-SS03-1012 | CBD-S05-SB03-1820 | CBD-S05-SS04-1012 | CBD-S05-SB04-2022 | CBD-S05-SS05-1012 | CBD-S05-SB05-2022 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/19/12 | 10/19/12 |
| **Chemical Name** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,1,2,2-Tetrachloroethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,1,2-Trichloroethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,1-Dichloroethane | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| 1,1-Dichloroethene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2,3-Trichlorobenzene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2,4-Trichlorobenzene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2-Dibromo-3-chloropropane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2-Dibromoethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2-Dichlorobenzene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2-Dichloroethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,2-Dichloropropane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 1,3-Dichlorobenzene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| 1,4-Dichlorobenzene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| 2-Butanone | 5.4 B | 0.44 U | 0.6 U | 0.52 U | 9.9 B | 0.5 U | 4.4 B | 210 J | 2.9 B | 1.9 B | 4.7 B | 0.52 U |
| 2-Hexanone | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| 4-Methyl-2-pentanone | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Acetone | 98 | 20 | 6 U | 5.2 U | 400 J | 16 | 160 | 430 J | 110 | 19 | 140 | 28 |
| Benzene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.2 J | 0.67 U | 0.52 U |
| Bromochloromethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Bromodichloromethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Bromoform | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Bromomethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Carbon disulfide | 0.38 B | 0.37 B | 0.51 B | 0.35 B | 0.42 B | 0.44 B | 0.7 B | 58 U | 0.41 B | 1.5 B | 0.45 B | 0.38 B |
| Carbon tetrachloride | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Chlorobenzene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Chloroethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Chloroform | 0.14 B | 0.12 B | 0.3 U | 0.18 B | 0.26 U | 0.25 U | 0.19 B | 29 U | 0.27 U | 0.29 B | 0.25 B | 0.26 U |
| Chloromethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 24 B | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| cis-1,2-Dichloroethene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| cis-1,3-Dichloropropene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Cyclohexane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Dibromochloromethane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Dichlorodifluoromethane (Freon-12) | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Ethylbenzene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 310 | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Isopropylbenzene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 2,600 | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| m- and p-Xylene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 390 | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Methyl acetate | 1.7 B | 1 B | 1.9 B | 1 B | NA | 1.6 B | 1.8 B | 1,300 | 2.9 B | 2 J | 31 | 2.4 B |
| Methylcyclohexane | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 160 J | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Methylene chloride | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 1.4 B | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 2.9 B |
| Methyl-tert-butyl ether (MTBE) | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| o-Xylene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 650 | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Styrene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Tetrachloroethene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 58 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Toluene | 0.78 J | 0.31 J | 0.6 U | 0.52 U | 1.3 J | 0.5 U | 0.24 J | 29 U | 0.71 J | 0.75 J | 1.8 J | 0.52 U |
| trans-1,2-Dichloroethene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| trans-1,3-Dichloropropene | 0.47 U | 0.44 U | 0.6 U | 0.52 U | 0.52 U | 0.5 U | 0.61 U | 29 U | 0.54 U | 0.51 U | 0.67 U | 0.52 U |
| Trichloroethene | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| Trichlorofluoromethane (Freon-11) | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 J | 0.25 U | 0.3 U | 58 U | 0.27 U | 0.25 U | 0.33 U | 0.43 J |
| Vinyl chloride | 0.23 U | 0.22 U | 0.3 U | 0.26 U | 0.26 U | 0.25 U | 0.3 U | 29 U | 0.27 U | 0.25 U | 0.33 U | 0.26 U |
| | | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 1,1-Biphenyl | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 45 | 18 U | 20 U | 25 U | 20 U |
| 1,2,4,5-Tetrachlorobenzene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| 2,2'-Oxybis(1-chloropropane) | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2,3,4,6-Tetrachlorophenol | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2,4,5-Trichlorophenol | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| 2,4,6-Trichlorophenol | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2,4-Dichlorophenol | 3.5 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.8 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2,4-Dimethylphenol | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 2,000 U | 39 U | 36 U | 39 U | 49 U | 40 U |
| 2,4-Dinitrophenol | 180 U | 170 U | 200 U | 200 U | 180 U | 200 U | 10,000 U | 190 U | 180 U | 200 U | 250 U | 200 U |
| 2,4-Dinitrotoluene | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| 2,6-Dinitrotoluene | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2-Chloronaphthalene | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2-Chlorophenol | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 2-Methylnaphthalene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 330 J | 720 | 1.8 U | 2 U | 2.5 U | 2 U |
| 2-Methylphenol | 7.1 U | 6.8 U | 7.9 U | 7.8 U | 6.9 U | 7.8 U | 400 U | 7.7 U | 7.2 U | 7.8 U | 9.7 U | 7.9 U |
| 2-Nitroaniline | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| 2-Nitrophenol | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 3,3'-Dichlorobenzidine | 360 U | 340 U | 400 U | 390 U | 350 U | 390 U | 20,000 U | 390 U | 360 U | 390 U | 490 U | 400 U |
| 3-Nitroaniline | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 2,000 U | 39 U | 36 U | 39 U | 49 U | 40 U |
| 4,6-Dinitro-2-methylphenol | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| 4-Bromophenyl-phenylether | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| 4-Chloro-3-methylphenol | 7.1 U | 6.8 U | 7.9 U | 7.8 U | 6.9 U | 7.8 U | 400 U | 7.7 U | 7.2 U | 7.8 U | 9.7 U | 7.9 U |
| 4-Chloroaniline | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| 4-Chlorophenyl-phenylether | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| 4-Methylphenol | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| 4-Nitroaniline | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 2,000 U | 39 U | 36 U | 39 U | 49 U | 40 U |
| 4-Nitrophenol | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 2,000 U | 39 U | 36 U | 39 U | 49 U | 40 U |

Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP01 | | | | CBD-S05-DP02 | | CBD-S05-DP03 | | CBD-S05-DP04 | | CBD-S05-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS01-1012 | CBD-S05-SS01P-1012 | CBD-S05-SB01-2022 | CBD-S05-SB01P-2022 | CBD-S05-SS02-1012 | CBD-S05-SB02-2022 | CBD-S05-SS03-1012 | CBD-S05-SB03-1820 | CBD-S05-SS04-1012 | CBD-S05-SB04-2022 | CBD-S05-SS05-1012 | CBD-S05-SB05-2022 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/19/12 | 10/19/12 |
| **Chemical Name** | | | | | | | | | | | | |
| Acenaphthene | 1.7 J | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 2,600 | 93 | 1.8 U | 2 U | 2.5 U | 2 U |
| Acenaphthylene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Acetophenone | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| Anthracene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 6,400 | 2.4 J | 1.8 U | 2 U | 2.5 U | 2 U |
| Atrazine | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| Benzaldehyde | 18 R | 17 R | 20 R | 20 R | 18 R | 20 R | 1,000 R | 19 R | 18 R | 20 R | 25 R | 20 R |
| Benzo(a)anthracene | 2.8 J | 5.2 J | 2 U | 2 U | 1.8 U | 2 U | 30,000 | 5.6 J | 4.8 J | 2 U | 6.4 J | 2 U |
| Benzo(a)pyrene | 3.6 U | 5.2 J | 4 U | 0.79 U | 3.5 U | 0.79 U | 3,700 | 7.8 U | 18 | 0.79 U | 250 | 0.8 U |
| Benzo(b)fluoranthene | 4.5 J | 6.6 J | 4 U | 3.9 U | 3.5 U | 3.9 U | 32,000 | 10 J | 6.6 J | 3.9 U | 12 J | 4 U |
| Benzo(g,h,i)perylene | 2.4 J | 3.1 J | 2 U | 2 U | 1.8 U | 2 U | 13,000 | 13 J | 2.9 J | 2 U | 5.4 J | 2 U |
| Benzo(k)fluoranthene | 2.4 J | 3.8 J | 4 U | 3.9 U | 3.5 U | 3.9 U | 11,000 | 4 J | 3.3 J | 3.9 U | 6.4 J | 4 U |
| bis(2-Chloroethoxy)methane | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| bis(2-Chloroethyl)ether | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| bis(2-Ethylhexyl)phthalate | 6.6 B | 6.3 B | 5.1 B | 5.9 B | 18 U | 6.3 B | 1,000 U | 10 B | 16 B | 7.6 B | 16 B | 5.6 B |
| Butylbenzylphthalate | 3.6 UJ | 61 J | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| Caprolactam | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| Carbazole | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 3,100 J | 39 U | 36 U | 39 U | 49 U | 40 U |
| Chrysene | 2.8 J | 4.9 J | 2 U | 2 U | 1.8 U | 2 U | 26,000 | 5.2 J | 5.1 J | 2 U | 6.9 J | 2 U |
| Dibenz(a,h)anthracene | 3.6 U | 3.4 U | 4 U | 0.79 U | 3.5 U | 0.79 U | 420 J | 7.8 U | 3.6 U | 0.79 U | 25 | 0.8 U |
| Dibenzofuran | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 1,200 | 59 | 1.8 U | 2 U | 2.5 U | 2 U |
| Diethylphthalate | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| Dimethyl phthalate | 3.6 U | 3.4 U | 2.3 J | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 2.6 J | 3.9 U | 4.9 U | 4 U |
| Di-n-butylphthalate | 18 U | 17 U | 20 U | 20 U | 18 U | 20 U | 1,000 U | 19 U | 18 U | 20 U | 25 U | 20 U |
| Di-n-octylphthalate | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Fluoranthene | 4.2 J | 7.3 J | 2 U | 2 U | 1 J | 2 U | 45,000 | 4.4 J | 6.3 J | 2 U | 6.9 J | 2 U |
| Fluorene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 2,100 | 25 | 1.8 U | 2 U | 2.5 U | 2 U |
| Hexachlorobenzene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Hexachlorobutadiene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Hexachlorocyclopentadiene | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| Hexachloroethane | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Indeno(1,2,3-cd)pyrene | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 13,000 | 6.8 J | 3.6 U | 3.9 U | 4.9 J | 4 U |
| Isophorone | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Naphthalene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 1,500 | 82 | 1.8 U | 2 U | 2.5 U | 2 U |
| n-Nitroso-di-n-propylamine | 3.6 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.9 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| n-Nitrosodiphenylamine | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Nitrobenzene | 1.8 U | 1.7 U | 2 U | 2 U | 1.8 U | 2 U | 100 U | 1.9 U | 1.8 U | 2 U | 2.5 U | 2 U |
| Pentachlorophenol | 36 U | 34 U | 40 U | 39 U | 35 U | 39 U | 2,000 U | 39 U | 36 U | 39 U | 49 U | 40 U |
| Phenanthrene | 2.8 J | 4.5 J | 1.2 J | 2 U | 1.8 U | 2 U | 27,000 | 13 J | 4 J | 2 U | 3.5 J | 2 U |
| Phenol | 3.5 U | 3.4 U | 4 U | 3.9 U | 3.5 U | 3.9 U | 200 U | 3.8 U | 3.6 U | 3.9 U | 4.9 U | 4 U |
| Pyrene | 4.9 J | 7.3 J | 4 U | 3.9 U | 3.5 U | 3.9 U | 48,000 | 13 J | 7.4 J | 3.9 U | 10 J | 4 U |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | | |
| 4,4'-DDD | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDE | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,4'-DDT | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| alpha-Chlordane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1016 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1221 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1232 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1242 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1248 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1254 | 9.1 J | 13 U | 16 U | 15 U | 14 U | 15 U | 46 | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1260 | 14 U | 8.2 J | 16 U | 15 U | 14 U | 15 U | 80 | 15 U | 5.6 J | 15 U | 19 U | 16 U |
| Aroclor-1262 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| Aroclor-1268 | 14 U | 13 U | 16 U | 15 U | 14 U | 15 U | 16 U | 15 U | 14 U | 15 U | 19 U | 16 U |
| beta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| delta-BHC | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dieldrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan I | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan II | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endosulfan sulfate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin aldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Endrin ketone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| gamma-BHC (Lindane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Heptachlor epoxide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methoxychlor | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toxaphene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | | |
| Aluminum | 5,600 J | 4,400 J | 2,500 | 2,300 | 2,700 | 4,400 | 7,400 | 1,800 | 6,300 | 7,000 | 2,300 | 1,800 |
| Antimony | 0.16 | 0.13 B | 0.13 B | 0.16 | 0.09 J | 0.13 | 2.4 | 0.33 | 0.81 | 0.32 | 0.066 J | 0.18 |
| Arsenic | 2.3 | 1.6 | 2.6 | 2.6 | 0.91 | 2.6 | 5.1 | 3.7 | 2.8 | 4.4 | 0.94 | 3.4 |
| Barium | 20 | 16 | 6.7 | 7.1 | 9.7 | 8.7 | 39 | 5.8 | 25 | 9.4 | 6 | 4.3 |
| Beryllium | 0.33 | 0.23 | 2.1 | 1.8 | 0.19 | 2.7 | 0.41 | 2.7 | 0.37 | 3.6 | 0.15 | 2.7 |
| Cadmium | 0.067 | 0.093 | 0.26 | 0.21 | 0.053 | 0.26 | 0.44 | 0.19 | 0.2 | 0.46 | 0.033 J | 0.3 |
| Calcium | 140 J | 460 J | 360 | 300 | 250 | 340 | 2,500 | 410 | 1,100 | 88 | 25 J | 450 |
| Chromium (hexavalent) | 0.17 J | 0.21 U | 0.25 U | 0.27 U | NA | NA | NA | NA | NA | NA | NA | NA |

# Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP01 | | | | CBD-S05-DP02 | | CBD-S05-DP03 | | CBD-S05-DP04 | | CBD-S05-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS01-1012 | CBD-S05-SS01P-1012 | CBD-S05-SB01-2022 | CBD-S05-SB01P-2022 | CBD-S05-SS02-1012 | CBD-S05-SB02-2022 | CBD-S05-SS03-1012 | CBD-S05-SB03-1820 | CBD-S05-SS04-1012 | CBD-S05-SB04-2022 | CBD-S05-SS05-1012 | CBD-S05-SB05-2022 |
| **Sample Date** | 10/18/12 | 10/18/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/18/12 | 10/18/12 | 10/19/12 | 10/19/12 | 10/19/12 | 10/19/12 |
| **Chemical Name** | | | | | | | | | | | | |
| Chromium | 9.9 | 6.2 | 8.4 | 8.2 | 4.8 | 9 | 18 | 7.6 | 17 | 7.4 | 4.8 | 8.2 |
| Cobalt | 2.1 | 1.1 | 2.9 | 2.6 | 0.83 | 3.9 | 2.1 | 9.8 | 1.7 | 110 | 0.7 | 5.4 |
| Copper | 5 | 5 | 1.1 | 1.2 | 1.9 | 1.3 | 230 | 5.6 | 17 | 1.5 | 2 | 1 |
| Cyanide | 0.054 U | 0.036 J | 0.06 U | 0.059 U | 0.036 J | 0.059 U | 0.065 J | 0.058 U | 0.032 J | 0.059 U | 0.034 J | 0.06 U |
| Iron | 8,000 J | 6,100 J | 3,800 | 3,400 | 3,200 | 4,500 | 14,000 | 4,300 | 10,000 B | 5,100 | 2,600 | 4,300 |
| Lead | 8.7 | 8 | 2.1 | 2 | 4.1 | 1.8 | 140 | 3.4 | 25 | 1.6 | 4.2 | 1.7 |
| Magnesium | 550 | 450 | 740 | 660 | 330 | 860 | 1,300 | 630 | 1,000 | 560 | 220 | 660 |
| Manganese | 39 | 42 | 13 J | 8.5 J | 26 | 12 | 65 | 46 | 47 | 290 | 13 | 21 |
| Mercury | 0.017 U | 0.011 J | 0.017 U | 0.016 U | 0.0066 J | 0.016 U | 0.11 | 0.017 U | 0.059 | 0.017 U | 0.017 U | 0.017 U |
| Nickel | 3.5 | 3 | 4.8 | 4.4 | 1.8 | 11 | 10 | 13 | 4.6 | 32 | 1.4 | 20 |
| Potassium | 430 | 370 | 480 | 420 | 250 | 530 | 1,000 | 410 | 760 | 380 | 220 | 450 |
| Selenium | 0.26 | 0.16 B | 0.3 | 0.4 | 0.17 | 0.53 | 0.38 | 0.26 | 0.33 | 0.86 | 0.1 | 0.071 J |
| Silver | 0.052 | 0.15 | 0.027 J | 0.028 J | 0.17 | 0.028 J | 0.3 | 0.29 | 0.49 | 0.024 J | 0.076 | 0.023 J |
| Sodium | 11 B | 9 B | 31 J | 26 J | 9.4 B | 55 B | 28 B | 12 B | 22 J | 44 B | 16 B | 14 B |
| Thallium | 0.11 | 0.076 | 0.21 | 0.19 | 0.052 | 0.18 | 0.13 | 0.15 | 0.12 | 0.31 | 0.045 J | 0.14 |
| Vanadium | 15 | 9.2 | 4.6 | 5 | 6.3 | 7.8 | 40 | 4.8 | 18 | 11 | 6.5 | 4.6 |
| Zinc | 19 B | 18 B | 68 | 78 | 12 B | 80 B | 200 B | 110 B | 52 B | 130 B | 5.9 | 57 B |
| | | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | | |
| pH (ph) | 5.5 | NA | NA | NA | 5.7 | NA | 6.2 | NA | 5.6 | NA | 4.9 | NA |
| Total organic carbon (TOC) (mg/kg) | 2,700 | NA | NA | NA | 5,300 | NA | 14,000 | NA | 7,200 | NA | 5,000 | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP07 | | CBD-S05-DP08 | | CBD-S05-DP09 | | CBD-S05-DP10 | | CBD-S05-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS07-000H | CBD-S05-SB07-0810 | CBD-S05-SS08-000H | CBD-S05-SB08-0810 | CBD-S05-SS09-000H | CBD-S05-SB09-0810 | CBD-S05-SS10-000H | CBD-S05-SB10-0810 | CBD-S05-SS11-000H | CBD-S05-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1-Biphenyl | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

## Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP07 | | CBD-S05-DP08 | | CBD-S05-DP09 | | CBD-S05-DP10 | | CBD-S05-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS07-000H | CBD-S05-SB07-0810 | CBD-S05-SS08-000H | CBD-S05-SB08-0810 | CBD-S05-SS09-000H | CBD-S05-SB09-0810 | CBD-S05-SS10-000H | CBD-S05-SB10-0810 | CBD-S05-SS11-000H | CBD-S05-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetophenone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Atrazine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzaldehyde | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Caprolactam | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 5.15 J- | 0.252 UJ | 4.16 J- | 0.234 U | 0.221 UJ | 0.136 U |
| 4,4'-DDE | 0.431 J- | 0.221 U | 0.121 U | 0.215 U | 150 | 0.252 UJ | 153 | 0.234 U | 7.18 J- | 0.136 U |
| 4,4'-DDT | 0.351 UJ | 0.442 U | 0.241 U | 0.43 U | 152 | 0.504 UJ | 181 | 0.469 U | 0.443 UJ | 0.273 U |
| Aldrin | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| alpha-BHC | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| alpha-Chlordane | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.27 J | 0.234 U | 0.221 UJ | 0.136 U |
| Aroclor-1016 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1221 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1232 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1242 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1248 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1254 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1260 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| delta-BHC | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Dieldrin | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Endosulfan I | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Endosulfan II | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Endosulfan sulfate | 0.351 UJ | 0.442 U | 0.241 U | 0.43 U | 0.428 UJ | 0.504 UJ | 0.557 UJ | 0.469 U | 0.443 UJ | 0.273 U |
| Endrin | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Endrin aldehyde | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Endrin ketone | 0.351 UJ | 0.442 U | 0.241 U | 0.43 U | 0.428 UJ | 0.504 UJ | 0.557 UJ | 0.469 U | 0.443 UJ | 0.273 U |
| gamma-BHC (Lindane) | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Heptachlor | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Heptachlor epoxide | 0.176 UJ | 0.221 U | 0.121 U | 0.215 U | 0.214 UJ | 0.252 UJ | 0.279 UJ | 0.234 U | 0.221 UJ | 0.136 U |
| Methoxychlor | 0.351 UJ | 0.442 U | 0.241 U | 0.43 U | 0.428 UJ | 0.504 UJ | 0.557 UJ | 0.469 U | 0.443 UJ | 0.273 U |
| Toxaphene | 17.6 UJ | 22.1 U | 12.1 U | 21.5 U | 21.4 UJ | 25.2 UJ | 27.9 UJ | 23.4 U | 22.1 UJ | 13.6 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

## Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP07 | | CBD-S05-DP08 | | CBD-S05-DP09 | | CBD-S05-DP10 | | CBD-S05-DP11 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS07-000H | CBD-S05-SB07-0810 | CBD-S05-SS08-000H | CBD-S05-SB08-0810 | CBD-S05-SS09-000H | CBD-S05-SB09-0810 | CBD-S05-SS10-000H | CBD-S05-SB10-0810 | CBD-S05-SS11-000H | CBD-S05-SB11-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S05-DP12 | | | CBD-S05-DP13 | | | CBD-S05-DP14 | | CBD-S05-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS12-000H | CBD-S05-SB12-0810 | CBD-S05-SB12P-0810 | CBD-S05-SS13-000H | CBD-S05-SS13P-000H | CBD-S05-SB13-0810 | CBD-S05-SS14-000H | CBD-S05-SB14-0810 | CBD-S05-SS15-000H | CBD-S05-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1-Biphenyl | 700 U | 800 U | 720 U | 480 U | 490 U | 690 U | 650 U | 670 UJ | 380 U | 650 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2,4,6-Trichlorophenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2,4-Dichlorophenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2,4-Dimethylphenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2,4-Dinitrophenol | 2,330 U | 2,660 U | 2,400 U | 1,610 U | 1,640 U | 2,310 U | 2,160 U | 2,230 UJ | 1,270 U | 2,170 U |
| 2,4-Dinitrotoluene | 467 U | 531 U | 481 U | 322 U | 327 U | 461 U | 432 U | 446 UJ | 254 U | 434 U |
| 2,6-Dinitrotoluene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 2-Chloronaphthalene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 2-Chlorophenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2-Methylnaphthalene | 2.4 U | 2.6 U | 2.7 U | 2.3 U | 2.4 U | 2.4 U | 2.1 U | 2.2 U | 59 J- | 2.4 U |
| 2-Methylphenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 2-Nitroaniline | 467 U | 531 U | 481 U | 322 U | 327 U | 461 U | 432 U | 446 UJ | 254 U | 434 U |
| 2-Nitrophenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 3,3'-Dichlorobenzidine | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 3-Nitroaniline | 470 U | 530 U | 480 U | 320 U | 330 U | 460 U | 430 U | 450 UJ | 250 U | 430 U |
| 4,6-Dinitro-2-methylphenol | 2,330 U | 2,660 U | 2,400 U | 1,610 U | 1,640 U | 2,310 U | 2,160 U | 2,230 U | 1,270 U | 2,170 U |
| 4-Bromophenyl-phenylether | 467 U | 531 U | 481 U | 322 U | 327 U | 461 U | 432 U | 446 UJ | 254 U | 434 U |
| 4-Chloro-3-methylphenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| 4-Chloroaniline | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 4-Chlorophenyl-phenylether | 467 U | 531 U | 481 U | 322 U | 327 U | 461 U | 432 U | 446 UJ | 254 U | 434 U |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| 4-Nitrophenol | 470 U | 530 U | 480 U | 320 U | 330 U | 460 U | 430 U | 450 U | 250 U | 430 U |

# Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP12 | | | CBD-S05-DP13 | | | CBD-S05-DP15 | | CBD-S05-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS12-000H | CBD-S05-SB12-0810 | CBD-S05-SB12P-0810 | CBD-S05-SS13-000H | CBD-S05-SS13P-000H | CBD-S05-SB13-0810 | CBD-S05-SS14-000H | CBD-S05-SB14-0810 | CBD-S05-SS15-000H | CBD-S05-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Acenaphthene | 15 | 1.4 U | 1.4 U | 1.2 U | 1.3 U | 1.3 U | 1.1 U | 1.2 U | 190 J- | 1.3 U |
| Acenaphthylene | 2.7 J | 1.4 U | 1.4 U | 1.6 J | 1.3 U | 1.3 U | 1.1 U | 1.2 U | 15 J | 1.3 U |
| Acetophenone | 230 U | 270 U | 240 U | 160 U | 160 U | 230 U | 220 U | 220 UJ | 130 U | 220 U |
| Anthracene | 39 | 5.6 U | 5.8 U | 5 U | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 600 J | 5.2 U |
| Atrazine | 700 U | 800 U | 720 U | 480 U | 490 U | 690 U | 650 U | 670 UJ | 380 U | 650 U |
| Benzaldehyde | 700 U | 800 U | 720 U | 480 U | 490 U | 690 U | 650 U | 670 UJ | 380 U | 650 U |
| Benzo(a)anthracene | 340 | 5.6 U | 5.8 U | 9.4 J | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 1,600 | 2.1 J |
| Benzo(a)pyrene | 330 | 5.6 U | 5.8 U | 10 J | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 1,600 | 5.2 U |
| Benzo(b)fluoranthene | 450 | 8.6 U | 8.9 U | 21 | 8 U | 8.1 U | 7 U | 7.3 U | 2,300 | 4.5 J |
| Benzo(g,h,i)perylene | 230 | 8.6 U | 8.9 U | 8.6 J | 8 U | 8.1 U | 7 U | 7.3 U | 890 | 2.8 J |
| Benzo(k)fluoranthene | 160 | 5.6 U | 5.8 U | 6.5 J | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 800 J | 3.6 J |
| bis(2-Chloroethoxy)methane | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| bis(2-Chloroethyl)ether | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| bis(2-Ethylhexyl)phthalate | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Butylbenzylphthalate | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Caprolactam | 5,800 U | 6,600 U | 6,000 U | 4,000 U | 4,100 U | 5,800 U | 5,400 U | 5,600 UJ | 3,200 U | 5,400 U |
| Carbazole | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Chrysene | 320 | 5.6 U | 5.8 U | 13 | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 1,700 | 3.4 J |
| Dibenz(a,h)anthracene | 56 | 8.6 U | 8.9 U | 7.7 U | 8 U | 8.1 U | 7 U | 7.3 U | 270 J- | 3.4 J |
| Dibenzofuran | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Diethylphthalate | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Dimethyl phthalate | 470 U | 530 U | 480 U | 320 U | 330 U | 460 U | 430 U | 450 UJ | 250 U | 430 U |
| Di-n-butylphthalate | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Di-n-octylphthalate | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Fluoranthene | 430 | 5.6 U | 5.8 U | 15 | 5.2 U | 5.3 U | 4.6 U | 4.8 U | 3,300 | 4.2 J |
| Fluorene | 9.9 J | 3.4 U | 3.6 U | 3.1 U | 3.2 U | 3.2 U | 2.8 U | 2.9 U | 250 J- | 1.1 J |
| Hexachlorobenzene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Hexachlorobutadiene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Hexachlorocyclopentadiene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Hexachloroethane | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Indeno(1,2,3-cd)pyrene | 260 | 8.6 U | 8.9 U | 10 J | 8 U | 8.1 U | 7 U | 7.3 U | 1,300 | 3.7 J |
| Isophorone | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Naphthalene | 2.4 U | 2.6 U | 2.7 U | 2.3 U | 2.4 U | 2.4 U | 2.1 U | 2.2 U | 150 J- | 0.89 J |
| n-Nitroso-di-n-propylamine | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| n-Nitrosodiphenylamine | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Nitrobenzene | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 UJ | 127 U | 217 U |
| Pentachlorophenol | 467 U | 531 U | 481 U | 322 U | 327 U | 461 U | 432 U | 446 U | 254 U | 434 U |
| Phenanthrene | 150 | 8.6 U | 8.9 U | 5.2 J | 8 U | 8.1 U | 7 U | 7.3 U | 2,600 | 8.4 J |
| Phenol | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| Pyrene | 390 | 8.6 U | 8.9 U | 13 | 8 U | 8.1 U | 7 U | 7.3 U | 2,600 | 7.9 U |
| Total cresols | 233 U | 266 U | 240 U | 161 U | 164 U | 231 U | 216 U | 223 U | 127 U | 217 U |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| 4,4'-DDD | 0.691 | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| 4,4'-DDE | 0.154 U | 0.272 U | 0.26 U | 1.12 J | 2.72 J | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| 4,4'-DDT | 0.308 U | 0.543 U | 0.519 U | 0.281 UJ | 1.47 J | 0.487 U | 0.409 U | 0.474 U | 0.246 U | 0.447 U |
| Aldrin | 0.154 U | 0.876 J | 0.26 UJ | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| alpha-BHC | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| alpha-Chlordane | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Aroclor-1016 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1221 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1232 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1242 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1248 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1254 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1260 | 7.7 UJ | 14 U | 13 U | 7 U | 6.8 U | 12 U | 10 U | 12 U | 6.2 U | 11 U |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| delta-BHC | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Dieldrin | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Endosulfan I | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Endosulfan II | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.268 J |
| Endosulfan sulfate | 0.308 U | 0.543 U | 0.519 U | 0.281 U | 0.273 U | 0.487 U | 0.409 U | 0.474 U | 0.246 U | 0.447 U |
| Endrin | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Endrin aldehyde | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Endrin ketone | 0.308 U | 0.543 U | 0.519 U | 0.281 U | 0.273 U | 0.487 U | 0.409 U | 0.474 U | 0.246 U | 0.447 U |
| gamma-BHC (Lindane) | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Heptachlor | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Heptachlor epoxide | 0.154 U | 0.272 U | 0.26 U | 0.14 U | 0.137 U | 0.243 U | 0.204 U | 0.237 U | 0.123 U | 0.224 U |
| Methoxychlor | 0.308 U | 0.543 U | 0.519 U | 0.281 U | 0.273 U | 0.487 U | 0.409 U | 0.474 U | 0.246 U | 0.447 U |
| Toxaphene | 15.4 U | 27.2 U | 26 U | 14 U | 13.7 U | 24.3 U | 20.4 U | 23.7 U | 12.3 U | 22.4 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | 9,200 | 12,000 | 13,000 | 8,700 | 9,000 | 14,000 | 3,300 | 11,000 | 4,300 | 15,000 |
| Antimony | 0.18 U | 0.16 U | 0.17 U | 0.16 U | 0.16 U | 0.17 U | 0.14 U | 0.16 U | 0.056 J | 0.15 U |
| Arsenic | 3.9 | 5 J | 9.7 J | 5.2 | 6 | 5.8 | 0.99 | 6.4 | 1.3 | 6.3 |
| Barium | 32 | 13 | 12 | 12 | 13 | 9.4 | 8.5 | 49 | 15 | 19 |
| Beryllium | 0.63 J | 0.21 J | 0.26 J | 0.27 J | 0.24 J | 0.29 J | 0.21 J | 0.37 J | 0.4 J | 0.44 J |
| Cadmium | 0.24 J | 0.16 U | 0.17 U | 0.16 U | 0.1 J | 0.17 U | 0.14 U | 0.16 U | 0.14 U | 0.15 U |
| Calcium | 3,280 | 47.1 | 44.6 | 577 | 714 | 115 | 94 | 237 | 48.2 | 45.8 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

# Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP12 | | | CBD-S05-DP13 | | | CBD-S05-DP14 | | CBD-S05-DP15 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS12-000H | CBD-S05-SB12-0810 | CBD-S05-SB12P-0810 | CBD-S05-SS13-000H | CBD-S05-SS13P-000H | CBD-S05-SB13-0810 | CBD-S05-SS14-000H | CBD-S05-SB14-0810 | CBD-S05-SS15-000H | CBD-S05-SB15-0810 |
| **Sample Date** | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 | 04/05/18 |
| **Chemical Name** | | | | | | | | | | |
| Chromium | 21 | 23 | 30 | 18 | 15 | 26 | 4.4 | 16 | 5 | 24 |
| Cobalt | 3.2 | 0.6 | 0.77 | 1.3 J | 0.95 J | 1.1 | 1.4 | 1.5 | 1.6 | 1.6 |
| Copper | 6.4 | 6.5 | 8.5 | 9.9 | 12 | 6.3 | 1.7 | 3 | 2.1 | 6.7 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 18,000 | 15,000 J | 29,000 J | 16,000 | 13,000 | 30,000 | 4,000 | 12,000 | 3,800 | 22,000 |
| Lead | 10 | 9.8 | 11 | 7.1 | 8.4 | 7.3 | 2.9 | 8.3 | 3.3 | 9.1 |
| Magnesium | 1,540 | 1,070 | 1,210 | 1,200 | 1,020 | 1,600 | 238 | 2,100 | 329 | 1,920 |
| Manganese | 80 | 5 | 4.4 | 20 J | 6.2 J | 6 | 32 | 10 | 51 | 14 |
| Mercury | 0.18 U | 0.16 U | 0.17 U | 0.16 U | 0.28 J | 0.17 U | 0.14 U | 0.16 U | 0.14 U | 0.15 U |
| Nickel | 8.1 | 1.1 | 1.2 | 3.3 | 3.2 | 1.7 | 1.9 | 2.8 | 3.3 | 2.7 |
| Potassium | 902 | 791 | 839 | 923 | 793 | 1,040 | 180 | 1,370 | 255 | 965 |
| Selenium | 0.97 | 0.65 | 0.97 | 0.98 | 1.5 | 1.1 | 0.28 U | 1.3 | 0.71 | 0.99 |
| Silver | 0.15 J | 0.16 U | 0.17 U | 0.13 J | 0.35 | 0.17 U | 0.081 J | 0.069 J | 0.11 J | 0.15 U |
| Sodium | 16.3 J+ | 31.1 J+ | 31 J+ | 12.5 U | 12 U | 14.5 J+ | 4.7 U | 38.4 J+ | 5 U | 43.6 J+ |
| Thallium | 0.18 J | 0.092 J | 0.092 J | 0.16 J | 0.12 J | 0.14 J | 0.14 U | 0.19 J | 0.077 J | 0.17 J |
| Vanadium | 19 | 15 J | 23 J | 15 | 14 | 24 | 6 | 14 | 6.5 | 17 |
| Zinc | 45 | 6.7 J | 10 J | 33 | 26 | 16 | 7.3 | 21 | 11 | 17 |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

▨ Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP16 | | CBD-S05-SO06 | CBD-S05-SS17 | CBD-S05-SS18 | | CBD-S05-SS19 | CBD-S05-SS20 | CBD-S05-SS21 | CBD-S05-SS22 | CBD-S05-SS23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS16-000H | CBD-S05-SB16-0810 | CBD-S05-SS06-1012 | CBD-S05-SS17-000H | CBD-S05-SS18-000H | CBD-S05-SS18P-000H | CBD-S05-SS19-000H | CBD-S05-SS20-000H | CBD-S05-SS21-000H | CBD-S05-SS22-000H | CBD-S05-SS23-000H |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/19/12 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | 6.9 B | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | 160 | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | 0.32 J | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | 0.59 B | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | 2.8 B | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | 0.46 J | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | 0.64 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | 0.32 U | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1-Biphenyl | 710 U | 620 U | 21 U | 920 UJ | 520 UJ | 580 UJ | 490 UJ | 580 UJ | 640 U | 650 U | 560 U |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | 2.1 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 2,3,4,6-Tetrachlorophenol | NA | NA | 4.3 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 237 U | 206 U | 21 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2,4,6-Trichlorophenol | 237 U | 206 U | 4.3 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2,4-Dichlorophenol | 237 U | 206 U | 4.2 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2,4-Dimethylphenol | 237 U | 206 U | 43 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2,4-Dinitrophenol | 2,370 U | 2,060 U | 210 U | 3,080 U | 1,720 U | 1,950 U | 1,620 U | 1,940 U | 2,130 U | 2,160 U | 1,870 U |
| 2,4-Dinitrotoluene | 474 U | 412 U | 21 U | 615 UJ | 343 UJ | 389 UJ | 324 UJ | 388 UJ | 425 U | 433 U | 374 U |
| 2,6-Dinitrotoluene | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 2-Chloronaphthalene | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 2-Chlorophenol | 237 U | 206 U | 4.3 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2-Methylnaphthalene | 2.4 U | 7.9 U | 13 J | 2.9 U | 2.5 U | 2.3 U | 2.2 U | 2.9 U | 14 U | 2.9 U | 2.4 U |
| 2-Methylphenol | 237 U | 206 U | 8.5 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 2-Nitroaniline | 474 U | 412 U | 21 U | 615 UJ | 343 UJ | 389 UJ | 324 UJ | 388 UJ | 425 U | 433 U | 374 U |
| 2-Nitrophenol | 237 U | 206 U | 4.3 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 3,3'-Dichlorobenzidine | 237 U | 206 U | 430 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 3-Nitroaniline | 470 U | 410 U | 43 U | 620 UJ | 340 UJ | 390 UJ | 320 UJ | 390 UJ | 430 U | 430 U | 370 U |
| 4,6-Dinitro-2-methylphenol | 2,370 U | 2,060 U | 21 U | 3,080 U | 1,720 U | 1,950 U | 1,620 U | 1,940 U | 2,130 U | 2,160 U | 1,870 U |
| 4-Bromophenyl-phenylether | 474 U | 412 U | 2.1 U | 615 UJ | 343 UJ | 389 UJ | 324 UJ | 388 UJ | 425 U | 433 U | 374 U |
| 4-Chloro-3-methylphenol | 237 U | 206 U | 8.5 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| 4-Chloroaniline | 237 U | 206 U | 21 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 4-Chlorophenyl-phenylether | 474 U | 412 U | 2.1 U | 615 UJ | 343 UJ | 389 UJ | 324 UJ | 388 UJ | 425 U | 433 U | 374 U |
| 4-Methylphenol | NA | NA | 4.3 U | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | 237 U | 206 U | 43 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| 4-Nitrophenol | 470 U | 410 U | 43 U | 620 UJ | 340 UJ | 390 U | 320 U | 390 U | 430 U | 430 U | 370 U |

Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP16 | | CBD-S05-SO06 | CBD-S05-SS17 | CBD-S05-SS18 | | CBD-S05-SS19 | CBD-S05-SS20 | CBD-S05-SS21 | CBD-S05-SS22 | CBD-S05-SS23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS16-000H | CBD-S05-SB16-0810 | CBD-S05-SS06-1012 | CBD-S05-SS17-000H | CBD-S05-SS18-000H | CBD-S05-SS18P-000H | CBD-S05-SS19-000H | CBD-S05-SS20-000H | CBD-S05-SS21-000H | CBD-S05-SS22-000H | CBD-S05-SS23-000H |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/19/12 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 |
| **Chemical Name** | | | | | | | | | | | |
| Acenaphthene | 15 | 1.2 U | 70 | 1.5 U | 4 J | 1.2 U | 0.95 J | 1.8 J | 37 | 6.6 J | 8.3 J |
| Acenaphthylene | 0.83 J | 1.2 U | 1.3 J | 1.5 U | 4 J | 2.2 J | 2 J | 2.3 J | 14 J | 1.8 J | 1.7 J |
| Acetophenone | 240 U | 210 U | 21 U | 310 UJ | 170 UJ | 190 UJ | 160 UJ | 190 UJ | 210 U | 220 U | 190 U |
| Anthracene | 31 | 5 U | 120 | 11 J | 3.7 J | 3.3 J | 3.2 J | 9.5 J | 100 | 21 | 14 |
| Atrazine | 710 U | 620 U | 21 U | 920 UJ | 520 UJ | 580 UJ | 490 UJ | 580 UJ | 640 U | 650 U | 560 U |
| Benzaldehyde | 710 U | 620 U | 21 R | 920 UJ | 520 UJ | 580 UJ | 490 UJ | 580 UJ | 640 U | 650 U | 560 U |
| Benzo(a)anthracene | 81 | 5 U | 290 | 26 | 14 | 12 | 20 | 92 | 560 | 160 | 89 |
| Benzo(a)pyrene | 74 | 5 U | 200 | 18 | 20 | 17 | 26 | 94 | 630 | 200 | 99 |
| Benzo(b)fluoranthene | 97 | 7.7 U | 370 | 50 | 44 | 37 | 43 | 140 | 870 | 280 | 140 |
| Benzo(g,h,i)perylene | 46 | 7.7 U | 110 | 17 | 20 | 16 | 22 | 69 | 490 | 150 | 70 |
| Benzo(k)fluoranthene | 35 | 5 U | 150 | 16 | 12 U | 10 U | 14 | 45 | 290 | 89 | 50 |
| bis(2-Chloroethoxy)methane | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| bis(2-Chloroethyl)ether | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| bis(2-Ethylhexyl)phthalate | 237 U | 206 U | 26 B | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Butylbenzylphthalate | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Caprolactam | 5,900 U | 5,100 U | 21 U | 7,700 UJ | 4,300 UJ | 4,900 UJ | 4,100 UJ | 4,900 UJ | 5,300 U | 5,400 U | 4,700 U |
| Carbazole | 237 U | 206 U | 64 J | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Chrysene | 77 | 5 U | 260 | 35 | 22 | 19 | 24 | 93 | 550 | 170 | 98 |
| Dibenz(a,h)anthracene | 13 | 7.7 U | 26 | 4.8 J | 4.6 J | 3.5 J | 4.9 J | 19 | 130 | 39 | 20 |
| Dibenzofuran | 237 U | 206 U | 39 | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Diethylphthalate | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Dimethyl phthalate | 470 U | 410 U | 4.3 U | 620 UJ | 340 UJ | 390 UJ | 320 UJ | 390 UJ | 430 U | 430 U | 370 U |
| Di-n-butylphthalate | 237 U | 206 U | 21 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 129 J | 216 U | 187 U |
| Di-n-octylphthalate | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Fluoranthene | 150 | 5 U | 430 | 38 | 20 | 19 | 31 | 110 | 790 | 210 | 150 |
| Fluorene | 12 | 3.1 U | 60 | 12 J | 5.1 J | 3.3 J | 1.7 J | 5.1 J | 46 | 15 | 9.7 J |
| Hexachlorobenzene | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Hexachlorobutadiene | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Hexachlorocyclopentadiene | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Hexachloroethane | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Indeno(1,2,3-cd)pyrene | 59 | 7.7 U | 110 | 22 | 23 | 19 | 26 | 86 | 600 | 170 | 87 |
| Isophorone | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Naphthalene | 4.3 U | 2.3 U | 27 | 2.9 U | 2.5 U | 2.3 U | 2.2 U | 2.9 U | 21 | 3.8 U | 2.4 U |
| n-Nitroso-di-n-propylamine | 237 U | 206 U | 4.3 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| n-Nitrosodiphenylamine | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Nitrobenzene | 237 U | 206 U | 2.1 U | 308 UJ | 172 UJ | 195 UJ | 162 UJ | 194 UJ | 213 U | 216 U | 187 U |
| Pentachlorophenol | 474 U | 412 U | 43 U | 615 U | 343 U | 389 U | 324 U | 388 U | 425 U | 433 U | 374 U |
| Phenanthrene | 130 | 7.7 U | 510 | 13 J | 9.9 J | 8 J | 12 | 32 | 390 | 89 | 86 |
| Phenol | 237 U | 206 U | 4.2 U | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| Pyrene | 120 | 7.7 U | 550 | 29 | 19 | 18 | 27 | 98 | 680 | 190 | 130 |
| Total cresols | 237 U | 206 U | NA | 308 U | 172 U | 195 U | 162 U | 194 U | 213 U | 216 U | 187 U |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| 4,4'-DDD | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 1.19 |
| 4,4'-DDE | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 21.1 | 0.176 U | 6.19 |
| 4,4'-DDT | 0.488 U | 0.297 U | NA | 0.928 UJ | 0.316 U | 0.35 UJ | 0.303 U | 0.345 U | 0.384 U | 0.353 U | 14.1 |
| Aldrin | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| alpha-BHC | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| alpha-Chlordane | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.616 |
| Aroclor-1016 | 12 U | 7.4 U | 17 U | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1221 | 12 U | 7.4 U | 17 U | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1232 | 12 U | 7.4 U | 17 U | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1242 | 12 U | 7.4 U | 17 U | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1248 | 12 U | 7.4 U | 17 U | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1254 | 12 U | 7.4 U | 32 | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1260 | 12 U | 7.4 U | 37 | 23 UJ | 7.9 UJ | 8.8 UJ | 7.6 U | 8.6 UJ | 9.6 U | 8.8 UJ | 8.5 UJ |
| Aroclor-1262 | NA | NA | 17 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | 17 U | NA | NA | NA | NA | NA | NA | NA | NA |
| beta-BHC | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| delta-BHC | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Dieldrin | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Endosulfan I | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Endosulfan II | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Endosulfan sulfate | 0.488 U | 0.297 U | NA | 0.928 UJ | 0.316 U | 0.35 UJ | 0.303 U | 0.345 U | 0.384 U | 0.353 U | 0.341 U |
| Endrin | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Endrin aldehyde | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Endrin ketone | 0.488 U | 0.297 U | NA | 0.928 UJ | 0.316 U | 0.35 UJ | 0.303 U | 0.345 U | 0.384 U | 0.353 U | 0.341 U |
| gamma-BHC (Lindane) | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Heptachlor | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Heptachlor epoxide | 0.244 U | 0.148 U | NA | 0.464 UJ | 0.158 U | 0.175 UJ | 0.151 U | 0.172 U | 0.192 U | 0.176 U | 0.17 U |
| Methoxychlor | 0.488 U | 0.297 U | NA | 0.928 UJ | 0.316 U | 0.35 UJ | 0.303 U | 0.345 U | 0.384 U | 0.353 U | 0.341 U |
| Toxaphene | 24.4 U | 14.8 U | NA | 46.4 UJ | 15.8 U | 17.5 UJ | 15.1 U | 17.2 U | 19.2 U | 17.6 U | 17 U |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 14,000 | 9,100 | 6,700 | 8,400 | 15,000 J | 7,000 J | 4,300 | 6,200 | 7,000 | 4,300 | 13,000 |
| Antimony | 0.17 U | 0.15 U | 2 | 0.22 J | 0.13 J | 0.14 J | 0.16 U | 0.2 U | 0.74 | 0.22 J | 0.18 U |
| Arsenic | 4.9 | 13 | 3.6 | 5.3 | 4.3 | 3.3 | 1.7 | 3.5 | 5.7 | 2.4 | 5.7 |
| Barium | 28 | 8.3 | 26 | 56 | 35 | 28 | 14 | 34 | 76 | 28 | 31 |
| Beryllium | 0.37 J | 0.25 J | 1.4 | 0.54 J | 0.37 J | 0.28 J | 0.32 U | 0.55 J | 0.36 J | 0.25 J | 0.42 J |
| Cadmium | 0.17 U | 0.15 U | 0.39 | 0.51 J | 0.26 J | 0.26 J | 0.18 J | 0.66 | 1.2 | 0.37 J | 0.13 J |
| Calcium | 2,310 | 302 | 1,300 | 4,490 | 1,460 | 1,520 | 580 | 2,640 | 6,300 | 2,680 | 1,020 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

# Appendix D - Site 5 Soil Analytical Data

| **Station ID** | CBD-S05-DP16 | | CBD-S05-SO06 | CBD-S05-SS17 | CBD-S05-SS18 | | CBD-S05-SS19 | CBD-S05-SS20 | CBD-S05-SS21 | CBD-S05-SS22 | CBD-S05-SS23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S05-SS16-000H | CBD-S05-SB16-0810 | CBD-S05-SS06-1012 | CBD-S05-SS17-000H | CBD-S05-SS18-000H | CBD-S05-SS18P-000H | CBD-S05-SS19-000H | CBD-S05-SS20-000H | CBD-S05-SS21-000H | CBD-S05-SS22-000H | CBD-S05-SS23-000H |
| **Sample Date** | 04/05/18 | 04/05/18 | 10/19/12 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 | 04/06/18 |
| **Chemical Name** | | | | | | | | | | | |
| Chromium | 22 | 18 | 14 | 24 | 17 | 13 | 9.2 | 18 | 17 | 8.1 | 22 |
| Cobalt | 1.6 | 1.2 | 6.9 | 3.5 | 3.1 | 2.4 | 1.2 | 3.4 | 2.6 | 1.7 | 3.3 |
| Copper | 6.9 | 5.3 | 72 | 8.7 | 9.2 | 8.8 | 5.2 | 8.1 | 180 | 28 | 15 |
| Cyanide | NA | NA | 0.064 U | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 24,000 | 46,000 | 12,000 | 16,000 | 28,000 J | 13,000 J | 8,600 | 13,000 | 15,000 | 7,300 | 22,000 |
| Lead | 12 | 5.9 | 60 | 15 | 40 | 32 | 14 | 14 | 270 | 25 | 26 |
| Magnesium | 1,010 | 1,080 | 950 | 2,350 | 1,150 | 910 | 406 | 1,520 | 1,460 | 846 | 1,530 |
| Manganese | 30 | 6.9 | 100 | 230 | 140 | 130 | 41 | 100 | 290 | 160 | 70 |
| Mercury | 0.17 U | 0.15 U | 0.078 | 0.34 U | 0.13 J | 0.11 J | 0.16 U | 0.2 U | 0.35 J | 0.19 U | 0.18 U |
| Nickel | 4 | 1.8 | 15 | 8.3 | 26 | 26 | 5.7 | 7.6 | 11 | 5.5 | 9.2 |
| Potassium | 791 | 661 | 800 | 1,620 | 708 | 565 | 297 | 917 | 1,220 | 625 | 924 |
| Selenium | 0.66 J | 0.86 | 0.47 | 1.4 | 0.7 J | 0.57 J | 0.32 U | 1.2 | 1 | 0.56 J | 0.61 J |
| Silver | 0.21 J | 0.15 U | 0.68 | 0.24 J | 1 | 0.92 | 0.078 J | 0.17 J | 0.54 | 0.19 J | 0.69 |
| Sodium | 13.1 J+ | 21.3 J+ | 28 B | 41.2 J+ | 19.3 J+ | 16 U | 22.6 J+ | 14.8 U | 24 J+ | 13.9 U | 27.1 J+ |
| Thallium | 0.11 J | 0.12 J | 0.11 | 0.17 J | 0.17 J | 0.12 J | 0.16 U | 0.18 J | 0.13 J | 0.19 U | 0.14 J |
| Vanadium | 26 | 21 | 35 | 26 | 23 | 17 | 12 | 18 | 30 | 13 | 380 |
| Zinc | 18 | 13 | 96 B | 69 | 45 | 38 | 29 | 81 | 280 | 59 | 39 |
| | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | |
| pH (ph) | NA | NA | 5.6 | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | 16,000 | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

## Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP01 | | | | CBD-S07-DP02 | | CBD-S07-DP03 | | CBD-S07-DP04 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS01-1012 | CBD-S07-SS01P-1012 | CBD-S07-SB01-0608 | CBD-S07-SB01P-0608 | CBD-S07-SS02-1012 | CBD-S07-SB02-0507 | CBD-S07-SS03-1012 | CBD-S07-SB03-0608 | CBD-S07-SS04-1012 | CBD-S07-SB04-0608 |
| **Sample Date** | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,1,2,2-Tetrachloroethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,1,2-Trichloroethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,1-Dichloroethane | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| 1,1-Dichloroethene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2,3-Trichlorobenzene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2,4-Trichlorobenzene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2-Dibromo-3-chloropropane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2-Dibromoethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2-Dichlorobenzene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2-Dichloroethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,2-Dichloropropane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 1,3-Dichlorobenzene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| 1,4-Dichlorobenzene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| 2-Butanone | 1.2 J | 0.58 U | 0.49 UJ | 0.53 U | 1 J | 2.6 J | 1.1 J | 2.6 J | 6.5 J | 0.52 U |
| 2-Hexanone | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| 4-Methyl-2-pentanone | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Acetone | 48 J | 17 J | 4.9 UJ | 5.3 U | 35 J | 4.9 UJ | 12 J | 5.2 U | 190 J | 5.2 UJ |
| Benzene | 0.51 U | 0.58 U | 170 J | 0.32 J | 0.43 U | 11 | 0.49 U | 21 | 0.7 U | 0.52 U |
| Bromochloromethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Bromodichloromethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Bromoform | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Bromomethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Carbon disulfide | 0.41 B | 0.31 B | 15 B | 1 B | 0.46 B | 0.99 B | 2.3 B | 1.8 B | 0.32 B | 0.21 B |
| Carbon tetrachloride | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Chlorobenzene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Chloroethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Chloroform | 0.15 B | 0.17 B | 0.24 UJ | 0.24 B | 0.15 B | 0.25 U | 0.14 B | 0.26 U | 0.25 B | 0.23 B |
| Chloromethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| cis-1,2-Dichloroethene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| cis-1,3-Dichloropropene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Cyclohexane | 0.51 U | 0.58 U | 570 J | 2.5 J | 0.43 U | 0.49 U | 0.49 U | 430 | 0.7 U | 0.52 U |
| Dibromochloromethane | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Dichlorodifluoromethane (Freon-12) | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Ethylbenzene | 0.51 U | 0.58 U | 18 J | 0.57 J | 0.43 U | 130 | 0.49 U | 520 | 0.7 U | 0.52 U |
| Isopropylbenzene | 0.25 U | 0.29 U | 160 J | 1.6 | 0.21 U | 170 | 0.25 U | 410 | 0.35 U | 0.26 U |
| m- and p-Xylene | 0.51 U | 0.58 U | 73 J | 2.2 | 0.43 U | 280 | 0.4 J | 2,500 | 0.7 U | 0.52 U |
| Methyl acetate | 2.6 B | 1.2 B | 20 J | 0.82 B | 1.1 B | 2.4 B | 2.2 B | 9.5 | 5.1 B | 1 B |
| Methylcyclohexane | 0.51 U | 0.58 U | 950 J | 5 J | 0.43 U | 1,200 | 0.49 U | 850 | 0.7 U | 0.52 U |
| Methylene chloride | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Methyl-tert-butyl ether (MTBE) | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| o-Xylene | 0.25 U | 0.29 U | 41 J | 1.9 | 0.21 U | 82 | 0.15 J | 660 | 0.35 U | 0.26 U |
| Styrene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Tetrachloroethene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Toluene | 2.9 | 0.58 U | NA | 0.47 B | 0.43 U | 4.3 | 0.43 B | 40 | 0.49 B | 0.52 U |
| trans-1,2-Dichloroethene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| trans-1,3-Dichloropropene | 0.51 U | 0.58 U | 0.49 UJ | 0.53 U | 0.43 U | 0.49 U | 0.49 U | 0.52 U | 0.7 U | 0.52 U |
| Trichloroethene | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Trichlorofluoromethane (Freon-11) | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| Vinyl chloride | 0.25 U | 0.29 U | 0.24 UJ | 0.27 U | 0.21 U | 0.25 U | 0.25 U | 0.26 U | 0.35 U | 0.26 U |
| | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | |
| Aroclor-1016 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1221 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1232 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1242 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1248 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1254 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1260 | 830 | 940 | 85 | 16 U | 350 | 16 U | 5.4 J | 17 U | 14 U | 14 U |
| Aroclor-1262 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| Aroclor-1268 | 60 U | 76 U | 15 U | 16 U | 29 U | 16 U | 15 U | 17 U | 14 U | 14 U |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Aluminum | 6,600 | 5,600 | 6,300 | 6,800 | 4,800 | 4,100 | 6,600 | 6,200 | 2,600 | 2,600 |
| Antimony | 0.17 J | 0.13 | 0.13 | 0.14 | 0.23 | 0.074 J | 0.13 | 0.12 | 0.077 J | 0.076 J |
| Arsenic | 1.6 | 1.6 | 3.1 | 3.4 | 2 | 1.5 | 2.3 | 0.31 B | 1.3 | 1.7 |
| Barium | 22 J | 16 J | 16 | 16 | 20 | 12 | 23 | 19 | 6.4 | 7.9 |
| Beryllium | 0.36 | 0.29 | 0.77 | 0.85 | 0.3 | 0.48 | 0.41 | 0.41 | 0.15 | 0.2 |
| Cadmium | 0.11 | 0.084 | 0.65 | 0.71 | 0.1 | 0.26 | 0.15 | 0.28 | 0.024 J | 0.011 J |
| Calcium | 1,200 | 1,100 | 920 | 1,000 | 1,100 | 430 | 980 | 1,000 | 170 | 180 |
| Chromium (hexavalent) | 0.23 J | 0.3 J | 0.13 L | 0.31 J | NA | NA | NA | NA | NA | NA |
| Chromium | 21 | 21 | 28 | 27 | 11 | 12 | 17 | 2.4 | 5 | 4.5 |
| Cobalt | 2.2 | 2 | 4.6 | 5.2 | 1.9 | 1.7 | 2.6 | 0.54 | 0.94 | 0.77 |
| Copper | 4.4 | 3.4 | 5.2 | 4.7 | 3.6 | 2.3 | 3.3 | 1.8 | 2.2 | 2.1 |
| Cyanide | 0.029 J | 0.058 U | 0.059 U | 0.062 U | 0.056 U | 0.063 U | 0.057 U | 0.067 U | 0.053 U | 0.049 U |
| Iron | 6,200 | 5,900 | 12,000 | 12,000 | 5,600 | 5,100 | 8,200 | 11,000 | 3,900 | 4,500 |
| Lead | 10 | 7.7 | 8.8 L | 7.4 | 8.5 | 3.8 | 9.6 | 2.6 | 3.4 | 2.7 |
| Magnesium | 1,500 K | 1,600 | 2,200 K | 2,100 | 740 | 780 | 1,300 | 1,900 | 210 | 260 |
| Manganese | 33 | 30 | 36 | 31 | 41 | 18 | 42 | 32 | 16 | 17 |

# Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP01 | | | | CBD-S07-DP02 | | CBD-S07-DP03 | | CBD-S07-DP04 | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS01-1012 | CBD-S07-SS01P-1012 | CBD-S07-SB01-0608 | CBD-S07-SB01P-0608 | CBD-S07-SS02-1012 | CBD-S07-SB02-0507 | CBD-S07-SS03-1012 | CBD-S07-SB03-0608 | CBD-S07-SS04-1012 | CBD-S07-SB04-0608 |
| **Sample Date** | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 |
| **Chemical Name** | | | | | | | | | | |
| Mercury | 0.017 J | 0.011 J | 0.0096 J | 0.012 J | 0.016 J | 0.017 U | 0.014 J | 0.017 J | 0.017 U | 0.0067 J |
| Nickel | 13 L | 12 J | 20 K | 13 | 6.4 | 3.3 | 12 | 0.86 | 1.2 | 1.2 |
| Potassium | 650 | 680 | 1,100 | 1,200 | 420 | 570 | 560 | 1,200 | 240 | 280 |
| Selenium | 0.26 B | 0.18 B | 0.41 B | 0.39 B | 0.11 B | 0.09 B | 0.32 B | 0.1 B | 0.068 B | 0.078 B |
| Silver | 0.048 J | 0.043 J | 0.043 J | 0.039 J | 0.036 J | 0.026 J | 0.033 J | 0.01 U | 0.022 J | 0.02 J |
| Sodium | 30 B | 23 B | 130 | 150 | 6.6 B | 50 B | 8 B | 75 | 25 U | 25 U |
| Thallium | 0.2 | 0.18 | 0.43 | 0.47 | 0.17 | 0.35 | 0.19 | 0.1 | 0.042 J | 0.048 J |
| Vanadium | 14 | 12 | 16 L | 16 | 9.5 | 9.3 | 11 | 1.3 | 7.1 | 6.5 |
| Zinc | 27 | 21 | 180 | 190 | 24 | 43 | 31 | 23 | 5.3 | 6.3 B |
| | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | |
| pH (ph) | 6.8 | NA | NA | NA | 7.8 | NA | 7.9 | NA | 6.2 | NA |
| Total organic carbon (TOC) (mg/kg) | 6,500 | NA | NA | NA | 4,500 | NA | 2,300 | NA | 760 J | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP05 | | CBD-S07-DP06 | | CBD-S07-DP07 | | CBD-S07-DP08 | | CBD-S07-DP09 | | CBD-S07-DP10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS05-1012 | CBD-S07-SB05-0608 | CBD-S07-SS06-1012 | CBD-S07-SB06-0608 | CBD-S07-SS07-1012 | CBD-S07-SB07-0608 | CBD-S07-SS08-1012 | CBD-S07-SB08-0608 | CBD-S07-SS09-1012 | CBD-S07-SB09-0608 | CBD-S07-SB10-0204 | CBD-S07-SB10P-0204 |
| **Sample Date** | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/17/12 | 10/17/12 |
| **Chemical Name** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,1,2,2-Tetrachloroethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,1,2-Trichloroethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,1-Dichloroethane | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| 1,1-Dichloroethene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2,3-Trichlorobenzene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2,4-Trichlorobenzene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2-Dibromo-3-chloropropane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2-Dibromoethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2-Dichlorobenzene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2-Dichloroethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,2-Dichloropropane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| 1,3-Dichlorobenzene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| 1,4-Dichlorobenzene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| 2-Butanone | 7.8 J | 0.42 U | 6.8 J | 0.47 U | 5.1 J | 0.57 U | 8.7 J | 1.1 J | 1.4 J | 4.1 J | 0.44 U | 0.43 U |
| 2-Hexanone | 0.55 J | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 UJ | 0.43 UJ |
| 4-Methyl-2-pentanone | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 UJ | 0.43 UJ |
| Acetone | 250 J | 4.2 UJ | 97 J | 4.7 UJ | 88 J | 24 J | 150 J | 42 J | 48 J | 88 J | 40 B | 5.8 B |
| Benzene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Bromochloromethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Bromodichloromethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Bromoform | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Bromomethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.64 J | 0.44 U | 0.43 U |
| Carbon disulfide | 0.23 B | 0.18 B | 0.27 B | 0.47 U | 0.26 B | 0.2 B | 1.5 B | 0.65 U | 0.24 B | 0.31 B | 0.4 B | 0.42 B |
| Carbon tetrachloride | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Chlorobenzene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Chloroethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Chloroform | 0.2 B | 0.14 B | 0.18 B | 0.19 B | 0.23 B | 0.18 B | 0.25 B | 0.28 B | 0.15 B | 0.3 B | 0.15 B | 0.21 U |
| Chloromethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| cis-1,2-Dichloroethene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| cis-1,3-Dichloropropene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Cyclohexane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Dibromochloromethane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Dichlorodifluoromethane (Freon-12) | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Ethylbenzene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Isopropylbenzene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| m- and p-Xylene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Methyl acetate | 8.1 | 0.93 B | 3.1 B | 1.2 B | 1.3 B | 1.4 B | 2.5 B | 2 B | 5.8 B | 2.3 B | 1 B | 0.83 B |
| Methylcyclohexane | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.15 J |
| Methylene chloride | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Methyl-tert-butyl ether (MTBE) | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| o-Xylene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Styrene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Tetrachloroethene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Toluene | 0.27 B | 0.42 U | 0.34 B | 0.47 U | 0.51 U | 0.57 U | 0.87 B | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| trans-1,2-Dichloroethene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| trans-1,3-Dichloropropene | 0.47 U | 0.42 U | 0.47 U | 0.47 U | 0.51 U | 0.57 U | 0.57 U | 0.65 U | 0.46 U | 0.75 U | 0.44 U | 0.43 U |
| Trichloroethene | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Trichlorofluoromethane (Freon-11) | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| Vinyl chloride | 0.23 U | 0.21 U | 0.24 U | 0.24 U | 0.25 U | 0.28 U | 0.29 U | 0.32 U | 0.23 U | 0.37 U | 0.22 U | 0.21 U |
| | | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | | |
| Aroclor-1016 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1221 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1232 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1242 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1248 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1254 | 14 U | 15 U | 14 U | 14 U | 50 | 18 U | 50 | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1260 | 4.2 J | 15 U | 14 U | 14 U | 65 | 18 U | 60 | 19 U | 110 | 23 U | 4.6 J | 14 U |
| Aroclor-1262 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| Aroclor-1268 | 14 U | 15 U | 14 U | 14 U | 15 U | 18 U | 15 U | 19 U | 70 U | 23 U | 14 U | 14 U |
| | | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | | |
| Aluminum | 2,900 | 1,600 | 4,500 | 2,600 | 6,200 | 10,000 | 5,400 | 10,000 | 5,300 | 7,800 | 3,900 | 3,600 |
| Antimony | 0.11 | 0.063 J | 0.12 | 0.11 | 0.4 | 0.19 | 0.33 | 0.21 | 0.31 | 0.18 | 0.082 J | 0.058 J |
| Arsenic | 1.4 | 1.3 | 2.1 | 2.7 | 3.5 | 3 | 2.7 | 3.2 | 2.5 | 5.5 | 1.7 | 1.9 |
| Barium | 6.8 | 6.5 | 19 | 8.3 | 33 | 26 | 24 | 27 | 24 | 20 | 23 | 26 |
| Beryllium | 0.18 | 0.13 | 0.33 | 0.21 | 0.45 | 0.44 | 0.36 | 0.65 | 0.4 | 0.35 | 0.4 | 0.4 |
| Cadmium | 0.025 J | 0.0072 J | 0.077 | 0.026 J | 0.52 | 0.058 | 0.27 | 0.097 | 0.15 | 0.097 | 0.055 | 0.025 B |
| Calcium | 150 | 120 | 360 | 180 | 16,000 | 2,000 | 1,200 | 1,600 | 1,700 | 680 | 410 J | 280 J |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | 5.1 | 3.8 | 7.1 | 6.1 | 21 | 37 | 15 | 21 | 13 | 41 | 4.5 | 4.8 |
| Cobalt | 1.1 | 0.35 | 1.8 | 1.3 | 2.6 | 1.8 | 2.2 | 1.9 | 2.1 | 3.8 | 1.9 | 2 |
| Copper | 2.7 | 1.5 | 3.1 | 2.1 | 9.9 | 3.3 | 6.7 | 3.4 | 4.9 | 3.5 | 2.2 | 2.3 |
| Cyanide | 0.053 U | 0.056 U | 0.027 J | 0.053 U | 0.32 | 0.069 U | 0.21 | 0.072 U | 0.068 J | 0.065 J | 0.046 J | 0.033 J |
| Iron | 4,300 | 3,300 | 5,900 | 5,200 | 15,000 | 18,000 | 9,000 | 20,000 | 8,800 | 21,000 | 5,100 | 5,800 |
| Lead | 3.8 | 2.2 | 7.1 | 3.3 | 62 | 6.9 | 64 | 7.6 | 25 | 6.5 | 7 J | 4.1 J |
| Magnesium | 230 | 160 | 430 | 310 | 4,300 | 2,500 | 960 | 2,500 | 1,200 | 2,400 | 360 | 370 |
| Manganese | 20 | 7.5 | 71 | 36 | 130 | 88 | 90 | 150 | 120 | 250 | 100 | 91 |

Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP05 | | CBD-S07-DP06 | | CBD-S07-DP07 | | CBD-S07-DP08 | | CBD-S07-DP09 | | CBD-S07-DP10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS05-1012 | CBD-S07-SB05-0608 | CBD-S07-SS06-1012 | CBD-S07-SB06-0608 | CBD-S07-SS07-1012 | CBD-S07-SB07-0608 | CBD-S07-SS08-1012 | CBD-S07-SB08-0608 | CBD-S07-SS09-1012 | CBD-S07-SB09-0608 | CBD-S07-SB10-0204 | CBD-S07-SB10P-0204 |
| **Sample Date** | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/22/12 | 10/17/12 | 10/17/12 |
| **Chemical Name** | | | | | | | | | | | | |
| Mercury | 0.0062 J | 0.017 U | 0.012 J | 0.017 U | 0.047 J | 0.027 J | 0.033 J | 0.028 J | 0.022 J | 0.024 J | 0.0099 J | 0.0067 J |
| Nickel | 1.3 | 0.66 | 3.6 | 1.1 | 19 | 5.3 | 18 | 6.4 | 11 | 4.5 | 3.2 | 2.9 |
| Potassium | 270 | 200 | 300 | 350 | 1,000 | 1,500 | 460 | 1,400 | 720 | 1,400 | 230 | 250 |
| Selenium | 0.15 B | 0.13 B | 0.22 B | 0.17 B | 0.34 | 0.41 B | 0.28 B | 0.4 B | 0.24 B | 0.4 B | 0.29 | 0.075 B |
| Silver | 0.019 J | 0.015 J | 0.039 J | 0.023 J | 0.065 | 0.044 J | 0.054 | 0.04 J | 0.036 J | 0.06 | 0.019 J | 0.014 J |
| Sodium | 9.5 B | 9.8 B | 8.6 B | 8.4 B | 46 B | 920 | 50 B | 900 | 110 | 380 | 280 J | 460 J |
| Thallium | 0.046 J | 0.027 J | 0.082 | 0.15 | 0.14 | 0.2 | 0.16 | 0.26 | 0.15 | 0.29 | 0.13 | 0.095 |
| Vanadium | 7.3 | 5.1 | 9.8 | 7.2 | 78 | 17 | 78 | 9.9 | 51 | 14 | 6.4 | 7.3 |
| Zinc | 5.9 | 3.7 | 19 | 7.8 | 260 | 35 | 150 | 25 B | 80 | 32 | 14 B | 11 B |
| | | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | | |
| pH (ph) | 6 | NA | 6.5 | NA | 7.1 | NA | 7.6 | NA | 7.3 | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | 1,100 | NA | 4,200 | NA | 15,000 | NA | 9,900 | NA | 6,900 | NA | NA | NA |

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**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J- - Analyte present, value may be biased low, actual value may be higher
J+ - Analyte present, value may be biased high, actual value may be lower
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP11 | CBD-S07-DP12 | CBD-S07-DP13 | CBD-S07-DP14 | CBD-S07-DP15 | CBD-S07-DP16 | CBD-S07-DP17 | CBD-S07-DP18 | CBD-S07-DP24 | CBD-S07-DP20 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SB11-0204 | CBD-S07-SB12-0204 | CBD-S07-SB13-0204 | CBD-S07-SB14-0204 | CBD-S07-SB15-0204 | CBD-S07-SB16-0204 | CBD-S07-SB17-0204 | CBD-S07-SB18-0204 | CBD-S07-SB19-0204 | CBD-S07-SS20-000H | CBD-S07-SB20-0508 |
| **Sample Date** | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/19/12 | 10/19/12 | 10/19/12 | 10/19/12 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,1,2,2-Tetrachloroethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,1,2-Trichloroethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,1-Dichloroethane | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| 1,1-Dichloroethene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2,3-Trichlorobenzene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2,4-Trichlorobenzene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2-Dibromo-3-chloropropane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2-Dibromoethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2-Dichlorobenzene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2-Dichloroethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,2-Dichloropropane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 1,3-Dichlorobenzene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| 1,4-Dichlorobenzene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| 2-Butanone | 0.46 B | 3.2 B | 0.44 U | 0.4 U | 12 B | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 2-Hexanone | 0.42 UJ | 0.41 UJ | 0.44 UJ | 0.4 UJ | 0.69 J | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| 4-Methyl-2-pentanone | 0.42 UJ | 0.41 UJ | 0.44 UJ | 0.4 UJ | 0.46 UJ | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Acetone | 25 B | 44 B | 28 B | 4 U | 81 J | 5 U | 5.3 U | 5 U | 5.3 UJ | NA | NA |
| Benzene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.2 J | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Bromochloromethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Bromodichloromethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Bromoform | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Bromomethane | 0.42 U | 0.39 J | 0.44 U | 0.4 U | 1.2 J | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Carbon disulfide | 0.68 B | 0.45 B | 0.43 B | 0.51 B | 0.41 B | 0.38 B | 0.39 B | 0.42 B | 0.25 J | NA | NA |
| Carbon tetrachloride | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Chlorobenzene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Chloroethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Chloroform | 0.15 B | 0.2 U | 0.22 U | 0.2 U | 0.18 B | 0.16 B | 0.27 U | 0.25 U | 0.13 B | NA | NA |
| Chloromethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| cis-1,2-Dichloroethene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| cis-1,3-Dichloropropene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Cyclohexane | 0.13 J | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Dibromochloromethane | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Dichlorodifluoromethane (Freon-12) | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Ethylbenzene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Isopropylbenzene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| m- and p-Xylene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Methyl acetate | 0.93 B | 0.73 B | 0.87 B | 0.85 B | 0.95 B | 1.2 B | 1.5 B | 1.2 B | 1.6 B | NA | NA |
| Methylcyclohexane | 0.28 J | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.21 J | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Methylene chloride | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Methyl-tert-butyl ether (MTBE) | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| o-Xylene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Styrene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Tetrachloroethene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Toluene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| trans-1,2-Dichloroethene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| trans-1,3-Dichloropropene | 0.42 U | 0.41 U | 0.44 U | 0.4 U | 0.46 U | 0.5 U | 0.53 U | 0.5 U | 0.53 U | NA | NA |
| Trichloroethene | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Trichlorofluoromethane (Freon-11) | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| Vinyl chloride | 0.21 U | 0.2 U | 0.22 U | 0.2 U | 0.23 U | 0.25 U | 0.27 U | 0.25 U | 0.26 U | NA | NA |
| | | | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | | | |
| Aroclor-1016 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1221 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1232 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1242 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1248 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1254 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 6.5 UJ | 6.6 U |
| Aroclor-1260 | 4.8 J | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | 110 J- | 54 |
| Aroclor-1262 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | NA | NA |
| Aroclor-1268 | 14 U | 14 U | 15 U | 14 U | 14 U | 14 U | 14 U | 14 U | 15 U | NA | NA |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 4,400 | 4,400 | 7,200 | 9,000 | 5,900 | 2,200 | 5,200 | 5,100 | 3,100 | 5,400 | 4,800 |
| Antimony | 0.06 J | 0.086 J | 0.16 | 0.14 | 0.19 | 0.062 J | 0.19 | 0.17 | 0.086 J | 0.13 J | 0.068 J |
| Arsenic | 2.2 | 3.5 | 4 | 4.6 | 4.2 | 1 | 2.6 | 3.1 | 1.1 | 2.6 | 1.4 |
| Barium | 26 | 38 | 14 | 33 | 19 | 16 | 28 | 23 | 8.8 | 16 | 16 |
| Beryllium | 0.36 | 0.69 | 0.27 | 0.36 | 0.51 | 1.1 | 0.61 | 0.5 | 0.22 | 0.3 J | 0.24 J |
| Cadmium | 0.042 J | 0.05 | 0.034 J | 0.069 | 0.028 J | 0.1 | 0.063 | 0.14 | 0.02 J | 0.14 U | 0.15 U |
| Calcium | 4,300 | 540 | 580 | 700 | 950 | 1,900 | 3,700 | 1,400 | 3,400 | 341 | 417 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | 4.8 | 5.9 | 13 | 13 | 8.2 | 8.2 | 7.8 | 9.5 | 8.7 | 26 | 14 |
| Cobalt | 1.7 | 3.3 | 2.1 | 2 | 2.8 | 0.53 | 3.5 | 2.2 | 0.67 | 1.4 | 1.2 |
| Copper | 2.3 | 2.8 | 4.4 | 4.3 | 3.1 | 1.5 | 2.9 | 2.1 | 1.2 | 4.8 | 2.7 |
| Cyanide | 0.053 U | 0.053 U | 0.058 U | 0.053 U | 0.054 U | 0.054 U | 0.04 J | 0.054 U | 0.057 U | NA | NA |
| Iron | 7,200 | 9,600 | 11,000 | 13,000 | 14,000 | 11,000 | 9,100 | 8,400 | 3,500 | 9,100 | 4,700 |
| Lead | 3.3 | 4 | 5.5 | 6.6 | 3.7 | 2.4 | 3.2 | 3.9 | 2 | 82 | 4.2 |
| Magnesium | 640 | 370 | 790 | 790 | 500 | 580 | 610 | 700 | 1,000 | 494 | 576 |
| Manganese | 71 | 110 | 60 | 68 | 62 | 76 | 210 | 130 | 15 | 40 | 20 |

## Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP11 | CBD-S07-DP12 | CBD-S07-DP13 | CBD-S07-DP14 | CBD-S07-DP15 | CBD-S07-DP16 | CBD-S07-DP17 | CBD-S07-DP18 | CBD-S07-DP19 | CBD-S07-DP20 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SB11-0204 | CBD-S07-SB12-0204 | CBD-S07-SB13-0204 | CBD-S07-SB14-0204 | CBD-S07-SB15-0204 | CBD-S07-SB16-0204 | CBD-S07-SB17-0204 | CBD-S07-SB18-0204 | CBD-S07-SB19-0204 | CBD-S07-SS20-000H | CBD-S07-SB20-0508 |
| **Sample Date** | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/17/12 | 10/19/12 | 10/19/12 | 10/19/12 | 10/19/12 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | | | |
| Mercury | 0.017 U | 0.017 U | 0.017 U | 0.015 J | 0.017 U | 0.017 U | 0.0073 J | 0.016 U | 0.017 U | 0.14 U | 0.15 U |
| Nickel | 2.8 | 2.3 | 4 | 4.5 | 2.3 | 1.3 | 3.2 | 3.7 | 1.2 | 3.4 | 3.1 |
| Potassium | 330 | 380 | 540 | 600 | 470 | 440 | 430 | 550 | 440 | 308 | 382 |
| Selenium | 0.2 B | 0.3 | 0.3 | 0.29 | 0.45 | 0.26 | 0.27 | 0.13 | 0.13 | 0.57 | 0.89 |
| Silver | 0.017 B | 0.023 B | 0.029 J | 0.032 J | 0.028 J | 0.025 J | 0.025 J | 0.028 J | 0.036 J | 0.14 J | 0.15 U |
| Sodium | 340 | 460 | 450 | 770 | 560 | 610 | 200 | 380 | 410 | 8.8 J+ | 7.2 U |
| Thallium | 0.1 | 0.098 | 0.12 | 0.15 | 0.11 | 0.076 | 0.17 | 0.19 | 0.14 | 0.11 J | 0.19 J |
| Vanadium | 8.6 | 9.4 | 17 | 21 | 15 | 7.3 | 9.4 | 8.9 | 4.3 | 11 | 9.5 |
| Zinc | 10 B | 11 B | 15 B | 16 B | 11 B | 13 B | 13 B | 18 B | 7.6 L | 15 | 11 |
| | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

## Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP21 | | | CBD-S07-DP22 | | CBD-S07-DP23 | | CBD-S07-DP24 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS21-000H | CBD-S07-SS21P-000H | CBD-S07-SB21-0508 | CBD-S07-SS22-000H | CBD-S07-SB22-0508 | CBD-S07-SS23-000H | CBD-S07-SB23-0508 | CBD-S07-SS24-000H | CBD-S07-SB24-0508 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | | | |
| Aroclor-1016 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1221 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1232 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1242 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1248 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1254 | 7.3 U | 7.3 U | 15 U | 6.8 U | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1260 | 490 J | 180 J | 15 U | 6.3 J | 13 U | 6.7 U | 7.4 U | 6 U | 7 U |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 5,800 | 6,600 | 8,000 | 2,800 | 5,100 | 4,800 | 7,100 | 3,200 | 6,100 |
| Antimony | 0.13 J | 0.084 J | 0.19 U | 0.063 J | 0.16 U | 0.19 U | 0.14 J | 0.16 U | 0.14 U |
| Arsenic | 2.5 | 2.9 | 4.4 | 2 | 2.1 | 2.8 | 3.8 | 1.6 | 2.8 |
| Barium | 27 | 28 | 21 | 13 | 11 | 14 | 35 J+ | 8.4 | 16 |
| Beryllium | 0.37 J | 0.47 J | 1.3 | 0.3 J | 0.41 J | 0.28 J | 0.64 | 0.22 J | 0.31 J |
| Cadmium | 0.18 J | 0.19 J | 0.49 | 0.17 J | 0.16 U | 0.19 U | 0.18 J | 0.16 U | 0.14 U |
| Calcium | 2,010 | 1,980 | 1,340 | 515 | 674 | 361 | 929 | 171,000 | 330,000 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | 12 J | 19 J | 28 | 6.7 | 18 | 7.1 | 14 | 9.3 | 9.7 |
| Cobalt | 2.5 | 2.8 | 3.6 | 1.6 | 0.92 | 2.4 | 3.1 | 1.1 | 1.6 |
| Copper | 15 J | 9.7 J | 7 | 2.6 | 2.4 | 3.6 | 25 J | 2.6 | 5.9 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 8,300 | 8,800 | 23,000 | 7,400 | 11,000 | 8,300 | 12,000 | 5,200 | 8,400 |
| Lead | 11 | 11 | 8.5 | 4 | 6.5 | 6.4 | 21 | 2.7 | 6.3 |
| Magnesium | 721 J | 1,220 J | 2,110 | 476 | 1,200 | 498 | 946 | 276,000 | 528,000 |
| Manganese | 61 | 48 | 34 | 71 | 12 | 66 | 160 | 27 | 57 |

# Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP21 | | | CBD-S07-DP22 | | CBD-S07-DP23 | | CBD-S07-DP24 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS21-000H | CBD-S07-SS21P-000H | CBD-S07-SB21-0508 | CBD-S07-SS22-000H | CBD-S07-SB22-0508 | CBD-S07-SS23-000H | CBD-S07-SB23-0508 | CBD-S07-SS24-000H | CBD-S07-SB24-0508 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 |
| **Chemical Name** | | | | | | | | | |
| Mercury | 0.18 U | 0.19 U | 0.19 U | 0.14 U | 0.16 U | 0.19 U | 0.16 U | 0.16 U | 0.14 U |
| Nickel | 8.7 | 11 | 7.6 | 2.5 | 2.1 | 2.8 | 6.3 | 1.7 | 3.2 |
| Potassium | 488 | 605 | 1,240 | 379 | 811 | 499 | 576 | 259,000 | 399,000 |
| Selenium | 0.85 | 1 | 1.5 | 0.46 J | 0.56 J | 0.62 J | 1.3 | 0.35 J | 0.72 |
| Silver | 0.18 U | 0.19 U | 0.19 U | 0.063 J | 0.16 U | 0.19 U | 0.16 J | 0.16 U | 0.14 U |
| Sodium | 19.9 J+ | 18.5 J+ | 216 | 5.9 U | 13.8 J+ | 6.5 U | 13.7 J+ | 4,310 | 6,640 |
| Thallium | 0.16 J | 0.24 J | 0.58 | 0.088 J | 0.13 J | 0.19 U | 0.18 J | 0.16 U | 0.09 J |
| Vanadium | 13 | 15 | 21 | 7.1 | 9.8 | 12 | 17 | 6.9 | 12 |
| Zinc | 31 | 34 | 120 | 16 | 17 | 34 | 36 | 5.8 | 13 |
| | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

▨ Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S07-DP25 | | | CBD-S07-DP26 | | CBD-S07-DP27 | |
|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS25-000H | CBD-S07-SB25-0508 | CBD-S07-SB25P-0508 | CBD-S07-SS26-000H | CBD-S07-SB26-0508 | CBD-S07-SS27-000H | CBD-S07-SB27-0508 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | |
| | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/KG)** | | | | | | | |
| Aroclor-1016 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1221 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1232 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1242 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1248 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1254 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 7 UJ | 12 U |
| Aroclor-1260 | 6.5 U | 6.3 U | 6.5 UJ | 6.5 U | 6.3 U | 260 J | 12 U |
| Aroclor-1262 | NA | NA | NA | NA | NA | NA | NA |
| Aroclor-1268 | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | |
| Aluminum | 3,000 | 5,200 | 4,500 | 4,300 | 3,700 | 5,700 | 9,300 |
| Antimony | 0.13 U | 0.13 U | 0.15 U | 0.15 U | 0.14 U | 0.14 U | 0.088 J |
| Arsenic | 2.2 | 5.5 J | 2.3 J | 2.6 | 2.9 | 3.5 | 1.9 |
| Barium | 12 | 28 | 21 | 19 | 16 | 27 | 51 |
| Beryllium | 0.25 J | 0.89 | 0.42 J | 0.4 J | 0.39 J | 0.38 J | 0.83 |
| Cadmium | 0.13 U | 0.18 J | 0.15 U | 0.096 J | 0.13 J | 0.31 | 0.12 J |
| Calcium | 89,000 | 390,000 J | 116,000 J | 397,000 | 531,000 | 5,870 | 847 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA |
| Chromium | 5.9 | 9.4 | 12 | 9.2 | 7.2 | 21 | 14 |
| Cobalt | 0.93 | 2 | 2.1 | 2.4 | 1.8 | 2.2 | 4 |
| Copper | 2.4 | 2.9 | 3.1 | 2.8 | 3.3 | 8.3 | 1.5 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA |
| Iron | 4,400 | 11,000 J | 6,900 J | 7,500 | 7,400 | 13,000 | 9,800 |
| Lead | 10 | 3.4 J | 5.5 J | 7.1 | 8.7 | 47 | 4.6 |
| Magnesium | 357,000 | 641,000 | 480,000 | 626,000 | 494,000 | 3,020 | 1,100 |
| Manganese | 34 | 74 J | 130 J | 94 | 73 | 73 | 190 |

# Appendix D - Site 7 Soil Analytical Data

| **Station ID** | CBD-S07-DP25 | | | CBD-S07-DP26 | | CBD-S07-DP27 | |
|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S07-SS25-000H | CBD-S07-SB25-0508 | CBD-S07-SB25P-0508 | CBD-S07-SS26-000H | CBD-S07-SB26-0508 | CBD-S07-SS27-000H | CBD-S07-SB27-0508 |
| **Sample Date** | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/03/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | |
| Mercury | 0.13 U | 0.13 U | 0.15 U | 0.15 U | 0.14 U | 0.14 U | 0.16 U |
| Nickel | 2.6 | 6.2 J | 4.3 J | 6.4 | 3.8 | 24 | 11 |
| Potassium | 273,000 | 349,000 | 292,000 | 431,000 | 315,000 | 916 | 554 |
| Selenium | 0.49 J | 1.1 | 0.93 | 0.78 | 0.7 | 1 | 1.7 |
| Silver | 0.13 U | 0.13 U | 0.15 U | 0.15 U | 0.14 U | 0.14 U | 0.077 J |
| Sodium | 2,710 | 4,830 | 6,630 | 4,880 | 4,410 | 58.4 J+ | 138 |
| Thallium | 0.093 J | 0.13 J | 0.1 J | 0.12 J | 0.1 J | 0.11 J | 0.21 J |
| Vanadium | 10 | 12 | 9.7 | 28 | 9.3 | 120 | 13 |
| Zinc | 16 | 22 | 18 | 19 | 18 | 220 | 40 |
| | | | | | | | |
| **Wet Chemistry** | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA |

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**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

# Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP01 | | | CBD-S09-DP02 | | CBD-S09-DP03 | | CBD-S09-DP04 | | CBD-S09-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS01-1012 | CBD-S09-SS01P-1012 | CBD-S09-SB01-1315 | CBD-S09-SS02-1012 | CBD-S09-SB02-1315 | CBD-S09-SS03-1012 | CBD-S09-SB03-1315 | CBD-S09-SS04-1012 | CBD-S09-SB04-1315 | CBD-S09-SS05-000H | CBD-S09-SB05-0810 |
| **Sample Date** | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | | |
| | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,1,2,2-Tetrachloroethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,1,2-Trichloroethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,1-Dichloroethane | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| 1,1-Dichloroethene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2,3-Trichlorobenzene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2,4-Trichlorobenzene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2-Dibromo-3-chloropropane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2-Dibromoethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2-Dichlorobenzene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2-Dichloroethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,2-Dichloropropane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 1,3-Dichlorobenzene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| 1,4-Dichlorobenzene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| 2-Butanone | 8.1 L | 4.5 J | 11 J | 4 J | 0.82 U | 7 J | 2.1 J | 8.1 J | 0.89 U | NA | NA |
| 2-Hexanone | 7.4 L | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| 4-Methyl-2-pentanone | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Acetone | 53 J | 30 J | 140 | 35 | 14 J | 55 | 8.7 U | 67 | 8.9 U | NA | NA |
| Benzene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.21 J | 0.87 U | 4.3 | 0.89 U | NA | NA |
| Bromochloromethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Bromodichloromethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Bromoform | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Bromomethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Carbon disulfide | 1.2 B | 0.79 B | 13 J | 0.26 B | 0.38 B | 8.4 J | 0.4 B | 1.1 J | 0.41 B | NA | NA |
| Carbon tetrachloride | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Chlorobenzene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Chloroethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Chloroform | 0.29 B | 0.21 B | 0.32 B | 0.19 B | 0.53 B | 0.18 B | 0.43 U | 0.26 B | 0.41 B | NA | NA |
| Chloromethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| cis-1,2-Dichloroethene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| cis-1,3-Dichloropropene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Cyclohexane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 3.4 J | 0.89 U | NA | NA |
| Dibromochloromethane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Dichlorodifluoromethane (Freon-12) | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Ethylbenzene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 1.7 | 0.89 U | NA | NA |
| Isopropylbenzene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 1.1 J | 0.44 U | NA | NA |
| m- and p-Xylene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 4.3 | 0.89 U | NA | NA |
| Methyl acetate | 1.5 B | 1.3 B | 1.2 B | 1.1 B | 2.4 B | 1.3 B | 2.5 B | 4.1 B | 1.5 B | NA | NA |
| Methylcyclohexane | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 6.5 J | 0.89 U | NA | NA |
| Methylene chloride | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Methyl-tert-butyl ether (MTBE) | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| o-Xylene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 2.9 | 0.44 U | NA | NA |
| Styrene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 1.8 | 0.44 U | NA | NA |
| Tetrachloroethene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 1.3 J | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Toluene | 0.34 B | 0.53 U | 0.44 B | 0.47 U | 0.82 U | 0.28 B | 0.87 U | 8.6 | 0.42 B | NA | NA |
| trans-1,2-Dichloroethene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| trans-1,3-Dichloropropene | 0.63 UL | 0.53 U | 0.77 U | 0.47 U | 0.82 U | 0.53 U | 0.87 U | 0.66 U | 0.89 U | NA | NA |
| Trichloroethene | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Trichlorofluoromethane (Freon-11) | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| Vinyl chloride | 0.32 UL | 0.27 U | 0.38 U | 0.23 U | 0.41 U | 0.26 U | 0.43 U | 0.33 U | 0.44 U | NA | NA |
| | | | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1-Biphenyl | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 420 U | 720 U |
| 1,2,4,5-Tetrachlorobenzene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 2,3,4,6-Tetrachlorophenol | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | NA | NA |
| 2,4,5-Trichlorophenol | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 139 U | 239 U |
| 2,4,6-Trichlorophenol | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 2,4-Dichlorophenol | 7 U | 7.1 U | 10 U | 7.6 U | 5.9 U | 7 U | 5.7 U | 15 U | 5.9 U | 139 U | 239 U |
| 2,4-Dimethylphenol | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 139 U | 239 U |
| 2,4-Dinitrophenol | 350 U | 360 U | 510 U | 390 U | 300 U | 350 U | 290 U | 780 U | 300 U | 1,390 U | 2,390 U |
| 2,4-Dinitrotoluene | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 277 U | 478 U |
| 2,6-Dinitrotoluene | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 2-Chloronaphthalene | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 2-Chlorophenol | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 2-Methylnaphthalene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 2.6 U | 3.4 U |
| 2-Methylphenol | 14 U | 14 U | 20 U | 15 U | 12 U | 14 U | 11 U | 31 U | 12 U | 139 U | 239 U |
| 2-Nitroaniline | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 277 U | 478 U |
| 2-Nitrophenol | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| 3,3'-Dichlorobenzidine | 710 U | 710 U | 1,000 U | 770 U | 590 U | 710 U | 580 U | 1,500 U | 590 U | 139 U | 239 U |
| 3-Nitroaniline | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 280 U | 480 U |
| 4,6-Dinitro-2-methylphenol | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 35 J | 78 U | 30 U | 1,390 U | 2,390 U |
| 4-Bromophenyl-phenylether | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 277 U | 478 U |
| 4-Chloro-3-methylphenol | 14 U | 14 U | 20 U | 15 U | 12 U | 14 U | 11 U | 31 U | 12 U | 139 U | 239 U |
| 4-Chloroaniline | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 139 U | 239 U |
| 4-Chlorophenyl-phenylether | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 277 U | 478 U |
| 4-Methylphenol | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | NA | NA |
| 4-Nitroaniline | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 139 U | 239 U |
| 4-Nitrophenol | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 280 U | 480 UJ |

Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP01 | | | CBD-S09-DP02 | | CBD-S09-DP03 | | CBD-S09-DP04 | | CBD-S09-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS01-1012 | CBD-S09-SS01P-1012 | CBD-S09-SB01-1315 | CBD-S09-SS02-1012 | CBD-S09-SB02-1315 | CBD-S09-SS03-1012 | CBD-S09-SB03-1315 | CBD-S09-SS04-1012 | CBD-S09-SB04-1315 | CBD-S09-SS05-000H | CBD-S09-SB05-0810 |
| **Sample Date** | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | | |
| Acenaphthene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 1.4 U | 1.8 U |
| Acenaphthylene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 1.1 J | 1.8 U |
| Acetophenone | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 140 U | 240 U |
| Anthracene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 2.2 J | 2.9 U | 12 J | 3 U | 2 J | 7.3 U |
| Atrazine | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 420 U | 720 U |
| Benzaldehyde | 35 UL | 36 UL | 51 UL | 39 UL | 30 UL | 35 UL | 29 UL | 78 UL | 30 UL | 420 U | 720 U |
| Benzo(a)anthracene | 3.5 U | 3.6 U | 5.1 U | 10 J | 3 U | 14 J | 2.9 U | 150 J | 3 U | 11 U | 7.3 U |
| Benzo(a)pyrene | 14 U | 29 U | 10 U | 31 U | 1.2 U | 18 J | 1.2 U | 46 J | 1.2 U | 15 J | 7.3 U |
| Benzo(b)fluoranthene | 4.3 B | 7.1 U | 10 U | 16 J | 5.9 U | 20 J | 5.8 U | 370 J | 5.9 U | 27 U | 11 U |
| Benzo(g,h,i)perylene | 11 B | 3.6 U | 5.1 U | 7.8 B | 3 U | 12 B | 2.9 U | 91 J | 3 U | 14 J | 11 U |
| Benzo(k)fluoranthene | 7.1 UL | 7.1 U | 10 U | 5.4 B | 5.9 U | 8 B | 5.8 U | 91 J | 5.9 U | 8.7 U | 7.3 U |
| bis(2-Chloroethoxy)methane | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| bis(2-Chloroethyl)ether | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| bis(2-Ethylhexyl)phthalate | 16 J | 36 U | 14 J | 12 J | 12 J | 9.4 B | 8.4 B | 91 J | 11 J | 139 U | 239 U |
| Butylbenzylphthalate | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| Caprolactam | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 3,500 U | 6,000 U |
| Carbazole | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 139 U | 239 U |
| Chrysene | 2.9 B | 3.6 U | 5.1 U | 9.3 B | 3 U | 13 B | 2.9 U | 170 J | 3 U | 16 U | 7.3 U |
| Dibenz(a,h)anthracene | 14 U | 29 U | 10 U | 31 U | 1.2 U | 7.1 U | 1.2 U | 30 U | 1.2 U | 8.7 U | 11 U |
| Dibenzofuran | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Diethylphthalate | 7.9 B | 6.2 B | 12 B | 8.5 B | 8.6 B | 8.7 B | 7.8 B | 15 U | 8.5 B | 139 U | 239 U |
| Dimethyl phthalate | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 280 U | 480 U |
| Di-n-butylphthalate | 35 U | 36 U | 51 U | 39 U | 30 U | 35 U | 29 U | 78 U | 30 U | 139 U | 239 U |
| Di-n-octylphthalate | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Fluoranthene | 3.6 J | 3.6 U | 5.1 U | 12 J | 3 U | 18 J | 2.9 U | 210 | 3 U | 20 U | 7.3 U |
| Fluorene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 3.5 U | 4.5 U |
| Hexachlorobenzene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Hexachlorobutadiene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Hexachlorocyclopentadiene | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| Hexachloroethane | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Indeno(1,2,3-cd)pyrene | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 11 B | 5.8 U | 88 J | 5.9 U | 16 J | 11 U |
| Isophorone | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Naphthalene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 2.6 U | 3.4 U |
| n-Nitroso-di-n-propylamine | 7.1 U | 7.1 U | 10 U | 7.7 U | 5.9 U | 7.1 U | 5.8 U | 15 U | 5.9 U | 139 U | 239 U |
| n-Nitrosodiphenylamine | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Nitrobenzene | 3.5 U | 3.6 U | 5.1 U | 3.9 U | 3 U | 3.5 U | 2.9 U | 7.8 U | 3 U | 139 U | 239 U |
| Pentachlorophenol | 71 U | 71 U | 100 U | 77 U | 59 U | 71 U | 58 U | 150 U | 59 U | 277 U | 478 U |
| Phenanthrene | 2.1 J | 3.6 U | 5.1 U | 8.5 J | 3 U | 8 J | 2.9 U | 130 | 3 U | 9 J | 11 U |
| Phenol | 7 U | 7.1 U | 10 U | 7.6 U | 5.9 U | 7 U | 5.7 U | 15 U | 5.9 U | 139 U | 239 U |
| Pyrene | 5.7 J | 7.1 U | 10 U | 20 J | 5.9 U | 25 J | 5.7 U | 320 J | 5.9 U | 17 J | 11 U |
| Total cresols | NA | NA | NA | NA | NA | NA | NA | NA | NA | 139 U | 239 U |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 3,300 | 3,200 | 7,100 | 4,200 | 8,200 | 4,700 | 7,800 | 2,600 | 5,000 | 2,900 | 5,300 |
| Antimony | 0.13 B | 0.1 B | 0.11 B | 0.38 | 0.3 | 0.88 | 0.22 B | 0.095 B | 0.14 B | 0.15 J | 0.17 U |
| Arsenic | 0.62 | 0.42 | 3.1 | 2.2 | 1.1 | 2.7 | 3.3 | 0.87 | 4.4 | 1.1 | 4.6 |
| Barium | 11 | 10 | 18 | 19 | 16 | 22 | 15 | 9.7 | 9.9 | 11 | 10 |
| Beryllium | 0.26 | 0.2 | 0.48 | 0.3 | 0.89 | 0.26 | 1.4 | 0.18 | 0.18 | 0.17 J | 0.5 J |
| Cadmium | 0.076 | 0.05 | 1.5 | 0.29 | 0.23 | 0.16 | 0.37 | 0.03 J | 0.37 | 0.14 J | 0.21 J |
| Calcium | 900 | 840 | 3,500 | 1,100 | 1,000 | 2,900 | 1,400 | 7,900 | 1,600 | 2,130 | 1,680 |
| Chromium (hexavalent) | 0.6 | 0.19 J | 0.31 U | 0.15 J | 0.89 | 0.5 | 0.98 | 1.05 | 0.29 J | NA | NA |
| Chromium | 12 | 12 | 28 | 18 | 22 | 15 | 25 | 9.1 | 28 | 9.7 | 23 |
| Cobalt | 0.64 | 0.52 | 2.2 | 2.1 | 44 | 1.9 | 3.6 | 0.68 | 0.76 | 1.4 | 5.7 |
| Copper | 3.1 | 3.7 | 3.7 | 13 | 3.9 | 4.2 | 4.6 | 1.8 | 3 | 8.2 | 3.3 |
| Cyanide | 0.053 U | 0.053 U | 0.077 U | 0.058 U | 0.089 U | 0.053 U | 0.087 U | 0.057 U | 0.089 U | NA | NA |
| Iron | 3,200 | 2,900 | 13,000 | 9,100 | 10,000 | 13,000 | 17,000 | 3,500 | 9,300 | 3,900 | 18,000 |
| Lead | 3.6 J | 2.9 J | 5 | 28 | 5 | 11 | 4.9 | 1.9 | 4.9 | 37 | 3.7 |
| Magnesium | 750 | 750 | 3,500 | 1,800 | 2,300 | 1,300 | 2,600 K | 810 | 1,400 | 999 | 2,380 |
| Manganese | 15 J | 7.2 J | 40 | 54 | 260 | 61 | 34 | 29 | 3.8 | 39 | 200 |
| Mercury | 0.041 J | 0.039 J | 0.017 U | 0.047 J | 0.015 J | 0.012 J | 0.0065 J | 0.017 U | 0.0082 J | 0.11 J | 0.17 U |
| Nickel | 1.1 J | 0.89 J | 9.8 | 9 | 6.5 | 5 | 5.2 | 1.5 | 2 | 6.6 | 9.8 |
| Potassium | 530 | 530 | 1,900 | 620 | 1,300 | 670 | 1,700 | 470 | 1,100 | 419 | 1,300 |
| Selenium | 0.25 | 0.22 | 0.59 | 0.25 | 0.36 B | 0.5 | 0.3 B | 0.087 B | 1 B | 0.97 | 0.4 J |
| Silver | 2.7 J | 3.9 J | 0.096 | 0.081 | 0.055 | 0.043 J | 0.055 | 0.041 J | 0.064 | 1.3 | 0.17 U |
| Sodium | 28 B | 21 B | 89 B | 57 B | 120 | 25 B | 100 B | 25 U | 98 B | 143 | 92.5 |
| Thallium | 0.15 | 0.13 | 0.2 | 0.15 | 0.25 | 0.059 B | 0.2 | 0.15 | 0.2 | 0.078 J | 0.34 J |
| Vanadium | 6.4 | 6.9 | 14 | 12 | 7.5 | 17 | 13 K | 4.7 | 15 | 9.5 | 12 |
| Zinc | 15 B | 15 B | 59 | 47 | 80 | 20 | 150 | 8.2 | 55 | 37 | 63 |
| | | | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | | | |
| pH (ph) | 7.6 | NA | NA | 8.4 | NA | 8.7 | NA | 12 | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | 840 J | NA | NA | 760 J | NA | 4,400 | NA | 1,000 J | NA | NA | NA |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

## Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP01 | | | CBD-S09-DP02 | | CBD-S09-DP03 | | CBD-S09-DP04 | | CBD-S09-DP05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS01-1012 | CBD-S09-SS01P-1012 | CBD-S09-SB01-1315 | CBD-S09-SS02-1012 | CBD-S09-SB02-1315 | CBD-S09-SS03-1012 | CBD-S09-SB03-1315 | CBD-S09-SS04-1012 | CBD-S09-SB04-1315 | CBD-S09-SS05-000H | CBD-S09-SB05-0810 |
| **Sample Date** | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 10/12/12 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | | | |

**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

# Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP06 | | | CBD-S09-DP07 | | CBD-S09-DP08 | | CBD-S09-DP09 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS06-000H | CBD-S09-SS06P-000H | CBD-S09-SB06-0810 | CBD-S09-SS07-000H | CBD-S09-SB07-0810 | CBD-S09-SS08-000H | CBD-S09-SB08-0810 | CBD-S09-SS09-000H | CBD-S09-SB09-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,1,1-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl acetate | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| o-Xylene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Styrene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,1-Biphenyl | 480 U | 470 U | 550 UJ | 360 UJ | 530 UJ | 470 U | 610 U | 420 U | 560 UJ |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2,4,6-Trichlorophenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2,4-Dichlorophenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2,4-Dimethylphenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2,4-Dinitrophenol | 1,610 U | 1,560 U | 1,850 U | 1,210 UJ | 1,780 R | 1,570 U | 2,020 U | 1,400 U | 1,860 U |
| 2,4-Dinitrotoluene | 321 U | 313 U | 369 UJ | 243 UJ | 355 UJ | 315 U | 404 U | 280 U | 371 UJ |
| 2,6-Dinitrotoluene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 2-Chloronaphthalene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 2-Chlorophenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2-Methylnaphthalene | 26 U | 24 U | 2.6 U | 21 U | 2.3 U | 2.2 U | 2.6 U | 84 U | 2.6 U |
| 2-Methylphenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 2-Nitroaniline | 321 U | 313 U | 369 UJ | 243 UJ | 355 UJ | 315 U | 404 U | 280 U | 371 UJ |
| 2-Nitrophenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 3,3'-Dichlorobenzidine | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 3-Nitroaniline | 320 U | 310 U | 370 UJ | 240 UJ | 360 UJ | 310 U | 400 U | 280 U | 370 UJ |
| 4,6-Dinitro-2-methylphenol | 1,610 U | 1,560 U | 1,850 U | 1,210 UJ | 1,780 UJ | 1,570 U | 2,020 U | 1,400 U | 1,860 U |
| 4-Bromophenyl-phenylether | 321 U | 313 U | 369 UJ | 243 UJ | 355 UJ | 315 U | 404 U | 280 U | 371 UJ |
| 4-Chloro-3-methylphenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| 4-Chloroaniline | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 4-Chlorophenyl-phenylether | 321 U | 313 U | 369 UJ | 243 UJ | 355 UJ | 315 U | 404 U | 280 U | 371 UJ |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| 4-Nitrophenol | 320 U | 310 U | 370 U | 240 UJ | 360 U | 310 U | 400 U | 280 U | 370 U |

Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP06 | | | CBD-S09-DP07 | | CBD-S09-DP08 | | CBD-S09-DP09 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS06-000H | CBD-S09-SS06P-000H | CBD-S09-SB06-0810 | CBD-S09-SS07-000H | CBD-S09-SB07-0810 | CBD-S09-SS08-000H | CBD-S09-SB08-0810 | CBD-S09-SS09-000H | CBD-S09-SB09-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |
| Acenaphthene | 14 U | 13 U | 1.4 U | 11 U | 1.2 U | 0.6 J | 1.4 U | 45 U | 1.4 U |
| Acenaphthylene | 14 U | 13 U | 1.4 U | 3.6 J | 1.2 U | 2.6 J | 1.4 U | 45 U | 1.4 U |
| Acetophenone | 160 U | 160 U | 180 UJ | 120 UJ | 180 UJ | 160 U | 200 U | 140 U | 190 UJ |
| Anthracene | 56 U | 52 U | 5.6 U | 46 U | 5.1 U | 2.6 J | 5.6 U | 180 U | 5.7 U |
| Atrazine | 480 U | 470 U | 550 UJ | 360 UJ | 530 UJ | 470 U | 610 U | 420 U | 560 UJ |
| Benzaldehyde | 480 UJ | 470 UJ | 550 UJ | 360 UJ | 530 UJ | 470 UJ | 610 UJ | 420 UJ | 560 UJ |
| Benzo(a)anthracene | 56 U | 52 U | 5.6 U | 46 U | 5.1 U | 11 | 5.6 U | 180 U | 5.7 U |
| Benzo(a)pyrene | 32 J | 52 U | 5.6 U | 33 J | 5.1 U | 16 | 5.6 U | 180 U | 5.7 U |
| Benzo(b)fluoranthene | 87 U | 80 U | 8.6 U | 70 U | 7.8 U | 21 | 8.7 U | 280 U | 8.8 U |
| Benzo(g,h,i)perylene | 32 J | 80 U | 8.6 U | 35 J | 7.8 U | 16 | 8.7 U | 280 U | 8.8 U |
| Benzo(k)fluoranthene | 56 U | 52 U | 5.6 U | 46 U | 5.1 U | 6.8 U | 5.6 U | 180 U | 5.7 U |
| bis(2-Chloroethoxy)methane | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| bis(2-Chloroethyl)ether | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| bis(2-Ethylhexyl)phthalate | 764 U | 804 U | 953 UJ | 554 UJ | 907 UJ | 798 U | 1,160 U | 725 U | 1,090 UJ |
| Butylbenzylphthalate | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Caprolactam | 4,000 UJ | 3,900 UJ | 4,600 UJ | 3,000 UJ | 4,400 UJ | 3,900 UJ | 5,000 UJ | 3,500 UJ | 4,600 UJ |
| Carbazole | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Chrysene | 56 U | 52 U | 5.6 U | 46 U | 5.1 U | 12 | 5.6 U | 180 U | 5.7 U |
| Dibenz(a,h)anthracene | 87 U | 80 U | 8.6 U | 70 U | 7.8 U | 3.1 J | 8.7 U | 280 U | 8.8 U |
| Dibenzofuran | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Diethylphthalate | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Dimethyl phthalate | 320 U | 310 U | 370 UJ | 240 UJ | 360 UJ | 310 U | 400 U | 280 U | 370 UJ |
| Di-n-butylphthalate | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Di-n-octylphthalate | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Fluoranthene | 56 U | 52 U | 5.6 U | 46 U | 5.1 U | 15 | 5.6 U | 180 U | 5.7 U |
| Fluorene | 35 U | 32 U | 3.4 U | 28 U | 3.1 U | 3 U | 3.5 U | 110 U | 3.5 U |
| Hexachlorobenzene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Hexachlorobutadiene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Hexachlorocyclopentadiene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Hexachloroethane | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Indeno(1,2,3-cd)pyrene | 87 U | 80 U | 8.6 U | 29 J | 7.8 U | 17 | 8.7 U | 280 U | 8.8 U |
| Isophorone | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Naphthalene | 26 U | 24 U | 2.6 U | 21 U | 2.3 U | 2.2 U | 2.6 U | 84 U | 2.6 U |
| n-Nitroso-di-n-propylamine | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| n-Nitrosodiphenylamine | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Nitrobenzene | 161 U | 156 U | 185 UJ | 121 UJ | 178 UJ | 157 U | 202 U | 140 U | 186 UJ |
| Pentachlorophenol | 321 U | 313 U | 369 U | 243 UJ | 355 U | 315 U | 404 U | 280 U | 371 U |
| Phenanthrene | 87 U | 80 U | 8.6 U | 70 U | 7.8 U | 6.3 J | 6 J | 280 U | 8.8 U |
| Phenol | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| Pyrene | 43 J | 80 U | 8.6 U | 40 J | 7.8 U | 14 | 8.7 U | 280 U | 8.8 U |
| Total cresols | 161 U | 156 U | 185 U | 121 UJ | 178 U | 157 U | 202 U | 140 U | 186 U |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 8,100 | 6,200 | 3,900 | 6,600 | 3,100 | 6,700 | 15,000 | 3,700 | 5,500 |
| Antimony | 0.1 J | 0.12 J | 0.17 U | 0.15 U | 0.097 J | 0.098 J | 0.17 U | 0.14 U | 0.2 U |
| Arsenic | 2.9 | 2.4 | 3.2 | 2.1 | 0.93 | 3 | 2 | 1.2 | 4.4 |
| Barium | 60 J | 39 J | 9.1 | 25 | 4.9 | 42 | 14 | 11 | 6.5 |
| Beryllium | 0.5 J | 0.41 J | 0.33 J | 0.22 J | 0.36 U | 0.45 J | 0.72 | 0.27 U | 0.4 J |
| Cadmium | 0.34 | 0.3 J | 0.3 J | 0.11 J | 0.18 U | 0.17 J | 0.14 J | 0.14 U | 0.15 J |
| Calcium | 3,870 | 2,600 | 1,090 | 2,470 | 1,100 | 3,230 | 1,140 | 7,110 | 1,460 |
| Chromium (hexavalent) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | 20 | 16 | 21 | 13 | 16 | 20 | 27 | 7.8 | 23 |
| Cobalt | 6.1 | 5.1 | 2.1 | 1.9 | 0.49 | 5.7 | 2.7 | 0.71 | 3.5 |
| Copper | 13 | 11 | 3.1 | 4.8 | 1.7 | 16 | 3.6 | 3.2 | 3.1 |
| Cyanide | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | 15,000 J | 12,000 J | 13,000 | 15,000 | 4,300 | 16,000 | 10,000 | 5,800 | 16,000 |
| Lead | 20 | 18 | 3 | 7 | 2 | 17 | 3.6 | 2.9 | 3.1 |
| Magnesium | 2,950 | 2,200 | 1,650 | 951 | 1,120 | 2,900 | 2,110 | 674 | 2,180 |
| Manganese | 230 | 170 | 18 | 65 | 2 | 170 | 14 | 29 | 31 |
| Mercury | 0.14 J | 0.16 U | 0.17 U | 0.15 U | 0.18 U | 0.17 U | 0.17 U | 0.14 U | 0.2 U |
| Nickel | 22 | 19 | 5.6 | 6.7 | 1.1 | 23 | 12 | 2.9 | 11 |
| Potassium | 1,320 | 1,210 | 1,120 | 516 | 606 | 1,460 | 1,120 | 230 | 1,220 |
| Selenium | 1.1 | 0.96 | 1 | 0.49 J | 0.49 J | 0.98 | 1.7 | 0.31 J | 0.44 J |
| Silver | 0.079 J | 0.075 J | 0.17 U | 0.15 U | 0.18 U | 0.11 J | 0.17 U | 0.14 U | 0.16 J |
| Sodium | 49.1 J | 28.9 J | 71.3 J+ | 23.2 J+ | 78.2 | 22.4 J+ | 120 | 20.2 J+ | 66.5 J+ |
| Thallium | 0.095 J | 0.083 J | 0.29 J | 0.15 U | 0.079 J | 0.077 J | 0.31 J | 0.14 U | 0.23 J |
| Vanadium | 24 | 18 | 8.9 | 19 | 6.6 | 23 | 10 | 11 | 12 |
| Zinc | 51 | 48 | 53 | 16 | 14 | 38 | 82 | 6.1 | 100 |
| | | | | | | | | | |
| **Wet Chemistry** | | | | | | | | | |
| pH (ph) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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## Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP06 | | | CBD-S09-DP07 | | CBD-S09-DP08 | | CBD-S09-DP09 | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S09-SS06-000H | CBD-S09-SS06P-000H | CBD-S09-SB06-0810 | CBD-S09-SS07-000H | CBD-S09-SB07-0810 | CBD-S09-SS08-000H | CBD-S09-SB08-0810 | CBD-S09-SS09-000H | CBD-S09-SB09-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | | | | | | | |

**Notes:**

Shading indicates detections
NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
J+ - Analyte present, value may be biased high, actual value may be lower
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
MG/KG - Milligrams per kilogram
PH - pH units
UG/KG - Micrograms per kilogram

| **Station ID** | CBD-S09-DP10 | | |
|---|---|---|---|
| **Sample ID** | CBD-S09-SS10-000H | CBD-S09-SB10-0810 | CBD-S09-SB10P-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | |
| | | | |
| **Volatile Organic Compounds (UG/KG)** | | | |
| 1,1,1-Trichloroethane | NA | NA | NA |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA |
| 1,1-Dichloroethene | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA |
| 1,2-Dibromo-3-chloropropane | NA | NA | NA |
| 1,2-Dibromoethane | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA |
| 2-Butanone | NA | NA | NA |
| 2-Hexanone | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA |
| Acetone | NA | NA | NA |
| Benzene | NA | NA | NA |
| Bromochloromethane | NA | NA | NA |
| Bromodichloromethane | NA | NA | NA |
| Bromoform | NA | NA | NA |
| Bromomethane | NA | NA | NA |
| Carbon disulfide | NA | NA | NA |
| Carbon tetrachloride | NA | NA | NA |
| Chlorobenzene | NA | NA | NA |
| Chloroethane | NA | NA | NA |
| Chloroform | NA | NA | NA |
| Chloromethane | NA | NA | NA |
| cis-1,2-Dichloroethene | NA | NA | NA |
| cis-1,3-Dichloropropene | NA | NA | NA |
| Cyclohexane | NA | NA | NA |
| Dibromochloromethane | NA | NA | NA |
| Dichlorodifluoromethane (Freon-12) | NA | NA | NA |
| Ethylbenzene | NA | NA | NA |
| Isopropylbenzene | NA | NA | NA |
| m- and p-Xylene | NA | NA | NA |
| Methyl acetate | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA |
| Methylene chloride | NA | NA | NA |
| Methyl-tert-butyl ether (MTBE) | NA | NA | NA |
| o-Xylene | NA | NA | NA |
| Styrene | NA | NA | NA |
| Tetrachloroethene | NA | NA | NA |
| Toluene | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA |
| trans-1,3-Dichloropropene | NA | NA | NA |
| Trichloroethene | NA | NA | NA |
| Trichlorofluoromethane (Freon-11) | NA | NA | NA |
| Vinyl chloride | NA | NA | NA |
| | | | |
| **Semivolatile Organic Compounds (UG/KG)** | | | |
| 1,1-Biphenyl | 430 U | 540 U | 830 UJ |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 145 U | 178 U | 275 UJ |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA |
| 2,4,5-Trichlorophenol | 145 U | 178 U | 275 U |
| 2,4,6-Trichlorophenol | 145 U | 178 U | 275 U |
| 2,4-Dichlorophenol | 145 U | 178 U | 275 U |
| 2,4-Dimethylphenol | 145 U | 178 U | 275 U |
| 2,4-Dinitrophenol | 1,450 U | 1,780 U | 2,750 U |
| 2,4-Dinitrotoluene | 289 U | 357 U | 550 UJ |
| 2,6-Dinitrotoluene | 145 U | 178 U | 275 UJ |
| 2-Chloronaphthalene | 145 U | 178 U | 275 UJ |
| 2-Chlorophenol | 145 U | 178 U | 275 U |
| 2-Methylnaphthalene | 2.1 U | 2.8 U | 2.6 U |
| 2-Methylphenol | 145 U | 178 U | 275 U |
| 2-Nitroaniline | 289 U | 357 U | 550 UJ |
| 2-Nitrophenol | 145 U | 178 U | 275 U |
| 3,3'-Dichlorobenzidine | 145 U | 178 U | 275 UJ |
| 3-Nitroaniline | 290 U | 360 U | 550 UJ |
| 4,6-Dinitro-2-methylphenol | 1,450 U | 1,780 U | 2,750 U |
| 4-Bromophenyl-phenylether | 289 U | 357 U | 550 UJ |
| 4-Chloro-3-methylphenol | 145 U | 178 U | 275 U |
| 4-Chloroaniline | 145 U | 178 U | 275 UJ |
| 4-Chlorophenyl-phenylether | 289 U | 357 U | 550 UJ |
| 4-Methylphenol | NA | NA | NA |
| 4-Nitroaniline | 145 U | 178 U | 275 UJ |
| 4-Nitrophenol | 290 U | 360 U | 550 U |

## Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP10 | | |
|---|---|---|---|
| **Sample ID** | CBD-S09-SS10-000H | CBD-S09-SB10-0810 | CBD-S09-SB10P-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | |
| Acenaphthene | 1.1 U | 1.5 U | 1.4 U |
| Acenaphthylene | 1.1 U | 1.5 U | 1.4 U |
| Acetophenone | 140 U | 180 U | 280 UJ |
| Anthracene | 4.6 U | 6.1 U | 5.6 U |
| Atrazine | 430 U | 540 U | 830 UJ |
| Benzaldehyde | 430 UJ | 540 UJ | 830 UJ |
| Benzo(a)anthracene | 4.6 U | 6.1 U | 5.6 U |
| Benzo(a)pyrene | 1.8 J | 6.1 U | 5.6 U |
| Benzo(b)fluoranthene | 7.1 U | 9.4 U | 8.6 U |
| Benzo(g,h,i)perylene | 7.1 U | 9.4 U | 8.6 U |
| Benzo(k)fluoranthene | 4.6 U | 6.1 U | 5.6 U |
| bis(2-Chloroethoxy)methane | 145 U | 178 U | 275 UJ |
| bis(2-Chloroethyl)ether | 145 U | 178 U | 275 UJ |
| bis(2-Ethylhexyl)phthalate | 727 U | 794 U | 1,220 UJ |
| Butylbenzylphthalate | 145 U | 178 U | 275 UJ |
| Caprolactam | 3,600 UJ | 4,500 UJ | 6,900 UJ |
| Carbazole | 145 U | 178 U | 275 UJ |
| Chrysene | 4.6 U | 6.1 U | 5.6 U |
| Dibenz(a,h)anthracene | 7.1 U | 9.4 U | 8.6 U |
| Dibenzofuran | 145 U | 178 U | 275 UJ |
| Diethylphthalate | 145 U | 178 U | 275 UJ |
| Dimethyl phthalate | 290 U | 360 U | 550 UJ |
| Di-n-butylphthalate | 145 U | 178 U | 275 UJ |
| Di-n-octylphthalate | 145 U | 178 U | 275 UJ |
| Fluoranthene | 4.6 U | 6.1 U | 5.6 U |
| Fluorene | 2.9 U | 3.7 U | 3.4 U |
| Hexachlorobenzene | 145 U | 178 U | 275 UJ |
| Hexachlorobutadiene | 145 U | 178 U | 275 UJ |
| Hexachlorocyclopentadiene | 145 U | 178 U | 275 UJ |
| Hexachloroethane | 145 U | 178 U | 275 UJ |
| Indeno(1,2,3-cd)pyrene | 7.1 U | 9.4 U | 8.6 U |
| Isophorone | 145 U | 178 U | 275 UJ |
| Naphthalene | 2.1 U | 2.8 U | 2.6 U |
| n-Nitroso-di-n-propylamine | 145 U | 178 U | 275 UJ |
| n-Nitrosodiphenylamine | 145 U | 178 U | 275 UJ |
| Nitrobenzene | 145 U | 178 U | 275 UJ |
| Pentachlorophenol | 289 U | 357 U | 550 U |
| Phenanthrene | 7.1 U | 9.4 U | 8.6 U |
| Phenol | 145 U | 178 U | 275 U |
| Pyrene | 7.1 U | 9.4 U | 8.6 U |
| Total cresols | 145 U | 178 U | 275 U |
| | | | |
| **Total Metals (MG/KG)** | | | |
| Aluminum | 3,000 | 6,200 | 6,300 |
| Antimony | 0.17 U | 0.19 U | 0.18 U |
| Arsenic | 1 | 5.8 J | 3.2 J |
| Barium | 8.9 | 8.5 J | 53 J |
| Beryllium | 0.35 U | 0.46 J | 0.53 J |
| Cadmium | 0.16 J | 0.19 U | 0.18 U |
| Calcium | 7,340 | 1,320 | 1,430 |
| Chromium (hexavalent) | NA | NA | NA |
| Chromium | 8.2 | 24 | 24 |
| Cobalt | 0.72 | 3.7 | 3.3 |
| Copper | 3.7 | 3 | 2.9 |
| Cyanide | NA | NA | NA |
| Iron | 4,900 | 15,000 J | 11,000 J |
| Lead | 7.7 | 4.1 J | 9.2 J |
| Magnesium | 606 | 2,120 | 2,200 |
| Manganese | 21 | 40 | 40 |
| Mercury | 0.17 U | 0.19 U | 0.18 U |
| Nickel | 2.6 | 5.9 | 6.1 |
| Potassium | 309 | 1,140 | 1,320 |
| Selenium | 0.34 J | 1.4 J | 2.3 J |
| Silver | 0.16 J | 0.19 U | 0.18 U |
| Sodium | 17.6 J+ | 69.1 J+ | 73.9 |
| Thallium | 0.17 U | 0.17 J | 0.31 J |
| Vanadium | 8.9 | 13 | 12 |
| Zinc | 27 | 62 | 65 |
| | | | |
| **Wet Chemistry** | | | |
| pH (ph) | NA | NA | NA |
| Total organic carbon (TOC) (mg/kg) | NA | NA | NA |

Appendix D - Site 9 Soil Analytical Data

| **Station ID** | CBD-S09-DP10 | | |
|---|---|---|---|
| **Sample ID** | CBD-S09-SS10-000H | CBD-S09-SB10-0810 | CBD-S09-SB10P-0810 |
| **Sample Date** | 04/04/18 | 04/04/18 | 04/04/18 |
| **Chemical Name** | | | |

**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

MG/KG - Milligrams per kilogram

PH - pH units

UG/KG - Micrograms per kilogram

# Appendix D - AOC D Soil Analytical Data

| **Station ID** | CBD-AOD-DP05 | | CBD-AOD-DP07 | | CBD-AOD-DP10 | | CBD-AOD-DP11 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-AOD-SS05-000H | CBD-AOD-SB05-1H02 | CBD-AOD-SS07-000H | CBD-AOD-SB07-1H02 | CBD-AOD-SS10-000H | CBD-AOD-SB10-1H02 | CBD-AOD-SS11-000H | CBD-AOD-SS11P-000H | CBD-AOD-SB11-1H02 | CBD-AOD-SB11P-1H02 |
| **Sample Date** | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | | | | |
| | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | |
| Lead | 300 | 100 | 1,300 | 24 | 250 | 19 | 220 | 170 | 77 J | 35 J |

**Notes:**

- ▨ Shading indicates detections
- NA - Not analyzed
- J - Analyte present, value may or may not be accurate or precise
- MG/KG - Milligrams per kilogram

Appendix D - AOC D Soil Analytical Data

| **Station ID** | CBD-AOD-DP12 | | | | CBD-AOD-DP13 | | | | CBD-AOD-DP18 | | CBD-AOD-DP19 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-AOD-SS12-000H | CBD-AOD-SS12P-000H | CBD-AOD-SB12-1H02 | CBD-AOD-SB12P-1H02 | CBD-AOD-SS13-000H | CBD-AOD-SS13P-000H | CBD-AOD-SB13-1H02 | CBD-AOD-SB13P-1H02 | CBD-AOD-SS18-000H | CBD-AOD-SB18-1H02 | CBD-AOD-SS19-000H | CBD-AOD-SB19-1H02 |
| **Sample Date** | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 |
| **Chemical Name** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | | |
| Lead | 1,300 | 1,300 | 160 J | 41 J | 2,800 | 2,800 | 42 | 41 | 2,000 | 140 | 370 | 7.8 |

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**Notes:**

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

# Appendix D - AOC D Soil Analytical Data

| **Station ID** | CBD-AOD-DP21 | | CBD-AOD-DP25 | | CBD-AOD-SO01 | | CBD-AOD-SO02 | CBD-AOD-SO03 | CBD-AOD-SO04 |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | CBD-AOD-SS21-000H | CBD-AOD-SB21-1H02 | CBD-AOD-SS25-000H | CBD-AOD-SB25-1H02 | CBD-AOD-SS01-1012 | CBD-AOD-SS01P-1012 | CBD-AOD-SS02-1012 | CBD-AOD-SS03-1012 | CBD-AOD-SS04-1012 |
| **Sample Date** | 04/11/18 | 04/11/18 | 04/11/18 | 04/11/18 | 10/15/12 | 10/15/12 | 10/15/12 | 10/15/12 | 10/15/12 |
| **Chemical Name** | | | | | | | | | |
| | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | |
| Lead | 440 | 63 | 100 | 130 | 2,100 | 2,000 | 3,000 | 2,900 | 1,200 |

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**Notes:**

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

MG/KG - Milligrams per kilogram

Appendix D - Site 3 Groundwater Analytical Data

| **Station ID** | CBD-S03-MW01 | CBD-S03-MW02 | CBD-S03-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S03-GW01-0418 | CBD-S03-GW02-0518 | CBD-S03-GW03-0418 |
| **Sample Date** | 04/25/18 | 05/03/18 | 04/25/18 |
| **Chemical Name** | | | |
| | | | |
| **Volatile Organic Compounds (UG/L)** | | | |
| 1,1,1-Trichloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2,2-Tetrachloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1-Dichloroethene | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromo-3-chloropropane | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromoethane | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dichlorobenzene | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloroethane | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloropropane | 0.4 U | 0.4 U | 0.4 U |
| 1,3-Dichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 1,4-Dichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 2-Butanone | 5 U | 5 U | 5 U |
| 2-Hexanone | 2 U | 2 U | 2 U |
| 4-Methyl-2-pentanone | 0.8 U | 0.8 U | 0.8 U |
| Acetone | 1 U | 1 U | 1 U |
| Benzene | 0.4 U | 0.4 U | 0.4 U |
| Bromodichloromethane | 0.4 U | 0.4 U | 0.4 U |
| Bromoform | 0.8 U | 0.8 U | 0.8 U |
| Bromomethane | 2 UJ | 2 UJ | 2 UJ |
| Carbon disulfide | 1 U | 1 U | 1 U |
| Carbon tetrachloride | 0.8 U | 0.8 U | 0.8 U |
| Chlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| Chloroethane | 0.8 U | 0.8 U | 0.8 U |
| Chloroform | 0.8 U | 0.8 U | 0.8 U |
| Chloromethane | 1 U | 1 U | 1 U |
| cis-1,2-Dichloroethene | 0.8 U | 0.8 U | 0.8 U |
| cis-1,3-Dichloropropene | 0.4 U | 0.4 U | 0.4 U |
| Cyclohexane | 1 U | 1 U | 1 U |
| Dibromochloromethane | 0.8 U | 0.8 U | 0.8 U |
| Dichlorodifluoromethane (Freon-12) | 0.8 U | 0.8 U | 0.8 U |
| Ethylbenzene | 0.8 U | 0.8 U | 0.8 U |
| Isopropylbenzene | 0.8 U | 0.8 U | 0.8 U |
| Methyl acetate | 1 U | 1 U | 1 U |
| Methylcyclohexane | 1 U | 1 U | 1 U |
| Methylene chloride | 1 U | 1 U | 1 U |
| Methyl-tert-butyl ether (MTBE) | 1.5 U | 1.5 U | 1.5 U |
| Styrene | 0.4 U | 0.4 U | 0.4 U |
| Tetrachloroethene | 0.8 U | 0.8 U | 0.8 U |
| Toluene | 0.4 U | 0.4 U | 1.34 J |
| trans-1,2-Dichloroethene | 1 U | 1 U | 1 U |
| trans-1,3-Dichloropropene | 0.4 U | 0.4 U | 0.4 U |
| Trichloroethene | 0.8 U | 0.8 U | 0.8 U |
| Trichlorofluoromethane (Freon-11) | 1.5 U | 1.5 U | 1.5 U |
| Vinyl chloride | 0.8 U | 0.8 U | 0.8 U |
| Xylene, total | 1.8 U | 1.8 U | 1.8 U |
| | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | |
| 1,1-Biphenyl | 6.3 U | 5.7 U | 5.8 U |
| 2,2'-Oxybis(1-chloropropane) | 2.11 U | 1.89 U | 1.92 U |
| 2,4,5-Trichlorophenol | 4.21 U | 3.77 U | 3.85 U |
| 2,4,6-Trichlorophenol | 4.21 U | 3.77 U | 3.85 U |
| 2,4-Dichlorophenol | 4.21 U | 3.77 U | 3.85 U |
| 2,4-Dimethylphenol | 4.21 U | 3.77 U | 3.85 U |
| 2,4-Dinitrophenol | 8.42 U | 7.55 UJ | 7.69 U |
| 2,4-Dinitrotoluene | 8.42 U | 7.55 UJ | 7.69 U |
| 2,6-Dinitrotoluene | 4.21 U | 3.77 U | 3.85 U |
| 2-Chloronaphthalene | 2.11 U | 1.89 U | 1.92 U |
| 2-Chlorophenol | 2.11 U | 1.89 U | 1.92 U |
| 2-Methylnaphthalene | 0.014 U | 0.01 J | 0.012 U |
| 2-Methylphenol | 4.21 U | 3.77 U | 3.85 U |
| 2-Nitroaniline | 4.21 U | 3.77 U | 3.85 U |

# Appendix D - Site 3 Groundwater Analytical Data

| **Station ID** | CBD-S03-MW01 | CBD-S03-MW02 | CBD-S03-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S03-GW01-0418 | CBD-S03-GW02-0518 | CBD-S03-GW03-0418 |
| **Sample Date** | 04/25/18 | 05/03/18 | 04/25/18 |
| **Chemical Name** | | | |
| 2-Nitrophenol | 4.21 U | 3.77 U | 3.85 U |
| 3,3'-Dichlorobenzidine | 4.21 U | 3.77 U | 3.85 U |
| 3-Nitroaniline | 4.2 U | 3.8 U | 3.8 U |
| 4,6-Dinitro-2-methylphenol | 4.21 U | 3.77 U | 3.85 U |
| 4-Bromophenyl-phenylether | 2.11 U | 1.89 U | 1.92 U |
| 4-Chloro-3-methylphenol | 4.21 U | 3.77 UJ | 3.85 U |
| 4-Chloroaniline | 4.21 U | 3.77 UJ | 3.85 U |
| 4-Chlorophenyl-phenylether | 2.11 U | 1.89 U | 1.92 U |
| 4-Nitroaniline | 4.21 U | 3.77 U | 3.85 U |
| 4-Nitrophenol | 8.4 U | 7.5 UJ | 7.7 U |
| Acenaphthene | 0.034 U | 0.031 U | 0.03 U |
| Acenaphthylene | 0.014 U | 0.013 U | 0.012 U |
| Acetophenone | 6.3 U | 5.7 U | 5.8 U |
| Anthracene | 0.023 U | 0.021 U | 0.02 U |
| Atrazine | 6.3 U | 5.7 UJ | 5.8 U |
| Benzaldehyde | 6.3 U | 5.7 U | 5.8 U |
| Benzo(a)anthracene | 0.014 U | 0.0059 J | 0.026 J |
| Benzo(a)pyrene | 0.014 U | 0.013 U | 0.015 J |
| Benzo(b)fluoranthene | 0.014 U | 0.013 U | 0.03 J |
| Benzo(g,h,i)perylene | 0.014 U | 0.013 U | 0.019 J |
| Benzo(k)fluoranthene | 0.014 U | 0.013 U | 0.037 J |
| bis(2-Chloroethoxy)methane | 2.11 U | 1.89 U | 1.92 U |
| bis(2-Chloroethyl)ether | 2.11 U | 1.89 U | 1.92 U |
| bis(2-Ethylhexyl)phthalate | 6.32 U | 5.66 U | 5.77 U |
| Butylbenzylphthalate | 2.11 U | 1.89 U | 1.92 U |
| Caprolactam | 53 U | 47 U | 48 U |
| Carbazole | 2.11 U | 1.89 U | 1.92 U |
| Chrysene | 0.0075 J | 0.0042 J | 0.035 J |
| Dibenz(a,h)anthracene | 0.014 U | 0.013 U | 0.012 U |
| Dibenzofuran | 2.11 U | 1.89 U | 1.92 U |
| Diethylphthalate | 2.11 U | 1.89 UJ | 1.92 U |
| Dimethyl phthalate | 2.1 U | 1.9 U | 1.9 U |
| Di-n-butylphthalate | 2.11 U | 1.89 U | 1.92 U |
| Di-n-octylphthalate | 2.11 U | 1.89 UJ | 1.92 U |
| Fluoranthene | 0.0052 J | 0.0076 J | 0.023 J |
| Fluorene | 0.023 U | 0.021 U | 0.02 U |
| Hexachlorobenzene | 2.11 U | 1.89 U | 1.92 U |
| Hexachlorobutadiene | 2.11 U | 1.89 U | 1.92 U |
| Hexachlorocyclopentadiene | 4.21 U | 3.77 U | 3.85 U |
| Hexachloroethane | 4.21 U | 3.77 U | 3.85 U |
| Indeno(1,2,3-cd)pyrene | 0.023 U | 0.021 U | 0.022 J |
| Isophorone | 2.11 U | 1.89 U | 1.92 U |
| Naphthalene | 0.014 U | 0.018 J | 0.012 U |
| n-Nitroso-di-n-propylamine | 4.21 U | 3.77 U | 3.85 U |
| n-Nitrosodiphenylamine | 4.21 U | 3.77 U | 3.85 U |
| Nitrobenzene | 2.11 U | 1.89 U | 1.92 U |
| Pentachlorophenol | 4.21 U | 3.77 U | 3.85 U |
| Phenanthrene | 0.023 U | 0.03 J | 0.013 J |
| Phenol | 4.21 U | 3.77 U | 3.85 U |
| Pyrene | 0.023 U | 0.021 U | 0.023 J |
| Total cresols | 4.21 U | 3.77 UJ | 3.85 U |
| | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | |
| 4,4'-DDD | 0.0011 U | 0.00105 U | 1.00E-03 U |
| 4,4'-DDE | 0.0018 U | 0.00168 U | 0.0016 U |
| 4,4'-DDT | 0.0012 U | 0.00116 U | 0.0011 U |
| Aldrin | 0.0011 U | 0.00105 U | 1.00E-03 U |
| alpha-BHC | 0.0017 U | 0.00158 U | 0.0015 U |
| alpha-Chlordane | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Aroclor-1016 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1221 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1232 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1242 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1248 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1254 | 0.11 UJ | 0.11 U | 0.1 U |
| Aroclor-1260 | 0.11 UJ | 0.11 U | 0.1 U |

## Appendix D - Site 3 Groundwater Analytical Data

| **Station ID** | CBD-S03-MW01 | CBD-S03-MW02 | CBD-S03-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S03-GW01-0418 | CBD-S03-GW02-0518 | CBD-S03-GW03-0418 |
| **Sample Date** | 04/25/18 | 05/03/18 | 04/25/18 |
| **Chemical Name** | | | |
| beta-BHC | 0.0017 U | 0.00158 U | 0.0015 U |
| delta-BHC | 0.0013 U | 0.00126 U | 0.0012 U |
| Dieldrin | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Endosulfan I | 0.0013 U | 0.00126 U | 0.0012 U |
| Endosulfan II | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Endosulfan sulfate | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Endrin | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Endrin aldehyde | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Endrin ketone | 0.0011 U | 0.00105 U | 1.00E-03 U |
| gamma-BHC (Lindane) | 0.0011 UJ | 0.00105 U | 1.00E-03 UJ |
| Heptachlor | 0.0011 U | 0.00105 U | 1.00E-03 U |
| Heptachlor epoxide | 0.0018 U | 0.00168 U | 0.0016 U |
| Methoxychlor | 0.0014 U | 0.00137 U | 0.0013 U |
| Toxaphene | 0.11 U | 0.105 U | 0.1 U |
| | | | |
| **Total Metals (UG/L)** | | | |
| Aluminum | 5,400 | 160 | 270 |
| Antimony | 0.5 U | 0.5 U | 0.5 U |
| Arsenic | 0.23 J | 0.59 | 0.51 |
| Barium | 16 | 16 | 34 |
| Beryllium | 0.45 J | 0.13 U | 0.96 |
| Cadmium | 3.2 | 0.15 J | 1 |
| Calcium | 6,000 | 50,900 | 9,420 |
| Chromium | 3.4 | 0.63 | 0.15 U |
| Cobalt | 1.8 | 0.49 J | 6.8 |
| Copper | 1.5 | 0.29 U | 0.07 J |
| Iron | 770 | 260 | 7,700 |
| Lead | 2.4 | 0.13 U | 0.1 J |
| Magnesium | 3,380 | 25,500 | 4,670 |
| Manganese | 20 | 48 | 90 |
| Mercury | 0.13 U | 0.13 U | 0.13 U |
| Nickel | 5.7 | 3.2 | 21 |
| Potassium | 2,100 | 1,800 | 3,140 |
| Selenium | 1.1 | 0.5 U | 0.5 U |
| Silver | 0.13 U | 0.13 U | 0.13 U |
| Sodium | 21,100 | 5,520 | 9,860 |
| Thallium | 0.28 J | 0.5 U | 0.5 U |
| Vanadium | 2.1 | 1.5 | 0.25 J |
| Zinc | 31 | 3.1 J+ | 280 |
| | | | |
| **Dissolved Metals (UG/L)** | | | |
| Aluminum, Dissolved | 53 | 9.9 | 240 |
| Antimony, Dissolved | 0.5 U | 0.5 U | 0.5 U |
| Arsenic, Dissolved | 0.13 U | 0.52 | 0.56 |
| Barium, Dissolved | 11 | 15 | 34 |
| Beryllium, Dissolved | 0.35 J | 0.13 U | 2.2 |
| Cadmium, Dissolved | 2.9 | 0.14 J | 1.1 |
| Calcium, Dissolved | 6,050 | 49,400 | 9,960 |
| Chromium, Dissolved | 0.43 J | 0.13 U | 0.11 J |
| Cobalt, Dissolved | 1.5 | 0.41 J | 6.9 |
| Copper, Dissolved | 1.3 | 0.51 | 1.3 |
| Iron, Dissolved | 13 | 22 | 7,400 |
| Lead, Dissolved | 0.37 J | 0.13 U | 0.11 J |
| Magnesium, Dissolved | 2,820 | 25,200 | 4,510 |
| Manganese, Dissolved | 14 | 44 | 88 |
| Mercury, Dissolved | 0.11 J | 0.13 U | 0.16 J |
| Nickel, Dissolved | 4.5 | 3.7 | 21 |
| Potassium, Dissolved | 1,740 | 1,710 | 3,030 |
| Selenium, Dissolved | 0.5 U | 0.5 U | 0.5 U |
| Silver, Dissolved | 0.13 U | 0.13 U | 0.13 U |
| Sodium, Dissolved | 20,200 | 5,370 | 9,600 |
| Thallium, Dissolved | 0.23 J | 0.5 U | 0.5 U |
| Vanadium, Dissolved | 0.13 U | 1.1 | 0.15 J |
| Zinc, Dissolved | 26 | 3.1 | 280 |

## Appendix D - Site 3 Groundwater Analytical Data

| **Station ID** | CBD-S03-MW01 | CBD-S03-MW02 | CBD-S03-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S03-GW01-0418 | CBD-S03-GW02-0518 | CBD-S03-GW03-0418 |
| **Sample Date** | 04/25/18 | 05/03/18 | 04/25/18 |
| **Chemical Name** | | | |

**Notes:**

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UG/L - Micrograms per liter

Appendix D - Site 4 Groundwater Analytical Data

| **Station ID** | CBD-S04-DP02 | CBD-S04-DP03 | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-GW02-1012 | CBD-S04-GW03-1012 | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | 10/19/12 | 10/19/12 | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | | |
| | | | | | | |
| **Volatile Organic Compounds (UG/L)** | | | | | | |
| 1,1,1-Trichloroethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2,2-Tetrachloroethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.5 U | 0.5 U | 1 U | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 0.5 U | 0.5 U | 1 U | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,1-Dichloroethene | 0.5 U | 0.5 U | 1 U | 1 U | 1 U | 1 U |
| 1,2,3-Trichlorobenzene | 0.5 U | 0.5 U | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromo-3-chloropropane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromoethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dichlorobenzene | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloroethane | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloropropane | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| 1,3-Dichlorobenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 1,4-Dichlorobenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| 2-Butanone | 1 U | 1 U | 5 U | 5 U | 5 U | 5 U |
| 2-Hexanone | 1 U | 1 U | 2 U | 2 U | 2 U | 2 U |
| 4-Methyl-2-pentanone | 1 U | 1 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Acetone | 2 U | 2 U | 1 U | 1 U | 1 U | 1 U |
| Benzene | 0.2 U | 0.2 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Bromochloromethane | 0.5 U | 0.5 U | NA | NA | NA | NA |
| Bromodichloromethane | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Bromoform | 1 U | 1 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Bromomethane | 0.57 B | 0.56 B | 2 UJ | 2 UJ | 2 UJ | 2 UJ |
| Carbon disulfide | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Carbon tetrachloride | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Chlorobenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Chloroethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Chloroform | 0.2 U | 0.1 B | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Chloromethane | 0.3 B | 0.36 B | 1 U | 1 U | 1 U | 1 U |
| cis-1,2-Dichloroethene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| cis-1,3-Dichloropropene | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Cyclohexane | 0.5 U | 0.5 U | 1 U | 1 U | 1 U | 1 U |
| Dibromochloromethane | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Dichlorodifluoromethane (Freon-12) | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Ethylbenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Isopropylbenzene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| m- and p-Xylene | 1 U | 1 U | NA | NA | NA | NA |
| Methyl acetate | 1.7 B | 1.8 B | 1 U | 1 U | 1 U | 1 U |
| Methylcyclohexane | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methylene chloride | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| Methyl-tert-butyl ether (MTBE) | 0.5 U | 0.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U |
| o-Xylene | 0.2 U | 0.2 U | NA | NA | NA | NA |
| Styrene | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Tetrachloroethene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Toluene | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| trans-1,2-Dichloroethene | 0.5 U | 0.5 U | 1 U | 1 U | 1 U | 1 U |
| trans-1,3-Dichloropropene | 0.5 U | 0.5 U | 0.4 U | 0.4 U | 0.4 U | 0.4 U |
| Trichloroethene | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Trichlorofluoromethane (Freon-11) | 0.5 U | 0.5 U | 1.5 U | 1.5 U | 1.5 U | 1.5 U |
| Vinyl chloride | 0.5 U | 0.5 U | 0.8 U | 0.8 U | 0.8 U | 0.8 U |
| Xylene, total | NA | NA | 1.8 U | 1.8 U | 1.8 U | 1.8 U |
| | | | | | | |

Appendix D - Site 4 Groundwater Analytical Data

| **Station ID** | CBD-S04-DP02 | CBD-S04-DP03 | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-GW02-1012 | CBD-S04-GW03-1012 | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | 10/19/12 | 10/19/12 | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | | | | |
| 1,1-Biphenyl | 0.1 U | 0.1 UL | 6 UJ | 5.9 U | 6 U | 6.3 U |
| 1,2,4,5-Tetrachlorobenzene | 0.1 U | 0.1 UL | NA | NA | NA | NA |
| 2,2'-Oxybis(1-chloropropane) | 0.1 U | 0.1 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| 2,3,4,6-Tetrachlorophenol | 0.5 U | 0.5 UL | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | 0.5 U | 0.5 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| 2,4,6-Trichlorophenol | 0.5 U | 0.5 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 2,4-Dichlorophenol | 0.25 U | 0.25 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 2,4-Dimethylphenol | 0.5 U | 0.5 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 2,4-Dinitrophenol | 5 U | 5 UL | 8 UJ | 7.84 UJ | 8 UJ | 8.42 UJ |
| 2,4-Dinitrotoluene | 0.1 U | 0.1 UL | 8 UJ | 7.84 UJ | 8 UJ | 8.42 UJ |
| 2,6-Dinitrotoluene | 0.25 U | 0.25 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| 2-Chloronaphthalene | 0.1 U | 0.1 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| 2-Chlorophenol | 0.1 U | 0.1 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| 2-Methylnaphthalene | 0.1 U | 0.1 UL | 0.014 U | 0.0054 J | 0.012 U | 0.013 U |
| 2-Methylphenol | 0.1 U | 0.1 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| 2-Nitroaniline | 0.5 U | 0.5 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 2-Nitrophenol | 0.25 U | 0.25 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| 3,3'-Dichlorobenzidine | 10 U | 10 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 3-Nitroaniline | 0.5 U | 0.5 UL | 4 U | 3.9 U | 4 U | 4.2 U |
| 4,6-Dinitro-2-methylphenol | 1 U | 1 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| 4-Bromophenyl-phenylether | 0.1 U | 0.1 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| 4-Chloro-3-methylphenol | 0.5 U | 0.5 UL | 4 UJ | 3.92 UJ | 4 UJ | 4.21 UJ |
| 4-Chloroaniline | 0.5 U | 0.5 UL | 4 UJ | 3.92 UJ | 4 UJ | 4.21 UJ |
| 4-Chlorophenyl-phenylether | 0.05 U | 0.05 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| 4-Methylphenol | 0.5 U | 0.16 L | NA | NA | NA | NA |
| 4-Nitroaniline | 0.5 U | 0.5 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| 4-Nitrophenol | 2 U | 2 UL | 8 UJ | 7.8 UJ | 8 UJ | 8.4 UJ |
| Acenaphthene | 0.032 J | 0.05 UL | 0.034 U | 0.03 U | 0.029 U | 0.032 U |
| Acenaphthylene | 0.05 U | 0.05 UL | 0.014 U | 0.012 U | 0.012 U | 0.013 U |
| Acetophenone | 0.2 J | 0.15 L | 6 UJ | 5.9 U | 6 U | 6.3 U |
| Anthracene | 0.05 U | 0.05 UL | 0.023 U | 0.02 U | 0.02 U | 0.021 U |
| Atrazine | 0.1 U | 0.1 UL | 6 UJ | 5.9 UJ | 6 UJ | 6.3 UJ |
| Benzaldehyde | 0.12 J | 0.25 UL | 6 U | 5.9 U | 6 U | 6.3 U |
| Benzo(a)anthracene | 0.02 U | 0.022 UL | 0.014 UJ | 0.012 U | 0.0032 J | 0.013 U |
| Benzo(a)pyrene | 0.02 U | 0.022 UL | 0.014 UJ | 0.012 U | 0.012 U | 0.013 U |
| Benzo(b)fluoranthene | 0.02 U | 0.022 UL | 0.014 UJ | 0.012 U | 0.012 U | 0.013 U |
| Benzo(g,h,i)perylene | 0.1 U | 0.1 UL | 0.014 UJ | 0.012 U | 0.012 U | 0.013 U |
| Benzo(k)fluoranthene | 0.02 U | 0.022 UL | 0.021 J | 0.012 U | 0.012 U | 0.013 U |
| bis(2-Chloroethoxy)methane | 0.05 U | 0.05 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| bis(2-Chloroethyl)ether | 0.1 U | 0.1 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| bis(2-Ethylhexyl)phthalate | 0.5 U | 0.5 UL | 6 UJ | 5.88 U | 6 U | 6.32 U |
| Butylbenzylphthalate | 0.5 U | 0.5 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| Caprolactam | 1 UL | 1 UL | 50 U | 49 U | 50 U | 53 U |
| Carbazole | 0.5 U | 0.5 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| Chrysene | 0.1 U | 0.1 UL | 0.004 J | 0.0061 J | 0.004 J | 0.013 U |
| Dibenz(a,h)anthracene | 0.02 U | 0.022 UL | 0.014 UJ | 0.012 U | 0.012 U | 0.013 U |
| Dibenzofuran | 0.1 U | 0.031 L | 2 UJ | 1.96 U | 2 U | 2.11 U |
| Diethylphthalate | 1.9 | 0.082 B | 2 UJ | 1.96 UJ | 2 UJ | 2.11 UJ |
| Dimethyl phthalate | 0.26 J | 0.25 UL | 2 U | 2 U | 2 U | 2.1 U |
| Di-n-butylphthalate | 0.73 J | 0.5 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| Di-n-octylphthalate | 0.5 U | 0.5 UL | 2 UJ | 1.96 UJ | 2 UJ | 2.11 UJ |
| Fluoranthene | 0.05 U | 0.052 L | 0.0062 J | 0.0054 J | 0.0045 J | 0.013 U |
| Fluorene | 0.05 U | 0.05 UL | 0.023 U | 0.02 U | 0.02 U | 0.021 U |
| Hexachlorobenzene | 0.1 U | 0.1 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| Hexachlorobutadiene | 0.05 U | 0.05 UL | 2 U | 1.96 U | 2 U | 2.11 U |

## Appendix D - Site 4 Groundwater Analytical Data

| **Station ID** | CBD-S04-DP02 | CBD-S04-DP03 | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-GW02-1012 | CBD-S04-GW03-1012 | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | 10/19/12 | 10/19/12 | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | | |
| Hexachlorocyclopentadiene | 0.1 U | 0.1 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| Hexachloroethane | 0.1 U | 0.1 UL | 4 U | 3.92 U | 4 U | 4.21 U |
| Indeno(1,2,3-cd)pyrene | 0.02 U | 0.022 UL | 0.023 UJ | 0.02 U | 0.02 U | 0.021 U |
| Isophorone | 0.14 J | 0.1 UL | 2 U | 1.96 U | 2 U | 2.11 U |
| Naphthalene | 0.052 B | 0.044 B | 0.01 J | 0.0075 J | 0.0058 J | 0.0077 J |
| n-Nitroso-di-n-propylamine | 0.1 U | 0.1 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| n-Nitrosodiphenylamine | 0.1 U | 0.1 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| Nitrobenzene | 0.25 U | 0.25 UL | 2 UJ | 1.96 U | 2 U | 2.11 U |
| Pentachlorophenol | 0.5 U | 0.5 UL | 4 UJ | 3.92 U | 4 U | 4.21 U |
| Phenanthrene | 0.05 U | 0.12 B | 0.023 U | 0.014 J | 0.012 J | 0.021 U |
| Phenol | 0.13 J | 0.16 L | 4 U | 3.92 U | 4 U | 4.21 U |
| Pyrene | 0.1 U | 0.031 L | 0.023 U | 0.02 U | 0.02 U | 0.021 U |
| Total cresols | NA | NA | 4 UJ | 3.92 UJ | 4 UJ | 4.21 UJ |
| | | | | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | | | | |
| 4,4'-DDD | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| 4,4'-DDE | NA | NA | 0.00157 UJ | 0.0016 U | 0.00151 U | 0.00168 U |
| 4,4'-DDT | NA | NA | 0.00108 UJ | 0.0011 U | 0.00104 U | 0.00116 U |
| Aldrin | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| alpha-BHC | NA | NA | 0.00147 UJ | 0.0015 U | 0.00142 U | 0.00158 U |
| alpha-Chlordane | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Aroclor-1016 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1221 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1232 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1242 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1248 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1254 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1260 | NA | 0.08 U | 0.098 UJ | 0.1 U | 0.094 U | 0.11 U |
| Aroclor-1262 | NA | 0.08 U | NA | NA | NA | NA |
| Aroclor-1268 | NA | 0.08 U | NA | NA | NA | NA |
| beta-BHC | NA | NA | 0.00147 U | 0.0015 U | 0.00142 U | 0.00158 U |
| delta-BHC | NA | NA | 0.00118 U | 0.0012 U | 0.00113 U | 0.00126 U |
| Dieldrin | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Endosulfan I | NA | NA | 0.00118 UJ | 0.0012 U | 0.00113 U | 0.00126 U |
| Endosulfan II | NA | NA | 9.80E-04 U | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Endosulfan sulfate | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Endrin | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Endrin aldehyde | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Endrin ketone | NA | NA | 9.80E-04 U | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| gamma-BHC (Lindane) | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Heptachlor | NA | NA | 9.80E-04 UJ | 1.00E-03 U | 9.43E-04 U | 0.00105 U |
| Heptachlor epoxide | NA | NA | 0.00157 U | 0.0016 U | 0.00151 U | 0.00168 U |
| Methoxychlor | NA | NA | 0.00127 UJ | 0.0013 U | 0.00123 U | 0.00137 U |
| Toxaphene | NA | NA | 0.098 U | 0.1 U | 0.0943 U | 0.105 U |
| | | | | | | |
| **Total Metals (UG/L)** | | | | | | |
| Aluminum | 24 J | 9,900 | 13,000 | 30 | 31 | 44 |
| Antimony | 0.5 U | 0.5 U | 0.5 UJ | 0.5 U | 0.5 U | 0.5 U |
| Arsenic | 0.5 U | 17 | 1.5 | 0.13 U | 0.13 U | 0.21 J |
| Barium | 81 | 130 | 41 | 34 | 34 | 40 |
| Beryllium | 0.46 J | 0.84 J | 0.79 J- | 0.43 J | 0.42 J | 0.13 U |
| Cadmium | 3.5 | 0.68 | 2.9 | 0.62 | 0.62 | 0.51 |
| Calcium | 3,800 | 9,500 | 4,250 | 8,780 | 8,770 | 22,300 |
| Chromium | 0.47 J | 92 | 5.7 | 0.85 | 0.87 | 0.24 J |
| Cobalt | 11 | 12 | 9.8 | 2.2 | 2.2 | 5 |
| Copper | 2.5 B | 8.7 | 6.9 | 0.42 U | 0.42 U | 0.72 |

Appendix D - Site 4 Groundwater Analytical Data

| **Station ID** | CBD-S04-DP02 | CBD-S04-DP03 | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-GW02-1012 | CBD-S04-GW03-1012 | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | 10/19/12 | 10/19/12 | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | | |
| Cyanide | 4 U | 4 U | NA | NA | NA | NA |
| Iron | 2,200 | 23,000 | 2,800 | 9 U | 7.8 U | 260 |
| Lead | 0.74 J | 18 | 1.8 J- | 0.13 U | 0.13 U | 0.13 U |
| Magnesium | 3,000 | 6,900 | 3,560 | 2,570 | 2,560 | 10,400 |
| Manganese | 130 | 220 | 74 | 13 | 13 | 120 |
| Mercury | 0.2 | 0.1 U | 0.13 R | 0.13 U | 0.13 U | 0.13 U |
| Nickel | 16 | 27 | 13 | 7.9 | 8 | 8.8 |
| Potassium | 2,500 | 4,600 | 2,840 | 2,240 | 2,260 | 2,840 |
| Selenium | 1 U | 2.5 B | 0.54 U | 0.5 U | 0.5 U | 0.77 U |
| Silver | 0.1 U | 0.061 J | 0.13 UJ | 0.13 U | 0.13 U | 0.13 U |
| Sodium | 14,000 | 8,700 | 5,490 | 7,910 | 7,890 | 13,000 |
| Thallium | 0.26 J | 1.5 | 0.54 J | 0.5 U | 0.5 U | 0.2 J |
| Vanadium | 0.2 U | 43 | 4.6 | 0.059 J | 0.061 J | 0.17 J |
| Zinc | 55 | 99 | 120 | 25 | 25 | 23 |
| | | | | | | |
| **Dissolved Metals (UG/L)** | | | | | | |
| Aluminum, Dissolved | 50 U | 50 U | 100 | 21 | 19 | 35 |
| Antimony, Dissolved | 0.48 B | 0.7 B | 0.5 U | 0.5 U | 0.5 U | 0.5 U |
| Arsenic, Dissolved | 0.21 J | 0.19 J | 1.1 | 0.13 U | 0.13 U | 0.2 J |
| Barium, Dissolved | 76 | 46 | 12 | 33 | 32 | 37 |
| Beryllium, Dissolved | 0.54 J | 0.4 U | 0.35 J | 0.56 | 0.5 | 0.14 J |
| Cadmium, Dissolved | 3 | 0.69 | 1.1 | 0.63 | 0.61 | 0.78 |
| Calcium, Dissolved | 3,800 | 8,400 | 6,750 | 8,420 | 8,520 | 24,500 |
| Chromium (hexavalent), Dissolved | 10 R | NA | 5 U | 5 U | 5 U | 5 U |
| Chromium, Dissolved | 0.44 J | 0.79 J | 0.13 U | 0.83 | 0.84 | 0.12 J |
| Cobalt, Dissolved | 11 | 7.4 | 5.9 | 2.2 | 2.2 | 5.9 |
| Copper, Dissolved | 2.5 B | 1.2 B | 0.13 U | 0.89 | 1.3 | 0.13 U |
| Iron, Dissolved | 2,100 | 190 | 960 | 5 U | 4.8 J | 190 |
| Lead, Dissolved | 0.65 J | 0.5 U | 0.13 U | 0.13 U | 0.13 U | 0.13 U |
| Magnesium, Dissolved | 3,100 | 4,000 | 3,360 | 2,450 | 2,420 | 8,120 |
| Manganese, Dissolved | 130 | 230 | 61 | 13 | 14 | 100 |
| Mercury, Dissolved | 0.19 J | 0.1 U | 0.13 R | 0.13 U | 0.13 U | 0.13 U |
| Nickel, Dissolved | 16 | 16 | 8.6 | 8.1 | 9.5 | 9.9 |
| Potassium, Dissolved | 2,300 | 2,100 | 1,870 | 2,110 | 2,120 | 2,790 |
| Selenium, Dissolved | 1 U | 1 U | 0.5 U | 0.29 J | 0.4 J | 0.72 J |
| Silver, Dissolved | 0.1 U | 0.1 U | 0.13 UJ | 0.13 U | 0.13 U | 0.13 U |
| Sodium, Dissolved | 14,000 | 9,400 | 6,690 | 7,640 | 7,660 | 15,200 |
| Thallium, Dissolved | 0.25 J | 0.19 J | 0.22 J | 0.5 U | 0.5 U | 0.37 J |
| Vanadium, Dissolved | 0.2 U | 0.2 U | 0.12 J | 0.053 J | 0.13 U | 0.081 J |
| Zinc, Dissolved | 55 | 57 | 42 | 26 | 26 | 31 |

\\orion\Proj\CLEANII\BASES\NavalResearchLab_ChesBayDetach\CTO JU23 CLEAN 9000 (Basewide Expanded SI)\2 deliverables\Expanded SI Report\5. Final\Appendicies\Appendix E - Validated Analytical Data\[Appendix E - Validated Data.xlsx], D'Onofrio, Jackie/WDC, 12/18/2018

Appendix D - Site 4 Groundwater Analytical Data

| **Station ID** | CBD-S04-DP02 | CBD-S04-DP03 | CBD-S04-MW01 | CBD-S04-MW02 | | CBD-S04-MW03 |
|---|---|---|---|---|---|---|
| **Sample ID** | CBD-S04-GW02-1012 | CBD-S04-GW03-1012 | CBD-S04-GW01-0518 | CBD-S04-GW02-0518 | CBD-S04-GW02P-0518 | CBD-S04-GW03-0518 |
| **Sample Date** | 10/19/12 | 10/19/12 | 05/03/18 | 05/03/18 | 05/03/18 | 05/03/18 |
| **Chemical Name** | | | | | | |

**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

J- - Analyte present, value may be biased low, actual value may be higher

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

UG/L - Micrograms per liter

# Appendix D - Site 5 Groundwater Analytical Data

| **Station ID** | CBD-S05-MW01 | CBD-S05-MW02 | CBD-S05-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S05-GW01-0418 | CBD-S05-GW02-0418 | CBD-S05-GW03-0418 |
| **Sample Date** | 04/25/18 | 04/25/18 | 04/25/18 |
| **Chemical Name** | | | |
| | | | |
| **Volatile Organic Compounds (UG/L)** | | | |
| 1,1,1-Trichloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2,2-Tetrachloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 1 U | 1 U | 1 U |
| 1,1,2-Trichloroethane | 1 U | 1 U | 1 U |
| 1,1-Dichloroethane | 0.8 U | 0.8 U | 0.8 U |
| 1,1-Dichloroethene | 1 U | 1 U | 1 U |
| 1,2,4-Trichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromo-3-chloropropane | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dibromoethane | 0.8 U | 0.8 U | 0.8 U |
| 1,2-Dichlorobenzene | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloroethane | 0.4 U | 0.4 U | 0.4 U |
| 1,2-Dichloropropane | 0.4 U | 0.4 U | 0.4 U |
| 1,3-Dichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 1,4-Dichlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| 2-Butanone | 5 U | 5 U | 5 U |
| 2-Hexanone | 2 U | 2 U | 2 U |
| 4-Methyl-2-pentanone | 0.8 U | 0.8 U | 0.8 U |
| Acetone | 1 U | 1 U | 1 U |
| Benzene | 0.4 U | 0.4 U | 0.4 U |
| Bromodichloromethane | 0.4 U | 0.4 U | 0.4 U |
| Bromoform | 0.8 U | 0.8 U | 0.8 U |
| Bromomethane | 2 UJ | 2 UJ | 2 UJ |
| Carbon disulfide | 1.04 | 1 U | 1.53 |
| Carbon tetrachloride | 0.8 U | 0.8 U | 0.8 U |
| Chlorobenzene | 0.8 U | 0.8 U | 0.8 U |
| Chloroethane | 0.8 U | 0.8 U | 0.8 U |
| Chloroform | 0.8 U | 0.8 U | 0.8 U |
| Chloromethane | 1 U | 1 U | 1 U |
| cis-1,2-Dichloroethene | 0.8 U | 0.8 U | 0.8 U |
| cis-1,3-Dichloropropene | 0.4 U | 0.4 U | 0.4 U |
| Cyclohexane | 1 U | 1 U | 1 U |
| Dibromochloromethane | 0.8 U | 0.8 U | 0.8 U |
| Dichlorodifluoromethane (Freon-12) | 0.8 U | 0.8 U | 0.8 U |
| Ethylbenzene | 0.8 U | 0.8 U | 0.8 U |
| Isopropylbenzene | 0.8 U | 0.8 U | 0.8 U |
| Methyl acetate | 1 U | 1 U | 1 U |
| Methylcyclohexane | 1 U | 1 U | 1 U |
| Methylene chloride | 1 U | 1 U | 1 U |
| Methyl-tert-butyl ether (MTBE) | 1.5 U | 1.5 U | 1.5 U |
| Styrene | 0.4 U | 0.4 U | 0.4 U |
| Tetrachloroethene | 0.8 U | 0.8 U | 0.8 U |
| Toluene | 0.4 U | 0.4 U | 0.4 U |
| trans-1,2-Dichloroethene | 1 U | 1 U | 1 U |
| trans-1,3-Dichloropropene | 0.4 U | 0.4 U | 0.4 U |
| Trichloroethene | 0.8 U | 0.8 U | 0.8 U |
| Trichlorofluoromethane (Freon-11) | 1.5 U | 1.5 U | 1.5 U |
| Vinyl chloride | 0.8 U | 0.8 U | 0.8 U |
| Xylene, total | 1.8 U | 1.8 U | 1.8 U |
| | | | |
| **Semivolatile Organic Compounds (UG/L)** | | | |
| 1,1-Biphenyl | 5.9 U | 6.7 U | 5.8 U |
| 2,2'-Oxybis(1-chloropropane) | 1.96 U | 2.22 U | 1.92 U |
| 2,4,5-Trichlorophenol | 3.92 U | 4.44 U | 3.85 U |
| 2,4,6-Trichlorophenol | 3.92 U | 4.44 U | 3.85 U |
| 2,4-Dichlorophenol | 3.92 U | 4.44 U | 3.85 U |
| 2,4-Dimethylphenol | 3.92 U | 4.44 U | 3.85 U |
| 2,4-Dinitrophenol | 7.84 U | 8.89 U | 7.69 U |
| 2,4-Dinitrotoluene | 7.84 U | 8.89 U | 7.69 U |
| 2,6-Dinitrotoluene | 3.92 U | 4.44 U | 3.85 U |
| 2-Chloronaphthalene | 1.96 U | 2.22 U | 1.92 U |
| 2-Chlorophenol | 1.96 U | 2.22 U | 1.92 U |
| 2-Methylnaphthalene | 0.012 U | 0.012 U | 0.012 U |
| 2-Methylphenol | 3.92 U | 4.44 U | 3.85 U |
| 2-Nitroaniline | 3.92 U | 4.44 U | 3.85 U |
| 2-Nitrophenol | 3.92 U | 4.44 U | 3.85 U |
| 3,3'-Dichlorobenzidine | 3.92 U | 4.44 U | 3.85 U |
| 3-Nitroaniline | 3.9 U | 4.4 U | 3.8 U |
| 4,6-Dinitro-2-methylphenol | 3.92 U | 4.44 U | 3.85 U |
| 4-Bromophenyl-phenylether | 1.96 U | 2.22 U | 1.92 U |
| 4-Chloro-3-methylphenol | 3.92 U | 4.44 U | 3.85 U |
| 4-Chloroaniline | 3.92 U | 4.44 U | 3.85 U |
| 4-Chlorophenyl-phenylether | 1.96 U | 2.22 U | 1.92 U |

## Appendix D - Site 5 Groundwater Analytical Data

| **Station ID** | CBD-S05-MW01 | CBD-S05-MW02 | CBD-S05-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S05-GW01-0418 | CBD-S05-GW02-0418 | CBD-S05-GW03-0418 |
| **Sample Date** | 04/25/18 | 04/25/18 | 04/25/18 |
| **Chemical Name** | | | |
| 4-Nitroaniline | 3.92 U | 4.44 U | 3.85 U |
| 4-Nitrophenol | 7.8 U | 8.9 U | 7.7 U |
| Acenaphthene | 0.031 U | 0.03 U | 0.029 U |
| Acenaphthylene | 0.012 U | 0.012 U | 0.012 U |
| Acetophenone | 5.9 U | 6.7 U | 5.8 U |
| Anthracene | 0.02 U | 0.02 U | 0.019 U |
| Atrazine | 5.9 U | 6.7 U | 5.8 U |
| Benzaldehyde | 5.9 U | 6.7 U | 5.8 U |
| Benzo(a)anthracene | 0.012 U | 0.009 J | 0.0046 J |
| Benzo(a)pyrene | 0.012 U | 0.012 U | 0.012 U |
| Benzo(b)fluoranthene | 0.012 U | 0.012 U | 0.012 U |
| Benzo(g,h,i)perylene | 0.012 U | 0.012 U | 0.012 U |
| Benzo(k)fluoranthene | 0.012 U | 0.012 U | 0.012 U |
| bis(2-Chloroethoxy)methane | 1.96 U | 2.22 U | 1.92 U |
| bis(2-Chloroethyl)ether | 1.96 U | 2.22 U | 1.92 U |
| bis(2-Ethylhexyl)phthalate | 5.88 U | 6.67 U | 5.77 U |
| Butylbenzylphthalate | 1.96 U | 2.22 U | 1.92 U |
| Caprolactam | 49 U | 56 U | 48 U |
| Carbazole | 1.96 U | 2.22 U | 1.92 U |
| Chrysene | 0.012 U | 0.0095 J | 0.0065 J |
| Dibenz(a,h)anthracene | 0.012 U | 0.012 U | 0.012 U |
| Dibenzofuran | 1.96 U | 2.22 U | 1.92 U |
| Diethylphthalate | 1.96 U | 2.22 U | 1.92 U |
| Dimethyl phthalate | 2 U | 2.2 U | 1.9 U |
| Di-n-butylphthalate | 1.96 U | 2.22 U | 1.92 U |
| Di-n-octylphthalate | 1.96 U | 2.22 U | 1.92 U |
| Fluoranthene | 0.0053 J | 0.0085 J | 0.0051 J |
| Fluorene | 0.02 U | 0.02 U | 0.019 U |
| Hexachlorobenzene | 1.96 U | 2.22 U | 1.92 U |
| Hexachlorobutadiene | 1.96 U | 2.22 U | 1.92 U |
| Hexachlorocyclopentadiene | 3.92 U | 4.44 U | 3.85 U |
| Hexachloroethane | 3.92 U | 4.44 U | 3.85 U |
| Indeno(1,2,3-cd)pyrene | 0.02 U | 0.02 U | 0.019 U |
| Isophorone | 1.96 U | 2.22 U | 1.92 U |
| Naphthalene | 0.012 U | 0.012 U | 0.012 U |
| n-Nitroso-di-n-propylamine | 3.92 U | 4.44 U | 3.85 U |
| n-Nitrosodiphenylamine | 3.92 U | 4.44 U | 3.85 U |
| Nitrobenzene | 1.96 U | 2.22 U | 1.92 U |
| Pentachlorophenol | 3.92 U | 4.44 U | 3.85 U |
| Phenanthrene | 0.02 U | 0.02 U | 0.019 U |
| Phenol | 3.92 U | 4.44 U | 3.85 U |
| Pyrene | 0.02 U | 0.02 U | 0.019 U |
| Total cresols | 3.92 U | 4.44 U | 3.85 U |
| | | | |
| **Pesticide/Polychlorinated Biphenyls (UG/L)** | | | |
| 4,4'-DDD | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| 4,4'-DDE | 0.0015 U | 0.0016 U | 0.0016 U |
| 4,4'-DDT | 1.00E-03 U | 0.0011 U | 0.0011 U |
| Aldrin | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| alpha-BHC | 0.0014 U | 0.0015 U | 0.0015 U |
| alpha-Chlordane | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Aroclor-1016 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1221 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1232 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1242 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1248 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1254 | 0.094 UJ | 0.1 U | 0.098 UJ |
| Aroclor-1260 | 0.094 UJ | 0.1 U | 0.098 UJ |
| beta-BHC | 0.0014 U | 0.0015 U | 0.0015 U |
| delta-BHC | 0.0011 U | 0.0012 U | 0.0012 U |
| Dieldrin | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Endosulfan I | 0.0011 U | 0.0012 U | 0.0012 U |
| Endosulfan II | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Endosulfan sulfate | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Endrin | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Endrin aldehyde | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Endrin ketone | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| gamma-BHC (Lindane) | 9.40E-04 UJ | 1.00E-03 UJ | 9.80E-04 UJ |
| Heptachlor | 9.40E-04 U | 1.00E-03 U | 9.80E-04 U |
| Heptachlor epoxide | 0.0015 U | 0.0016 U | 0.0016 U |
| Methoxychlor | 0.0012 U | 0.0013 U | 0.0013 U |
| Toxaphene | 0.094 U | 0.1 U | 0.098 U |
| | | | |
| **Total Metals (UG/L)** | | | |

# Appendix D - Site 5 Groundwater Analytical Data

| **Station ID** | CBD-S05-MW01 | CBD-S05-MW02 | CBD-S05-MW03 |
|---|---|---|---|
| **Sample ID** | CBD-S05-GW01-0418 | CBD-S05-GW02-0418 | CBD-S05-GW03-0418 |
| **Sample Date** | 04/25/18 | 04/25/18 | 04/25/18 |
| **Chemical Name** | | | |
| Aluminum | 26 J+ | 430 | 35 J+ |
| Antimony | 0.5 U | 0.5 U | 0.5 U |
| Arsenic | 0.33 J | 0.77 | 0.16 J |
| Barium | 29 | 60 | 36 |
| Beryllium | 0.13 U | 0.15 J | 0.13 U |
| Cadmium | 0.5 | 0.79 | 0.81 |
| Calcium | 155,000 | 106,000 | 61,900 |
| Chromium | 0.3 U | 1.1 | 0.52 |
| Cobalt | 1 | 4.9 | 6.5 |
| Copper | 0.13 U | 0.82 | 0.33 J |
| Iron | 83 | 480 | 48 |
| Lead | 0.13 U | 0.42 J | 0.13 U |
| Magnesium | 2,730 | 5,060 | 7,780 |
| Manganese | 29 | 56 | 44 |
| Mercury | 0.13 U | 0.13 U | 0.13 U |
| Nickel | 4.4 | 8.8 | 21 |
| Potassium | 1,240 | 1,420 | 2,430 |
| Selenium | 0.61 U | 0.75 U | 0.88 U |
| Silver | 0.13 U | 0.13 U | 0.13 U |
| Sodium | 5,740 | 6,680 | 5,730 |
| Thallium | 0.5 U | 0.5 U | 0.16 J |
| Vanadium | 0.59 | 1.5 | 0.47 J |
| Zinc | 3 J+ | 15 | 30 |
| | | | |
| **Dissolved Metals (UG/L)** | | | |
| Aluminum, Dissolved | 4.2 J+ | 38 | 11 J+ |
| Antimony, Dissolved | 0.5 U | 0.5 U | 0.5 U |
| Arsenic, Dissolved | 0.35 J | 0.44 J | 0.25 J |
| Barium, Dissolved | 28 | 59 | 44 |
| Beryllium, Dissolved | 0.13 U | 0.13 U | 0.13 U |
| Cadmium, Dissolved | 0.48 J | 0.74 | 0.4 J |
| Calcium, Dissolved | 149,000 | 117,000 | 74,200 |
| Chromium, Dissolved | 0.14 J | 0.2 J | 0.11 J |
| Cobalt, Dissolved | 0.95 J | 3.6 | 2 |
| Copper, Dissolved | 0.49 U | 0.28 U | 1.2 |
| Iron, Dissolved | 53 | 72 | 30 |
| Lead, Dissolved | 0.13 U | 0.13 U | 0.13 U |
| Magnesium, Dissolved | 2,600 | 4,380 | 5,800 |
| Manganese, Dissolved | 27 | 50 | 42 |
| Mercury, Dissolved | 0.13 U | 0.13 U | 0.09 J |
| Nickel, Dissolved | 4.4 | 7.3 | 6.6 |
| Potassium, Dissolved | 1,180 | 1,310 | 2,520 |
| Selenium, Dissolved | 0.5 U | 0.29 J | 0.75 J |
| Silver, Dissolved | 0.13 U | 0.13 U | 0.13 U |
| Sodium, Dissolved | 5,550 | 6,110 | 5,390 |
| Thallium, Dissolved | 0.5 U | 0.5 U | 0.5 U |
| Vanadium, Dissolved | 0.52 | 0.76 | 0.34 J |
| Zinc, Dissolved | 4.4 | 8.3 | 7.5 |

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**Notes:**

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

J+ - Analyte present, value may be biased high, actual value may be lower

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UG/L - Micrograms per liter

# Appendix D - Site 9 Groundwater Analytical Data

| **Station ID** | CBD-S09-DP01 | CBD-S09-DP03 |
|---|---|---|
| **Sample ID** | CBD-S09-GW01P-1012 | CBD-S09-GW01-1012 |
| **Sample Date** | 10/15/12 | 10/15/12 |
| **Chemical Name** | | |
| | | |
| **Volatile Organic Compounds (UG/L)** | | |
| 1,1,1-Trichloroethane | 0.5 U | 0.5 U |
| 1,1,2,2-Tetrachloroethane | 0.5 U | 0.5 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.5 U | 0.5 U |
| 1,1,2-Trichloroethane | 0.5 U | 0.5 U |
| 1,1-Dichloroethane | 0.5 U | 0.5 U |
| 1,1-Dichloroethene | 0.5 U | 0.5 U |
| 1,2,3-Trichlorobenzene | 0.5 U | 0.5 U |
| 1,2,4-Trichlorobenzene | 0.5 U | 0.5 U |
| 1,2-Dibromo-3-chloropropane | 0.5 U | 0.5 U |
| 1,2-Dibromoethane | 0.5 U | 0.5 U |
| 1,2-Dichlorobenzene | 0.5 U | 0.5 U |
| 1,2-Dichloroethane | 0.5 U | 0.5 U |
| 1,2-Dichloropropane | 0.5 U | 0.5 U |
| 1,3-Dichlorobenzene | 0.5 U | 0.5 U |
| 1,4-Dichlorobenzene | 0.5 U | 0.5 U |
| 2-Butanone | 1 U | 1 U |
| 2-Hexanone | 1 U | 1 U |
| 4-Methyl-2-pentanone | 1 U | 1 U |
| Acetone | 2 UJ | 2 U |
| Benzene | 0.2 U | 0.2 U |
| Bromochloromethane | 0.5 U | 0.5 U |
| Bromodichloromethane | 0.5 U | 0.5 U |
| Bromoform | 1 U | 1 U |
| Bromomethane | 0.5 U | 0.87 B |
| Carbon disulfide | 1 U | 4.7 B |
| Carbon tetrachloride | 0.5 U | 0.5 U |
| Chlorobenzene | 0.5 U | 0.5 U |
| Chloroethane | 0.5 U | 0.5 U |
| Chloroform | 0.2 U | 0.2 U |
| Chloromethane | 0.5 U | 0.51 B |
| cis-1,2-Dichloroethene | 0.5 U | 0.5 U |
| cis-1,3-Dichloropropene | 0.5 U | 0.5 U |
| Cyclohexane | 0.5 U | 0.5 U |
| Dibromochloromethane | 0.5 U | 0.5 U |
| Dichlorodifluoromethane (Freon-12) | 0.5 U | 0.5 U |
| Ethylbenzene | 0.5 U | 0.5 U |
| Isopropylbenzene | 0.5 U | 0.5 U |
| m- and p-Xylene | 1 U | 1 U |
| Methyl acetate | 1.8 B | 1.9 B |
| Methylcyclohexane | 1 U | 1 U |
| Methylene chloride | 1 U | 1 U |
| Methyl-tert-butyl ether (MTBE) | 0.5 U | 0.5 U |
| o-Xylene | 0.2 U | 0.2 U |
| Styrene | 0.5 U | 0.5 U |
| Tetrachloroethene | 0.5 U | 0.5 U |
| Toluene | 0.5 U | 0.5 U |
| trans-1,2-Dichloroethene | 0.5 U | 0.5 U |
| trans-1,3-Dichloropropene | 0.5 U | 0.5 U |
| Trichloroethene | 0.5 U | 0.5 U |
| Trichlorofluoromethane (Freon-11) | 0.5 U | 0.5 U |
| Vinyl chloride | 0.5 U | 0.5 U |
| | | |
| **Semivolatile Organic Compounds (UG/L)** | | |
| 1,1-Biphenyl | 0.1 U | 0.1 U |
| 1,2,4,5-Tetrachlorobenzene | 0.1 U | 0.1 U |
| 2,2'-Oxybis(1-chloropropane) | 0.1 U | 0.1 U |
| 2,3,4,6-Tetrachlorophenol | 0.5 U | 0.5 U |
| 2,4,5-Trichlorophenol | 0.5 U | 0.5 U |
| 2,4,6-Trichlorophenol | 0.5 U | 0.5 U |
| 2,4-Dichlorophenol | 0.25 U | 0.25 U |
| 2,4-Dimethylphenol | 0.5 U | 0.5 U |
| 2,4-Dinitrophenol | 5 U | 5 U |
| 2,4-Dinitrotoluene | 0.1 U | 0.1 U |
| 2,6-Dinitrotoluene | 0.25 U | 0.25 U |
| 2-Chloronaphthalene | 0.1 U | 0.1 U |
| 2-Chlorophenol | 0.1 U | 0.1 U |
| 2-Methylnaphthalene | 0.1 U | 0.1 U |
| 2-Methylphenol | 0.1 U | 0.1 U |
| 2-Nitroaniline | 0.5 U | 0.5 U |
| 2-Nitrophenol | 0.25 U | 0.25 U |
| 3,3'-Dichlorobenzidine | 10 U | 10 U |
| 3-Nitroaniline | 0.5 U | 0.5 U |

## Appendix D - Site 9 Groundwater Analytical Data

| **Station ID** | CBD-S09-DP01 | CBD-S09-DP03 |
|---|---|---|
| **Sample ID** | CBD-S09-GW01P-1012 | CBD-S09-GW01-1012 |
| **Sample Date** | 10/15/12 | 10/15/12 |
| **Chemical Name** | | |
| 4,6-Dinitro-2-methylphenol | 1 U | 1 U |
| 4-Bromophenyl-phenylether | 0.1 U | 0.1 U |
| 4-Chloro-3-methylphenol | 0.5 U | 0.5 U |
| 4-Chloroaniline | 0.5 U | 0.5 U |
| 4-Chlorophenyl-phenylether | 0.05 U | 0.05 U |
| 4-Methylphenol | 0.5 U | 0.5 U |
| 4-Nitroaniline | 0.5 U | 0.5 U |
| 4-Nitrophenol | 2 U | 2 U |
| Acenaphthene | 0.05 U | 0.05 U |
| Acenaphthylene | 0.05 U | 0.05 U |
| Acetophenone | 0.1 U | 0.1 U |
| Anthracene | 0.05 U | 0.05 U |
| Atrazine | 0.1 U | 0.1 U |
| Benzaldehyde | 0.25 U | 0.25 U |
| Benzo(a)anthracene | 0.02 U | 0.02 U |
| Benzo(a)pyrene | 0.02 U | 0.02 U |
| Benzo(b)fluoranthene | 0.02 U | 0.02 U |
| Benzo(g,h,i)perylene | 0.09 B | 0.1 U |
| Benzo(k)fluoranthene | 0.02 U | 0.02 U |
| bis(2-Chloroethoxy)methane | 0.05 U | 0.05 U |
| bis(2-Chloroethyl)ether | 0.1 U | 0.1 U |
| bis(2-Ethylhexyl)phthalate | 0.5 U | 0.5 U |
| Butylbenzylphthalate | 0.5 U | 0.5 U |
| Caprolactam | 1 UL | 1 UL |
| Carbazole | 0.5 U | 0.5 U |
| Chrysene | 0.4 B | 0.1 U |
| Dibenz(a,h)anthracene | 0.02 U | 0.02 U |
| Dibenzofuran | 0.1 U | 0.1 U |
| Diethylphthalate | 0.16 B | 0.11 B |
| Dimethyl phthalate | 0.25 U | 0.25 U |
| Di-n-butylphthalate | 0.5 U | 0.5 U |
| Di-n-octylphthalate | 0.5 U | 0.5 U |
| Fluoranthene | 0.06 B | 0.05 U |
| Fluorene | 0.05 U | 0.05 U |
| Hexachlorobenzene | 0.1 U | 0.1 U |
| Hexachlorobutadiene | 0.05 U | 0.05 U |
| Hexachlorocyclopentadiene | 0.1 U | 0.1 U |
| Hexachloroethane | 0.1 U | 0.1 U |
| Indeno(1,2,3-cd)pyrene | 0.02 U | 0.02 U |
| Isophorone | 0.1 U | 0.1 U |
| Naphthalene | 0.05 J | 0.03 J |
| n-Nitroso-di-n-propylamine | 0.1 U | 0.1 U |
| n-Nitrosodiphenylamine | 0.1 U | 0.1 U |
| Nitrobenzene | 0.25 U | 0.25 U |
| Pentachlorophenol | 0.5 U | 0.5 U |
| Phenanthrene | 0.03 B | 0.05 U |
| Phenol | 0.05 U | 0.05 U |
| Pyrene | 0.06 B | 0.1 U |
| | | |
| **Total Metals (UG/L)** | | |
| Aluminum | 1,100 J | 72 B |
| Antimony | 0.4 B | 0.5 U |
| Arsenic | 0.54 J | 0.5 U |
| Barium | 62 | 47 |
| Beryllium | 0.2 J | 0.4 U |
| Cadmium | 1.3 | 1.2 |
| Calcium | 34,000 J | 14,000 J |
| Chromium | 7.9 J | 0.91 J |
| Cobalt | 3.1 | 1.7 |
| Copper | 13 J | 2.6 B |
| Cyanide | 4 U | 4 U |
| Iron | 1,800 J | 140 J |
| Lead | 0.93 J | 0.22 J |
| Magnesium | 6,300 J | 4,600 J |
| Manganese | 110 J | 21 J |
| Mercury | 0.1 U | 0.1 U |
| Nickel | 15 J | 5.1 J |
| Potassium | 10,000 | 9,100 |
| Selenium | 1 U | 1 U |
| Silver | 0.1 U | 0.1 U |
| Sodium | 32,000 | 28,000 |
| Thallium | 0.29 J | 0.22 B |
| Vanadium | 2.9 J | 0.45 J |
| Zinc | 56 B | 29 B |

# Appendix D - Site 9 Groundwater Analytical Data

| **Station ID** | CBD-S09-DP01 | CBD-S09-DP03 |
|---|---|---|
| **Sample ID** | CBD-S09-GW01P-1012 | CBD-S09-GW01-1012 |
| **Sample Date** | 10/15/12 | 10/15/12 |
| **Chemical Name** | | |
| | | |
| **Dissolved Metals (UG/L)** | | |
| Aluminum, Dissolved | 23 B | 17 B |
| Antimony, Dissolved | 0.28 B | 0.52 B |
| Arsenic, Dissolved | 0.27 J | 2 |
| Barium, Dissolved | 38 | 37 |
| Beryllium, Dissolved | 0.4 U | 0.2 J |
| Cadmium, Dissolved | 1.1 | 1.3 |
| Calcium, Dissolved | 13,000 | 15,000 L |
| Chromium (hexavalent), Dissolved | 10 UJ | 10 UJ |
| Chromium, Dissolved | 0.6 J | 1 |
| Cobalt, Dissolved | 1.5 | 1.5 |
| Copper, Dissolved | 1.4 B | 1.6 B |
| Iron, Dissolved | 30 J | 8.1 J |
| Lead, Dissolved | 0.5 U | 0.45 J |
| Magnesium, Dissolved | 4,700 | 5,100 L |
| Manganese, Dissolved | 15 | 15 |
| Mercury, Dissolved | 0.1 U | 0.1 U |
| Nickel, Dissolved | 3.6 | 3.7 |
| Potassium, Dissolved | 8,900 | 9,500 |
| Selenium, Dissolved | 0.64 J | 1.6 |
| Silver, Dissolved | 0.1 U | 0.51 |
| Sodium, Dissolved | 29,000 | 32,000 L |
| Thallium, Dissolved | 0.32 J | 1 |
| Vanadium, Dissolved | 0.31 J | 0.66 J |
| Zinc, Dissolved | 22 B | 25 B |

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**Notes:**

Shading indicates detections

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

L - Analyte present, value may be biased low, actual value may be higher

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

UG/L - Micrograms per liter

# Appendix F
# Human Health Risk Screening Tables

Table 1. Summary of Data Used in Baseline Human Health Risk Assessment

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Medium/Sampling Station | Sample ID | Sample Type | Sample Date | Parameters |
|---|---|---|---|---|
| ***Site 3 Groundwater*** | | | | |
| CBD-S03-MW01 | CBD-S03-GW01-0418 | N | 4/25/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S03-MW02 | CBD-S03-GW02-0518 | N | 5/3/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S03-MW03 | CBD-S03-GW03-0418 | N | 4/25/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| ***Site 3 Surface Soil*** | | | | |
| CBD-S03-DP01 | CBD-S03-SS01-1012 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S03-DP02 | CBD-S03-SS02-1012 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S03-DP03 | CBD-S03-SS03-1012 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S03-DP04 | CBD-S03-SS04-1012 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S03-DP05 | CBD-S03-SS05-1012 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S03-DP06 | CBD-S03-SS06-000H | N | 4/3/2018 | Pesticide |
| CBD-S03-DP07 | CBD-S03-SS07-000H | N | 4/3/2018 | Pesticide |
| CBD-S03-DP08 | CBD-S03-SS08-000H | N | 4/3/2018 | Pesticide |
| CBD-S03-DP09 | CBD-S03-SS09-000H | N | 4/3/2018 | Pesticide |
| CBD-S03-DP10 | CBD-S03-SS10-000H | N | 4/3/2018 | Pesticide |
| CBD-S03-DP11 | CBD-S03-SS11-000H | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP11 | CBD-S03-SS11P-000H | FD | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP12 | CBD-S03-SS12-000H | N | 4/4/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP13 | CBD-S03-SS13-000H | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP14 | CBD-S03-SS14-000H | N | 4/4/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP15 | CBD-S03-SS15-000H | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 3 Subsurface Soil*** | | | | |
| CBD-S03-DP01 | CBD-S03-SB01-1315 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP01 | CBD-S03-SB01P-1315 | FD | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP02 | CBD-S03-SB02-2022 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP03 | CBD-S03-SB03-2022 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP04 | CBD-S03-SB04-1820 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP05 | CBD-S03-SB05-1315 | N | 10/17/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S03-DP06 | CBD-S03-SB06-0810 | N | 4/3/2018 | Pesticide |
| CBD-S03-DP07 | CBD-S03-SB07-0810 | N | 4/3/2018 | Pesticide |
| CBD-S03-DP08 | CBD-S03-SB08-0810 | N | 4/3/2018 | Pesticide |
| CBD-S03-DP09 | CBD-S03-SB09-0810 | N | 4/3/2018 | Pesticide |
| CBD-S03-DP10 | CBD-S03-SB10-0810 | N | 4/3/2018 | Pesticide |
| CBD-S03-DP11 | CBD-S03-SB11-0810 | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP12 | CBD-S03-SB12-0810 | N | 4/4/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP13 | CBD-S03-SB13-0810 | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP14 | CBD-S03-SB14-0810 | N | 4/4/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP15 | CBD-S03-SB15-0810 | N | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S03-DP15 | CBD-S03-SB15P-0810 | FD | 4/3/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 4 Groundwater*** | | | | |
| CBD-S04-DP02 | CBD-S04-GW02-1012 | N | 10/19/2012 | VOC, SVOC, Total Metals, Dissolved Metals |
| CBD-S04-DP03 | CBD-S04-GW03-1012 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals, Dissolved Metals |
| CBD-S04-MW01 | CBD-S04-GW01-0518 | N | 5/3/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S04-MW02 | CBD-S04-GW02-0518 | N | 5/3/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S04-MW02 | CBD-S04-GW02P-0518 | FD | 5/3/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S04-MW03 | CBD-S04-GW03-0518 | N | 5/3/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| ***Site 4 Surface Soil*** | | | | |
| CBD-S04-DP01 | CBD-S04-SS01-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP01 | CBD-S04-SS01P-1012 | FD | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP02 | CBD-S04-SS02-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP03 | CBD-S04-SS03-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP04 | CBD-S04-SS04-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP05 | CBD-S04-SS05-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-SO06 | CBD-S04-SS06-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S04-DP07 | CBD-S04-SS07-000H | N | 4/5/2018 | Pesticide |
| CBD-S04-DP08 | CBD-S04-SS08-000H | N | 4/5/2018 | Pesticide |
| CBD-S04-DP09 | CBD-S04-SS09-000H | N | 4/4/2018 | Pesticide |
| CBD-S04-DP10 | CBD-S04-SS10-000H | N | 4/4/2018 | Pesticide |
| CBD-S04-DP11 | CBD-S04-SS11-000H | N | 4/5/2018 | Pesticide |
| CBD-S04-DP12 | CBD-S04-SS12-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP13 | CBD-S04-SS13-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP13 | CBD-S04-SS13P-000H | FD | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP14 | CBD-S04-SS14-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP15 | CBD-S04-SS15-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP16 | CBD-S04-SS16-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 4 Subsurface Soil*** | | | | |
| CBD-S04-DP01 | CBD-S04-SB01-1820 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S04-DP02 | CBD-S04-SB02-1618 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S04-DP03 | CBD-S04-SB03-1416 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S04-DP04 | CBD-S04-SB04-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S04-DP05 | CBD-S04-SB05-1315 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |

Table 1. Summary of Data Used in Baseline Human Health Risk Assessment

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Medium/Sampling Station | Sample ID | Sample Type | Sample Date | Parameters |
|---|---|---|---|---|
| CBD-S04-DP07 | CBD-S04-SB07-0810 | N | 4/5/2018 | Pesticide |
| CBD-S04-DP08 | CBD-S04-SB08-0810 | N | 4/5/2018 | Pesticide |
| CBD-S04-DP09 | CBD-S04-SB09-0810 | N | 4/4/2018 | Pesticide |
| CBD-S04-DP10 | CBD-S04-SB10-0810 | N | 4/4/2018 | Pesticide |
| CBD-S04-DP11 | CBD-S04-SB11-0810 | N | 4/5/2018 | Pesticide |
| CBD-S04-DP12 | CBD-S04-SB12-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP12 | CBD-S04-SB12P-0810 | FD | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP13 | CBD-S04-SB13-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP14 | CBD-S04-SB14-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP15 | CBD-S04-SB15-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S04-DP16 | CBD-S04-SB16-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 5 Groundwater*** |  | N |  |  |
| CBD-S05-MW01 | CBD-S05-GW01-0418 | N | 4/25/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S05-MW02 | CBD-S05-GW02-0418 | N | 4/25/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| CBD-S05-MW03 | CBD-S05-GW03-0418 | N | 4/25/2018 | VOC, SVOC, Pesticide/PCB, Total Metals, Dissolved Metals |
| ***Site 5 Surface Soil*** |  |  |  |  |
| CBD-S05-DP01 | CBD-S05-SS01-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP01 | CBD-S05-SS01P-1012 | FD | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP02 | CBD-S05-SS02-1012 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP03 | CBD-S05-SS03-1012 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP04 | CBD-S05-SS04-1012 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP05 | CBD-S05-SS05-1012 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-SO06 | CBD-S05-SS06-1012 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals, Wet Chemistry |
| CBD-S05-DP07 | CBD-S05-SS07-000H | N | 4/5/2018 | Pesticide |
| CBD-S05-DP08 | CBD-S05-SS08-000H | N | 4/5/2018 | Pesticide |
| CBD-S05-DP09 | CBD-S05-SS09-000H | N | 4/5/2018 | Pesticide |
| CBD-S05-DP10 | CBD-S05-SS10-000H | N | 4/5/2018 | Pesticide |
| CBD-S05-DP11 | CBD-S05-SS11-000H | N | 4/5/2018 | Pesticide |
| CBD-S05-DP12 | CBD-S05-SS12-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP13 | CBD-S05-SS13-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP13 | CBD-S05-SS13P-000H | FD | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP14 | CBD-S05-SS14-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP15 | CBD-S05-SS15-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP16 | CBD-S05-SS16-000H | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS17 | CBD-S05-SS17-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS18 | CBD-S05-SS18-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS18 | CBD-S05-SS18P-000H | FD | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS19 | CBD-S05-SS19-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS20 | CBD-S05-SS20-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS21 | CBD-S05-SS21-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS22 | CBD-S05-SS22-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-SS23 | CBD-S05-SS23-000H | N | 4/6/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 5 Subsurface Soil*** |  |  |  |  |
| CBD-S05-DP01 | CBD-S05-SB01-2022 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP01 | CBD-S05-SB01P-2022 | FD | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP02 | CBD-S05-SB02-2022 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP03 | CBD-S05-SB03-1820 | N | 10/18/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP04 | CBD-S05-SB04-2022 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP05 | CBD-S05-SB05-2022 | N | 10/19/2012 | VOC, SVOC, PCB, Total Metals |
| CBD-S05-DP07 | CBD-S05-SB07-0810 | N | 4/5/2018 | Pesticide |
| CBD-S05-DP08 | CBD-S05-SB08-0810 | N | 4/5/2018 | Pesticide |
| CBD-S05-DP09 | CBD-S05-SB09-0810 | N | 4/5/2018 | Pesticide |
| CBD-S05-DP10 | CBD-S05-SB10-0810 | N | 4/5/2018 | Pesticide |
| CBD-S05-DP11 | CBD-S05-SB11-0810 | N | 4/5/2018 | Pesticide |
| CBD-S05-DP12 | CBD-S05-SB12-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP12 | CBD-S05-SB12P-0810 | FD | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP13 | CBD-S05-SB13-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP14 | CBD-S05-SB14-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP15 | CBD-S05-SB15-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| CBD-S05-DP16 | CBD-S05-SB16-0810 | N | 4/5/2018 | SVOC, Pesticide/PCB, Total Metals |
| ***Site 7 Surface Soil*** |  |  |  |  |
| CBD-S07-DP01 | CBD-S07-SS01-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP01 | CBD-S07-SS01P-1012 | FD | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP02 | CBD-S07-SS02-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP03 | CBD-S07-SS03-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP04 | CBD-S07-SS04-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP05 | CBD-S07-SS05-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP06 | CBD-S07-SS06-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP07 | CBD-S07-SS07-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP08 | CBD-S07-SS08-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |
| CBD-S07-DP09 | CBD-S07-SS09-1012 | N | 10/22/2012 | VOC, PCB, Total Metals, Wet Chemistry |

Table 1. Summary of Data Used in Baseline Human Health Risk Assessment

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Medium/Sampling Station | Sample ID | Sample Type | Sample Date | Parameters |
|---|---|---|---|---|
| CBD-S07-DP20 | CBD-S07-SS20-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP21 | CBD-S07-SS21-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP21 | CBD-S07-SS21P-000H | FD | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP22 | CBD-S07-SS22-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP23 | CBD-S07-SS23-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP24 | CBD-S07-SS24-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP25 | CBD-S07-SS25-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP26 | CBD-S07-SS26-000H | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP27 | CBD-S07-SS27-000H | N | 4/4/2018 | PCB, Total Metals |
| ***Site 7 Subsurface Soil*** | | | | |
| CBD-S07-DP01 | CBD-S07-SB01-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP01 | CBD-S07-SB01P-0608 | FD | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP02 | CBD-S07-SB02-0507 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP03 | CBD-S07-SB03-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP04 | CBD-S07-SB04-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP05 | CBD-S07-SB05-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP06 | CBD-S07-SB06-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP07 | CBD-S07-SB07-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP08 | CBD-S07-SB08-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP09 | CBD-S07-SB09-0608 | N | 10/22/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP10 | CBD-S07-SB10-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP10 | CBD-S07-SB10P-0204 | FD | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP11 | CBD-S07-SB11-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP12 | CBD-S07-SB12-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP13 | CBD-S07-SB13-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP14 | CBD-S07-SB14-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP15 | CBD-S07-SB15-0204 | N | 10/17/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP16 | CBD-S07-SB16-0204 | N | 10/19/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP17 | CBD-S07-SB17-0204 | N | 10/19/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP18 | CBD-S07-SB18-0204 | N | 10/19/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP19 | CBD-S07-SB19-0204 | N | 10/19/2012 | VOC, PCB, Total Metals |
| CBD-S07-DP20 | CBD-S07-SB20-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP21 | CBD-S07-SB21-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP22 | CBD-S07-SB22-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP23 | CBD-S07-SB23-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP24 | CBD-S07-SB24-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP25 | CBD-S07-SB25-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP25 | CBD-S07-SB25P-0508 | FD | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP26 | CBD-S07-SB26-0508 | N | 4/3/2018 | PCB, Total Metals |
| CBD-S07-DP27 | CBD-S07-SB27-0508 | N | 4/4/2018 | PCB, Total Metals |
| ***Site 9 Surface Soil*** | | | | |
| CBD-S09-DP01 | CBD-S09-SS01-1012 | N | 10/12/2012 | VOC, SVOC,Total Metals, Wet Chemistry |
| CBD-S09-DP01 | CBD-S09-SS01P-1012 | FD | 10/12/2012 | VOC, SVOC,Total Metals, Wet Chemistry |
| CBD-S09-DP02 | CBD-S09-SS02-1012 | N | 10/12/2012 | VOC, SVOC,Total Metals, Wet Chemistry |
| CBD-S09-DP03 | CBD-S09-SS03-1012 | N | 10/12/2012 | VOC, SVOC,Total Metals, Wet Chemistry |
| CBD-S09-DP04 | CBD-S09-SS04-1012 | N | 10/12/2012 | VOC, SVOC,Total Metals, Wet Chemistry |
| CBD-S09-DP05 | CBD-S09-SS05-000H | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP06 | CBD-S09-SS06-000H | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP06 | CBD-S09-SS06P-000H | FD | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP07 | CBD-S09-SS07-000H | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP08 | CBD-S09-SS08-000H | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP09 | CBD-S09-SS09-000H | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP10 | CBD-S09-SS10-000H | N | 4/4/2018 | SVOC, Total Metals |
| ***Site 9 Subsurface Soil*** | | | | |
| CBD-S09-DP01 | CBD-S09-SB01-1315 | N | 10/12/2012 | VOC, SVOC, Total Metals |
| CBD-S09-DP02 | CBD-S09-SB02-1315 | N | 10/12/2012 | VOC, SVOC, Total Metals |
| CBD-S09-DP03 | CBD-S09-SB03-1315 | N | 10/12/2012 | VOC, SVOC, Total Metals |
| CBD-S09-DP04 | CBD-S09-SB04-1315 | N | 10/12/2012 | VOC, SVOC, Total Metals |
| CBD-S09-DP05 | CBD-S09-SB05-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP06 | CBD-S09-SB06-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP07 | CBD-S09-SB07-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP08 | CBD-S09-SB08-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP09 | CBD-S09-SB09-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP10 | CBD-S09-SB10-0810 | N | 4/4/2018 | SVOC, Total Metals |
| CBD-S09-DP10 | CBD-S09-SB10P-0810 | FD | 4/4/2018 | SVOC, Total Metals |
| ***Surface Soil*** | | | | |
| CBD-AOD-SO01 | CBD-AOD-SS01-1012 | N | 10/15/2012 | Lead |
| CBD-AOD-SO01 | CBD-AOD-SS01P-1012 | FD | 10/15/2012 | Lead |
| CBD-AOD-SO02 | CBD-AOD-SS02-1012 | N | 10/15/2012 | Lead |
| CBD-AOD-SO03 | CBD-AOD-SS03-1012 | N | 10/15/2012 | Lead |
| CBD-AOD-SO04 | CBD-AOD-SS04-1012 | N | 10/15/2012 | Lead |

Table 1. Summary of Data Used in Baseline Human Health Risk Assessment

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Medium/Sampling Station | Sample ID | Sample Type | Sample Date | Parameters |
|---|---|---|---|---|
| CBD-AOD-DP05 | CBD-AOD-SS05-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP07 | CBD-AOD-SS07-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP10 | CBD-AOD-SS10-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP11 | CBD-AOD-SS11-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP11 | CBD-AOD-SS11P-000H | FD | 4/11/2018 | Lead |
| CBD-AOD-DP12 | CBD-AOD-SS12-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP12 | CBD-AOD-SS12P-000H | FD | 4/11/2018 | Lead |
| CBD-AOD-DP13 | CBD-AOD-SS13-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP13 | CBD-AOD-SS13P-000H | FD | 4/11/2018 | Lead |
| CBD-AOD-DP18 | CBD-AOD-SS18-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP19 | CBD-AOD-SS19-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP21 | CBD-AOD-SS21-000H | N | 4/11/2018 | Lead |
| CBD-AOD-DP25 | CBD-AOD-SS25-000H | N | 4/11/2018 | Lead |
| ***Subsurface Soil*** | | | | |
| CBD-AOD-DP05 | CBD-AOD-SB05-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP07 | CBD-AOD-SB07-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP10 | CBD-AOD-SB10-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP11 | CBD-AOD-SB11-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP11 | CBD-AOD-SB11P-1H02 | FD | 4/11/2018 | Lead |
| CBD-AOD-DP12 | CBD-AOD-SB12-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP12 | CBD-AOD-SB12P-1H02 | FD | 4/11/2018 | Lead |
| CBD-AOD-DP13 | CBD-AOD-SB13-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP13 | CBD-AOD-SB13P-1H02 | FD | 4/11/2018 | Lead |
| CBD-AOD-DP18 | CBD-AOD-SB18-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP19 | CBD-AOD-SB19-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP21 | CBD-AOD-SB21-1H02 | N | 4/11/2018 | Lead |
| CBD-AOD-DP25 | CBD-AOD-SB25-1H02 | N | 4/11/2018 | Lead |

Notes:

N = normal sample

FD = field duplicate sample

# Appendix F.1
# Site 3 Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potentail Concern - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening [2] | Background Value [3] | Screening Toxicity Value [4] | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for Contaminant Deletion or Selection [5] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 108-10-1 | 4-Methyl-2-pentanone | 3.0E-03 J | 3.0E-03 J | MG/KG | CBD-S03-SS03-1012 | 1/5 | 0.0042 - 0.005 | 3.0E-03 | N/A | 3.3E+03 N | 1.4E-01 | SSL | NO | BSL |
| | 67-64-1 | Acetone | 6.5E-02 J | 6.5E-02 J | MG/KG | CBD-S03-SS05-1012 | 1/5 | 0.031 - 0.071 | 6.5E-02 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 67-66-3 | Chloroform | 1.4E-04 J | 1.4E-04 J | MG/KG | CBD-S03-SS05-1012 | 1/5 | 0.00018 - 0.00028 | 1.4E-04 | N/A | 3.2E-01 C | 6.1E-05 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 2.8E-04 J | 2.8E-04 J | MG/KG | CBD-S03-SS03-1012 | 1/5 | 0.21 - 0.25 | 2.8E-04 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 7.6E-04 J | 1.5E-03 J | MG/KG | CBD-S03-SS04-1012 | 3/10 | 0.0011 - 0.0018 | 1.5E-03 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 208-96-8 | Acenaphthylene | 6.9E-04 J | 1.2E-02 | MG/KG | CBD-S03-SS14-000H | 3/10 | 0.0011 - 0.0018 | 1.2E-02 | N/A | 3.6E+02 N | N/A | | NO | BSL |
| | 120-12-7 | Anthracene | 2.6E-03 J | 1.3E-02 | MG/KG | CBD-S03-SS14-000H | 2/10 | 0.0011 -0.00 65 | 1.3E-02 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 1.5E-02 | 2.9E-02 | MG/KG | CBD-S03-SS14-000H | 2/10 | 0.0018 - 0.041 | 2.9E-02 | N/A | 1.1E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 50-32-8 | Benzo(a)pyrene | 2.9E-03 J | 4.8E-02 | MG/KG | CBD-S03-SS04-1012 | 6/10 | 0.0029 - 0.0074 | 4.8E-02 | N/A | 1.1E-01 C | 2.9E-02 | SSL | NO | BSL |
| | 205-99-2 | Benzo(b)fluoranthene | 1.5E-02 | 1.2E-01 | MG/KG | CBD-S03-SS04-1012 | 4/10 | 0.0023 - 0.023 | 1.2E-01 | N/A | 1.1E+00 C | 3.0E-01 | SSL | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 9.1E-03 J | 4.2E-02 | MG/KG | CBD-S03-SS04-1012, CBD-S03-SS14-000H | 4/10 | 0.0018 - 0.01 | 4.2E-02 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 1.3E-02 | 5.8E-02 | MG/KG | CBD-S03-SS04-1012 | 3/10 | 0.0026 - 0.0089 | 5.8E-02 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 218-01-9 | Chrysene | 2.4E-02 J | 4.7E-02 | MG/KG | CBD-S03-SS14-000H | 2/10 | 0.0022 - 0.045 | 4.7E-02 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | 53-70-3 | Dibenz(a,h)anthracene | 3.7E-03 J | 1.0E-02 J | MG/KG | CBD-S03-SS14-000H | 5/10 | 0.0029 - 0.01 | 1.0E-02 | N/A | 1.1E-01 C | 9.6E-02 | SSL | NO | BSL |
| | 206-44-0 | Fluoranthene | 2.9E-02 J | 5.2E-02 | MG/KG | CBD-S03-SS14-000H | 3/10 | 0.0018 - 0.011 | 5.2E-02 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 86-73-7 | Fluorene | 1.1E-03 J | 2.1E-03 J | MG/KG | CBD-S03-SS14-000H | 3/10 | 0.0018 - 0.04 | 2.1E-03 | N/A | 2.4E+02 N | 5.4E-01 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 1.0E-02 J | 5.1E-02 | MG/KG | CBD-S03-SS14-000H | 4/10 | 0.0036 - 0.01 | 5.1E-02 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 6.6E-03 J | 2.1E-02 | MG/KG | CBD-S03-SS04-1012 | 4/10 | 0.0011 - 0.0078 | 2.1E-02 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 3.4E-03 J | 6.8E-02 | MG/KG | CBD-S03-SS04-1012 | 5/10 | 0.0015 - 0.013 | 6.8E-02 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 72-55-9 | 4,4'-DDE | 2.7E-03 | 1.4E-02 | MG/KG | CBD-S03-SS15-000H | 3/9 | 0.00013 - 0.00029 | 1.4E-02 | N/A | 2.0E+00 C | 1.1E-02 | SSL | NO | BSL |
| | **11096-82-5** | **Aroclor-1260** | **4.1E-02** | **5.5E+00** | **MG/KG** | **CBD-S03-SS03-1012** | **10/10** | **0.0071 - 0.290** | **5.5E+00** | **N/A** | **2.4E-01 C** | **5.5E-03** | **SSL** | **YES** | **ASL** |
| | 7429-90-5 | **Aluminum** | 4.5E+03 | 7.9E+03 | MG/KG | CBD-S03-SS05-1012 | 10/10 | N/A | 7.9E+03 | 1.3E+04 | 7.7E+03 N | 3.0E+03 | SSL | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 7.6E-02 J | 9.0E-01 | MG/KG | CBD-S03-SS03-1012 | 10/10 | N/A | 9.0E-01 | 4.2E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **1.2E+00** | **1.4E+01** | **MG/KG** | **CBD-S03-SS03-1012** | **10/10** | **N/A** | **1.4E+01** | **6.4E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 9.8E+00 | 4.4E+01 | MG/KG | CBD-S03-SS05-1012 | 10/10 | N/A | 4.4E+01 | 5.8E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 2.4E-01 J | 6.4E-01 | MG/KG | CBD-S03-SS05-1012 | 10/10 | N/A | 6.4E-01 | 8.1E-01 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 5.5E-02 | 1.7E+00 | MG/KG | CBD-S03-SS15-000H | 10/10 | N/A | 1.7E+00 | 1.7E+00 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 1.8E+02 | 7.8E+05 | MG/KG | CBD-S03-SS11-000H | 10/10 | N/A | 7.8E+05 | 9.4E+03 | N/A | N/A | | NO | NUT |
| | 18540-29-9 | Chromium (hexavalent) | 1.5E-01 J | 1.5E-01 J | MG/KG | CBD-S03-SS01-1012 | 1/1 | N/A | 1.5E-01 | 4.0E-01 | 3.0E-01 C | 6.7E-04 | SSL | NO | BSL |
| | 7440-47-3 | Chromium | 6.2E+00 | 1.6E+01 | MG/KG | CBD-S03-SS13-000H | 10/10 | N/A | 1.6E+01 | 3.1E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **1.4E+00** | **3.9E+00** | **MG/KG** | **CBD-S03-SS14-000H** | **10/10** | **N/A** | **3.9E+00** | **1.2E+01** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.9E+00 | 1.6E+01 | MG/KG | CBD-S03-SS15-000H | 10/10 | N/A | 1.6E+01 | 2.7E+01 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 57-12-5 | Cyanide | 4.3E-02 J | 4.3E-02 J | MG/KG | CBD-S03-SS05-1012 | 1/5 | N/A | 4.3E-02 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **5.6E+03** | **1.0E+04** | **MG/KG** | **CBD-S03-SS13-000H** | **10/10** | **N/A** | **1.0E+04** | **4.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 2.9E+00 | 9.5E+01 | MG/KG | CBD-S03-SS15-000H | 10/10 | N/A | 9.5E+01 | 5.0E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 4.8E+02 | 8.0E+05 | MG/KG | CBD-S03-SS11-000H | 10/10 | N/A | 8.0E+05 | 3.8E+03 | N/A | N/A | | NO | NUT |

### Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potentail Concern - Site 3

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7439-96-5 | Manganese | 2.0E+01 | 1.6E+02 | MG/KG | CBD-S03-SS01-1012 | 10/10 | N/A | 1.6E+02 | 2.0E+02 | 1.8E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 7439-97-6 | Mercury | 7.8E-03 J | 1.2E-02 J | MG/KG | CBD-S03-SS01-1012 | 4/10 | 0.017 - 0.19 | 1.2E-02 | 1.9E-01 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 2.3E+00 | 1.0E+01 | MG/KG | CBD-S03-SS01-1012 | 10/10 | N/A | 1.0E+01 | 1.2E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 2.5E+02 | 5.8E+05 | MG/KG | CBD-S03-SS11-000H | 10/10 | N/A | 5.8E+05 | 1.5E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 2.5E-01 | 1.3E+00 | MG/KG | CBD-S03-SS12-000H | 9/10 | N/A | 1.3E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 2.4E-02 J | 1.4E-01 J | MG/KG | CBD-S03-SS13-000H | 8/10 | 0.15 - 0.19 | 1.4E-01 | 1.4E+00 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.4E+01 J+ | 3.8E+05 J | MG/KG | CBD-S03-SS11P-000H | 4/10 | 6.3 - 12.9 | 3.8E+05 | 3.1E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **8.0E-02** | **2.4E-01 J** | **MG/KG** | **CBD-S03-SS05-1012 : CBD-S03-SS12-000H** | **10/10** | **N/A** | **2.4E-01** | **1.3E+00** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 8.2E+00 | 1.8E+01 | MG/KG | CBD-S03-SS03-1012 | 10/10 | N/A | 1.8E+01 | 3.0E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 2.9E+01 | 7.0E+01 | MG/KG | CBD-S03-SS15-000H | 8/10 | N/A | 7.0E+01 | 7.9E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of $10^{-6}$ for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for acenaphthene used as surrogate for acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/
To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level
from November 2019 RSL Table. If risk-based SSL not available,
used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.1a. Step 2 Surface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Step 1 COPC** | **Detection Frequency** | **Maximum Detected Concentration (Qualifier) (MG/KG)** | **Sample Location of Maximum Detected Concentration** | **Noncarcinogenic Residential Soil RSL HQ=1** | **Carcinogenic Residential Soil RSL ELCR = 1E-06** | **Hazard Index[a]** | **Cancer Risk[b]** | **Target Organ** |
|---|---|---|---|---|---|---|---|---|
| Aroclor-1260 | 10 / 10 | 5.5E+00 | CBD-S03-SS03-1012 | N/A | 2.4E-01 | N/A | 2E-05 | N/A |
| Aluminum | 10 / 10 | 7.9E+03 | CBD-S03-SS05-1012 | 7.7E+04 | N/A | 0.1 | N/A | Neurological |
| **Arsenic** | **10 / 10** | **1.4E+01** | **CBD-S03-SS03-1012** | **3.5E+01** | **6.8E-01** | **0.4** | **2E-05** | **Cardiovascular, Dermal** |
| Cobalt | 10 / 10 | 3.9E+00 | CBD-S03-SS14-000H | 2.3E+01 | 4.2E+02 | 0.2 | 9E-09 | Thyroid, Respiratory |
| Iron | 10 / 10 | 1.0E+04 | CBD-S03-SS13-000H | 5.5E+04 | N/A | 0.2 | N/A | Gastrointestinal |
| **Thallium** | **10 / 10** | **2.4E-01 J** | **CBD-S03-SS05-1012 : CBD-S03-SS12-000H** | **7.8E-01** | **N/A** | **0.3** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **1** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **4E-05** | |

Total Neurological HI = 0.1
Total Cardiovascular HI = 0.4
Total Dermal HI = 0.7
Total Thyroid HI = 0.2
Total Respiratory HI = 0.2
Total Gastrointestinal HI = 0.2

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

**Table 2.1b. Step 3 Surface Soil Screening - Risk Ratio, 95% UCL, Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| **Aroclor-1260** | **10 / 10** | **3.7E+00** | **95% Adjusted Gamma UCL** | **1, 3** | **N/A** | **2.4E-01** | **N/A** | **2E-05** | **NA** |
| **Arsenic** | **10 / 10** | **6.1E+00** | **95% H-UCL** | **1** | **3.5E+01** | **6.8E-01** | **0.2** | **9E-06** | **Cardiovascular, Dermal** |
| Thallium | 10 / 10 | 2.1E-01 | 95% Student's-t UCL | 2 | 7.8E-01 | N/A | 0.3 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **0.4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **2E-05** | |

Total Cardiovascular HI = 0.2

Total Dermal HI = 0.4

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit

MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

**Table 2.1c. Comparison of Concentrations of COPCs to Background Concentrations - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | **7440-38-2** | **Arsenic** | **1.2E+00** | **1.4E+01** | **MG/KG** | **CBD-S03-SS03-1012** | **10/10** | **N/A** | **1.4E+01** | **6.4E+00** | **YES** |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background value is the surface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram
N/A = not applicable

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 22 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 71-43-2 | Benzene | 3.8E-04 J | 3.8E-04 J | MG/KG | CBD-S03-SB04-1820 | 1/5 | 0.00047 - 0.0009 | 3.8E-04 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
| | 100-41-4 | Ethylbenzene | 2.2E-04 J | 2.2E-04 J | MG/KG | CBD-S03-SB04-1820 | 1/5 | 0.00047 - 0.0009 | 2.2E-04 | N/A | 5.8E+00 C | 1.7E-03 | SSL | NO | BSL |
| | m&pXYLENE | m- and p-Xylene | 4.3E-04 J | 4.3E-04 J | MG/KG | CBD-S03-SB04-1820 | 1/5 | 0.00047 - 0.0009 | 4.3E-04 | N/A | 5.8E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 108-87-2 | Methylcyclohexane | 1.8E-04 J | 1.8E-04 J | MG/KG | CBD-S03-SB04-1820 | 1/5 | 0.00047 - 0.0009 | 1.8E-04 | N/A | 6.1E+01 N | N/A | | NO | BSL |
| | 75-09-2 | Methylene chloride | 1.8E-02 | 1.8E-02 | MG/KG | CBD-S03-SB05-1315 | 1/5 | 0.00047 - 0.0009 | 1.8E-02 | N/A | 3.5E+01 N | 2.7E-03 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 1.1E-03 J | 1.1E-03 J | MG/KG | CBD-S03-SB04-1820 | 1/5 | 0.00047 - 0.0009 | 1.1E-03 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 1.5E-03 J | 1.5E-03 J | MG/KG | CBD-S03-SB02-2022 | 1/5 | 0000.23 - 0.00045 | 1.5E-03 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 5.8E-04 J | 5.8E-04 J | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0029 | 5.8E-04 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 120-12-7 | Anthracene | 1.7E-03 J | 1.7E-03 J | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0054 | 1.7E-03 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 1.1E-02 | 1.1E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0054 | 1.1E-02 | N/A | 1.1E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 50-32-8 | Benzo(a)pyrene | 1.4E-02 | 1.4E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0032 - 0.0054 | 1.4E-02 | N/A | 1.1E-01 C | 2.9E-02 | SSL | NO | BSL |
| | 205-99-2 | Benzo(b)fluoranthene | 2.6E-02 | 2.6E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0037 - 0.0083 | 2.6E-02 | N/A | 1.1E+00 C | 3.0E-01 | SSL | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 1.2E-02 | 1.2E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0083 | 1.2E-02 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 218-01-9 | Chrysene | 1.6E-02 | 1.6E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0054 | 1.6E-02 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | 53-70-3 | Dibenz(a,h)anthracene | 3.2E-03 J | 3.2E-03 J | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0032 - 0.0083 | 3.2E-03 | N/A | 1.1E-01 C | 9.6E-02 | SSL | NO | BSL |
| | 206-44-0 | Fluoranthene | 1.6E-02 | 1.6E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0054 | 1.6E-02 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 1.5E-02 | 1.5E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0037 - 0.0083 | 1.5E-02 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 8.6E-03 J | 8.6E-03 J | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0019 - 0.0083 | 8.6E-03 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 1.3E-02 | 1.3E-02 | MG/KG | CBD-S03-SB12-0810 | 1/10 | 0.0037 - 0.0083 | 1.3E-02 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 11096-82-5 | Aroclor-1260 | 4.9E-03 J | 8.1E-02 | MG/KG | CBD-S03-SB03-2022 | 4/10 | 0.0037 - 0.0083 | 8.1E-02 | N/A | 2.4E-01 C | 5.5E-03 | SSL | NO | BSL |
| | 7429-90-5 | Aluminum | 1.6E+03 | 6.1E+03 | MG/KG | CBD-S03-SB04-1820 | 10/10 | N/A | 6.1E+03 | 1.6E+04 | 7.7E+03 N | 3.0E+03 | SSL | NO | BSL |
| | 7440-36-0 | Antimony | 7.1E-02 J | 1.8E-01 | MG/KG | CBD-S03-SB02-2022 | 8/10 | 0.14 - 0.17 | 1.8E-01 | 5.5E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **2.8E-01** | **5.2E+00** | **MG/KG** | **CBD-S03-SB02-2022** | **10/10** | **N/A** | **5.2E+00** | **9.8E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 3.1E+00 | 1.4E+01 | MG/KG | CBD-S03-SB02-2022 | 10/10 | N/A | 1.4E+01 | 5.7E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.2E-01 | 1.1E+00 | MG/KG | CBD-S03-SB03-2022 | 6/10 | 0.27 - 0.33 | 1.1E+00 | 1.2E+00 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 1.8E-01 | 9.3E-01 | MG/KG | CBD-S03-SB04-1820 | 3/10 | 0.14 - 0.17 | 9.3E-01 | 8.1E-01 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 4.7E+01 | 3.6E+04 | MG/KG | CBD-S03-SB04-1820 | 9/10 | N/A | 3.6E+04 | 1.4E+03 | N/A | N/A | | NO | NUT |
| | **18540-29-9** | **Chromium (hexavalent)** | **5.8E-01** | **5.8E-01** | **MG/KG** | **CBD-S03-SB01P-1315** | **1/1** | **N/A** | **5.8E-01** | **4.9E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |
| | 7440-47-3 | Chromium | 3.5E+00 | 2.6E+01 | MG/KG | CBD-S03-SB04-1820 | 10/10 | N/A | 2.6E+01 | 5.8E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **2.4E-01 J** | **5.0E+00** | **MG/KG** | **CBD-S03-SB04-1820** | **10/10** | **N/A** | **5.0E+00** | **5.9E+00** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.1E+00 | 3.3E+00 | MG/KG | CBD-S03-SB12-0810 | 10/10 | N/A | 3.3E+00 | 7.9E+00 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **1.8E+03** | **1.8E+04** | **MG/KG** | **CBD-S03-SB02-2022** | **10/10** | **N/A** | **1.8E+04** | **3.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 1.6E+00 | 5.0E+00 | MG/KG | CBD-S03-SB02-2022 | 10/10 | N/A | 5.0E+00 | 1.2E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 1.8E+02 | 1.9E+04 | MG/KG | CBD-S03-SB04-1820 | 10/10 | N/A | 1.9E+04 | 3.4E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **2.5E+00** | **3.2E+02** | **MG/KG** | **CBD-S03-SB04-1820** | **10/10** | **N/A** | **3.2E+02** | **2.3E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7439-97-6 | Mercury | 1.0E-02 J | 1.0E-02 J | MG/KG | CBD-S03-SB01P-1315 | 1/10 | 0.016 - 0.17 | 1.0E-02 | 4.0E-02 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 22 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7440-02-0 | Nickel | 5.9E-01 | 1.8E+01 | MG/KG | CBD-S03-SB04-1820 | 10/10 | N/A | 1.8E+01 | 1.3E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 2.2E+02 | 1.8E+03 | MG/KG | CBD-S03-SB04-1820 | 10/10 | N/A | 1.8E+03 | 1.6E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 3.0E-01 J | 1.4E+00 | MG/KG | CBD-S03-SB02-2022 | 7/10 | 0.27 - 0.33 | 1.4E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 3.5E-02 J | 7.7E-02 J | MG/KG | CBD-S03-SB13-0810 | 8/10 | 0.14 - 0.17 | 7.7E-02 | 2.3E-01 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 2.1E+01 J+ | 2.0E+02 | MG/KG | CBD-S03-SB04-1820 | 2/10 | 4.8 - 25 | 2.0E+02 | 1.4E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **6.6E-02 J** | **3.2E-01** | **MG/KG** | **CBD-S03-SB02-2022** | **8/10** | **0.14 - 0.17** | **3.2E-01** | **4.1E-01** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 3.2E+00 | 1.4E+01 | MG/KG | CBD-S03-SB02-2022 | 10/10 | N/A | 1.4E+01 | 3.6E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 2.6E+00 | 5.4E+01 | MG/KG | CBD-S03-SB02-2022 | 10/10 | N/A | 5.4E+01 | 6.4E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of $10^{-6}$ for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for xylenes used for m- and p-xylenes.
RSL value for n-hexane used as surrogate for methylcyclohexane.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.2a. Step 2 Subsurface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (MG/KG) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| **Arsenic** | **10 / 10** | **5.2E+00** | **CBD-S03-SB02-2022** | **3.5E+01** | **6.8E-01** | **0.1** | **8E-06** | **Cardiovascular, Dermal** |
| Chromium (hexavalent) | 1 / 1 | 5.8E-01 | CBD-S03-SB01P-1315 | 2.3E+02 | 3.0E-01 | 0.003 | 2E-06 | None Reported, Respiratory |
| Cobalt | 10 / 10 | 5.0E+00 | CBD-S03-SB04-1820 | 2.3E+01 | N/A | 0.2 | N/A | Thyroid, Respiratory |
| Iron | 10 / 10 | 1.8E+03 | CBD-S03-SB02-2022 | 5.5E+04 | N/A | 0.03 | N/A | Gastrointestinal |
| Manganese | 10 / 10 | 3.2E+02 | CBD-S03-SB04-1820 | 1.8E+03 | N/A | 0.2 | N/A | Nervous |
| **Thallium** | **8 / 10** | **3.2E-01** | **CBD-S03-SB02-2022** | **7.8E-01** | **N/A** | **0.4** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **1** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 0.6 |
| Total Respiratory HI = | 0.2 |
| Total Thyroid HI = | 0.2 |
| Total Gastrointestinal HI = | 0.03 |
| Total Nervous HI = | 0.2 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern

ELCR = Excess Lifetime Cancer Risk

HI = Hazard Index

HQ = Hazard Quotient

MG/KG = milligrams per kilogram

MDE = Maryland Department of the Environment

N/A = Not available/not applicable

RSL = Regional Screening Levels, November 2019

USEPA = US Environmental Protection Agency

**Table 2.2b. Step 3 Subsurface Soil Screening - Risk Ratio, 95% UCL, Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Step 2 COPC** | **Detection Frequency** | **95% UCL (MG/KG)** | | **95% UCL Rationale** | **Noncarcinogenic Residential Soil RSL HQ=1** | **Carcinogenic Residential Soil RSL ELCR = 1E-06** | **Hazard Index[a]** | **Cancer Risk[b]** | **Target Organ** |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 10 / 10 | 3.2E+00 | 95% Student's-t UCL | 1, 3 | 3.5E+01 | 6.8E-01 | 0.1 | 5E-06 | Cardiovascular, Dermal |
| Thallium | 10 / 10 | 2.0E-01 | 95% KM (t) UCL | 2, 3 | 7.8E-01 | N/A | 0.3 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **0.3** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **5E-06** | |

| | |
|---|---|
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 0.3 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit

MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations

**Table 2.3. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 108-88-3 | Toluene | 1.3E+00 J | 1.3E+00 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.4 - 0.4 | 1.3E+00 | ND | 1.1E+02 N | 1.0E+03 | MCL | NO | BSL |
| | 91-57-6 | 2-Methylnaphthalene | 1.0E-02 J | 1.0E-02 J | UG/L | CBD-S03-GW02-0518 | 1/3 | 0.012- 0.014 | 1.0E-02 | ND | 3.6E+00 N | N/A | | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 5.9E-03 J | 2.6E-02 J | UG/L | CBD-S03-GW03-0418 | 2/3 | 0.012- 0.014 | 2.6E-02 | ND | 3.0E-02 C | N/A | | NO | BSL |
| | 50-32-8 | Benzo(a)pyrene | 1.5E-02 J | 1.5E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.012- 0.014 | 1.5E-02 | ND | 2.5E-02 C | 2.0E-01 | MCL | NO | BSL |
| | 205-99-2 | Benzo(b)fluoranthene | 3.0E-02 J | 3.0E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.012- 0.014 | 3.0E-02 | ND | 2.5E-01 C | N/A | | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 1.9E-02 J | 1.9E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.012- 0.014 | 1.9E-02 | ND | 1.2E+01 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 3.7E-02 J | 3.7E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.012- 0.014 | 3.7E-02 | ND | 2.5E+00 C | N/A | | NO | BSL |
| | 218-01-9 | Chrysene | 4.2E-03 J | 3.5E-02 J | UG/L | CBD-S03-GW03-0418 | 3/3 | 0.012- 0.014 | 3.5E-02 | 1.3E-02 | 2.5E+01 C | N/A | | NO | BSL |
| | 206-44-0 | Fluoranthene | 5.2E-03 J | 2.3E-02 J | UG/L | CBD-S03-GW03-0418 | 3/3 | 0.02 - 0.023 | 2.3E-02 | 2.6E-02 | 8.0E+01 N | N/A | | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 2.2E-02 J | 2.2E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.02 - 0.023 | 2.2E-02 | ND | 2.5E-01 C | N/A | | NO | BSL |
| | 91-20-3 | Naphthalene | 1.8E-02 J | 1.8E-02 J | UG/L | CBD-S03-GW02-0518 | 1/3 | 0.012- 0.014 | 1.8E-02 | 4.1E-02 | 1.7E-01 C | N/A | | NO | BSL |
| | 85-01-8 | Phenanthrene | 1.3E-02 J | 3.0E-02 J | UG/L | CBD-S03-GW02-0518 | 2/3 | 0.02 - 0.023 | 3.0E-02 | 3.8E-02 | 1.8E+02 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 2.3E-02 J | 2.3E-02 J | UG/L | CBD-S03-GW03-0418 | 1/3 | 0.02 - 0.023 | 2.3E-02 | 1.3E-02 | 1.2E+01 N | N/A | | NO | BSL |
| | **7429-90-5** | **Aluminum** | **1.6E+02** | **5.4E+03** | **UG/L** | **CBD-S03-GW01-0418** | **3/3** | **N/A** | **5.4E+03** | **5.0E+03** | **2.0E+03 N** | **N/A** | | **YES** | **ASL** |
| | **7440-38-2** | **Arsenic** | **2.3E-01 J** | **5.9E-01** | **UG/L** | **CBD-S03-GW02-0518** | **3/3** | **N/A** | **5.9E-01** | **6.1E+00** | **5.2E-02 C** | **1.0E+01** | **MCL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 1.6E+01 | 3.4E+01 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 3.4E+01 | 1.6E+02 | 3.8E+02 N | 2.0E+03 | MCL | NO | BSL |
| | 7440-41-7 | Beryllium | 4.5E-01 J | 9.6E-01 | UG/L | CBD-S03-GW03-0418 | 2/3 | 0.13 | 9.6E-01 | 3.0E+00 | 2.5E+00 N | 4.0E+00 | MCL | NO | BSL |
| | **7440-43-9** | **Cadmium** | **1.5E-01 J** | **3.2E+00** | **UG/L** | **CBD-S03-GW01-0418** | **3/3** | **N/A** | **3.2E+00** | **6.4E+01** | **9.2E-01 N** | **5.0E+00** | **MCL** | **YES** | **ASL** |
| | 7440-70-2 | Calcium | 6.0E+03 | 5.1E+04 | UG/L | CBD-S03-GW02-0518 | 3/3 | N/A | 5.1E+04 | 1.3E+05 | N/A | N/A | | NO | NUT |
| | **7440-47-3** | **Chromium** | **6.3E-01** | **3.4E+00** | **UG/L** | **CBD-S03-GW01-0418** | **2/3** | **0.15** | **3.4E+00** | **2.5E+01** | **3.5E-02 C** | **1.0E+02** | **MCL** | **YES** | **ASL** |
| | **7440-48-4** | **Cobalt** | **4.9E-01 J** | **6.8E+00** | **UG/L** | **CBD-S03-GW03-0418** | **3/3** | **N/A** | **6.8E+00** | **4.0E+01** | **6.0E-01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-50-8 | Copper | 7.0E-02 J | 1.5E+00 | UG/L | CBD-S03-GW01-0418 | 2/3 | 0.29 | 1.5E+00 | 1.1E+01 | 8.0E+01 N | 1.3E+03 | | NO | BSL |
| | **7439-89-6** | **Iron** | **2.6E+02** | **7.7E+03** | **UG/L** | **CBD-S03-GW03-0418** | **3/3** | **N/A** | **7.7E+03** | **2.3E+04** | **1.4E+03 N** | **N/A** | | **YES** | **ASL** |
| | 7439-92-1 | Lead | 1.0E-01 J | 2.4E+00 | UG/L | CBD-S03-GW01-0418 | 2/3 | 0.13 | 2.4E+00 | 1.4E+00 | 1.5E+01 L | 1.5E+01 | MCL | NO | BSL |
| | 7439-95-4 | Magnesium | 3.4E+03 | 2.6E+04 | UG/L | CBD-S03-GW02-0518 | 3/3 | N/A | 2.6E+04 | 3.8E+04 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **2.0E+01** | **9.0E+01** | **UG/L** | **CBD-S03-GW03-0418** | **3/3** | **N/A** | **9.0E+01** | **4.0E+03** | **4.3E+01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-02-0 | Nickel | 3.2E+00 | 2.1E+01 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 2.1E+01 | 2.6E+02 | 3.9E+01 N | N/A | | NO | BSL |
| | 7440-09-7 | Potassium | 1.8E+03 | 3.1E+03 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 3.1E+03 | 1.2E+04 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 1.1E+00 | 1.1E+00 | UG/L | CBD-S03-GW01-0418 | 1/3 | 0.5 | 1.1E+00 | 1.4E+00 | 1.0E+01 N | 5.0E+01 | MCL | NO | BSL |
| | 7440-23-5 | Sodium | 5.5E+03 | 2.1E+04 | UG/L | CBD-S03-GW01-0418 | 3/3 | N/A | 2.1E+04 | 5.5E+04 | N/A | N/A | | NO | NUT |

**Table 2.3. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **7440-28-0** | **Thallium** | **2.8E-01 J** | **2.8E-01 J** | **UG/L** | **CBD-S03-GW01-0418** | **1/3** | **0.5** | **2.8E-01** | **3.1E+00** | **2.0E-02 N** | **2.0E+00** | **MCL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 2.5E-01 J | 2.1E+00 | UG/L | CBD-S03-GW01-0418 | 3/3 | N/A | 2.1E+00 | 4.7E+00 | 8.6E+00 N | N/A | | NO | BSL |
| | 7440-66-6 | Zinc | 3.1E+00 J+ | 2.8E+02 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 2.8E+02 | 3.2E+02 | 6.0E+02 N | N/A | | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Tap Water RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium (hexavalent) used for chromium.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
MCL = USEPA Maximum Contaminant Level
L = Lead screening level from November 2019 RSL Table
UG/L = Micrograms per liter
N/A = Not available/not applicable
ND = Not detected

**Table 2.3a. Step 2 Groundwater Screening - Risk Ratio, Maximum Detected Concentration, Site 3**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Tap Water RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| **Metals (UG/L)** | | | | | | | | |
| Aluminum | 3 / 3 | 5.4E+03 | CBD-S03-GW01-0418 | 2.0E+04 | N/A | 0.3 | N/A | Neurological |
| **Arsenic** | **3 / 3** | **5.9E-01** | **CBD-S03-GW02-0518** | **6.0E+00** | **5.2E-02** | **0.1** | **1E-05** | **Cardiovascular, Dermal** |
| Cadmium | 3 / 3 | 3.2E+00 | CBD-S03-GW01-0418 | 9.2E+00 | N/A | 0.3 | N/A | Urinary, Kidney |
| **Chromium** | **2 / 3** | **3.4E+00** | **CBD-S03-GW01-0418** | **2.2E+04** | **N/A** | **0.0002** | **N/A** | **No effects observed, Respiratory** |
| **Cobalt** | **3 / 3** | **6.8E+00** | **CBD-S03-GW03-0418** | **6.0E+00** | **N/A** | **1** | **N/A** | **Thyroid, Respiratory** |
| **Iron** | **3 / 3** | **7.7E+03** | **CBD-S03-GW03-0418** | **1.4E+04** | **N/A** | **0.6** | **N/A** | **Gastrointestinal** |
| Manganese | 3 / 3 | 9.0E+01 | CBD-S03-GW03-0418 | 4.3E+02 | N/A | 0.2 | N/A | Nervous |
| **Thallium** | **1 / 3** | **2.8E-01 J** | **CBD-S03-GW01-0418** | **2.0E-01** | **N/A** | **1** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.5 |
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 1 |
| Total Urinary/Kidney HI = | 0.3 |
| Total Thyroid HI = | 1 |
| Total Respiratory HI = | 1 |
| Total Gastrointestinal HI = | 0.6 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of Hazard Indices for each constituent.

[d] Cumulative Cancer Risk equals sum of Cancer Risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.
COPC = Chemical of Potential Concern
HI = Hazard Index
UG/L = micrograms per liter
NA = Not available/not applicable
RSL = Regional Screening Levels, November 2019
MDE = Maryland Department of the Environment
USEPA = US Environmental Protection Agency

## Table 2.3b. Comparison of Concentrations of COPCs to Background Concentrations - Site 3

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 7440-38-2 | Arsenic | 2.3E-01 J | 5.9E-01 | UG/L | CBD-S03-GW02-0518 | 3/3 | N/A | 5.9E-01 | 6.1E+00 | NO |
| | 7440-48-4 | Cobalt | 4.9E-01 J | 6.8E+00 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 6.8E+00 | 4.0E+01 | NO |
| | 7439-89-6 | Iron | 2.6E+02 | 7.7E+03 | UG/L | CBD-S03-GW03-0418 | 3/3 | N/A | 7.7E+03 | 2.3E+04 | NO |
| | 7440-28-0 | Thallium | 2.8E-01 J | 2.8E-01 J | UG/L | CBD-S03-GW01-0418 | 1/3 | 0.5 - 0.5 | 2.8E-01 | 3.1E+00 | NO |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background value is the groundwater background threshold value (BTV).

COPC = Chemical of Potential Concern
UG/L = microgram per liter
N/A = not available/not applicable

Site 3 Surface Soil

## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/3/2019 8:11:04 AM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Aroclor-1260 (UG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 41 | Mean | 1118 |
| Maximum | 5500 | Median | 250 |
| SD | 1710 | Std. Error of Mean | 540.8 |
| Coefficient of Variation | 1.529 | Skewness | 2.199 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.694 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.273 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

#### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 2110 | 95% Adjusted-CLT UCL (Chen-1995) | 2410 |
| | | 95% Modified-t UCL (Johnson-1978) | 2172 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.504 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.775 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.228 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.28 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.529 | k star (bias corrected MLE) | 0.437 |
| Theta hat (MLE) | 2116 | Theta star (bias corrected MLE) | 2561 |
| nu hat (MLE) | 10.57 | nu star (bias corrected) | 8.733 |
| MLE Mean (bias corrected) | 1118 | MLE Sd (bias corrected) | 1692 |
| | | Approximate Chi Square Value (0.05) | 3.167 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 2.613 |

#### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 3084 | 95% Adjusted Gamma UCL (use when n<50) | 3738 |

#### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | **Shapiro Wilk Lognormal GOF Test** |

| | | |
|---|---|---|
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.18 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.714 | Mean of logged Data | 5.828 |
| Maximum of Logged Data | 8.613 | SD of logged Data | 1.744 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 25053 | 90% Chebyshev (MVUE) UCL | 3188 |
| 95% Chebyshev (MVUE) UCL | 4103 | 97.5% Chebyshev (MVUE) UCL | 5374 |
| 99% Chebyshev (MVUE) UCL | 7869 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 2008 | 95% Jackknife UCL | 2110 |
| 95% Standard Bootstrap UCL | 1953 | 95% Bootstrap-t UCL | 3326 |
| 95% Hall's Bootstrap UCL | 5219 | 95% Percentile Bootstrap UCL | 2054 |
| 95% BCA Bootstrap UCL | 2589 | | |
| 90% Chebyshev(Mean, Sd) UCL | 2741 | 95% Chebyshev(Mean, Sd) UCL | 3476 |
| 97.5% Chebyshev(Mean, Sd) UCL | 4496 | 99% Chebyshev(Mean, Sd) UCL | 6499 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Adjusted Gamma UCL | 3738 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Arsenic (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 1.2 | Mean | 3.68 |
| Maximum | 14 | Median | 2.7 |
| SD | 3.713 | Std. Error of Mean | 1.174 |
| Coefficient of Variation | 1.009 | Skewness | 2.891 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.578 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.387 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

### Assuming Normal Distribution

## Site 3 Surface Soil

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 5.832 | 95% Adjusted-CLT UCL (Chen-1995) | 6.758 |
| | | 95% Modified-t UCL (Johnson-1978) | 6.011 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.969 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.735 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.291 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.27 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.125 | k star (bias corrected MLE) | 1.554 |
| Theta hat (MLE) | 1.732 | Theta star (bias corrected MLE) | 2.368 |
| nu hat (MLE) | 42.49 | nu star (bias corrected) | 31.08 |
| MLE Mean (bias corrected) | 3.68 | MLE Sd (bias corrected) | 2.952 |
| | | Approximate Chi Square Value (0.05) | 19.34 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 17.75 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 5.913 | 95% Adjusted Gamma UCL (use when n<50) | 6.443 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.869 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.232 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.182 | Mean of logged Data | 1.049 |
| Maximum of Logged Data | 2.639 | SD of logged Data | 0.659 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 6.098 | 90% Chebyshev (MVUE) UCL | 5.687 |
| 95% Chebyshev (MVUE) UCL | 6.695 | 97.5% Chebyshev (MVUE) UCL | 8.095 |
| 99% Chebyshev (MVUE) UCL | 10.84 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 5.611 | 95% Jackknife UCL | 5.832 |
| 95% Standard Bootstrap UCL | 5.499 | 95% Bootstrap-t UCL | 11.04 |
| 95% Hall's Bootstrap UCL | 14.02 | 95% Percentile Bootstrap UCL | 5.99 |
| 95% BCA Bootstrap UCL | 7.18 | | |
| 90% Chebyshev(Mean, Sd) UCL | 7.202 | 95% Chebyshev(Mean, Sd) UCL | 8.798 |
| 97.5% Chebyshev(Mean, Sd) UCL | 11.01 | 99% Chebyshev(Mean, Sd) UCL | 15.36 |

### Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 6.098 |

## Site 3 Surface Soil

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**
**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**
**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**
**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**

### UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.111/7/2019 10:21:40 AM |
| From File | UCLInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Thallium (MG/KG)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 6 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.08 | Mean | 0.183 |
| Maximum | 0.24 | Median | 0.195 |
| SD | 0.0497 | Std. Error of Mean | 0.0157 |
| Coefficient of Variation | 0.271 | Skewness | -1.087 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.874 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.256 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.212 | 95% Adjusted-CLT UCL (Chen-1995) | 0.203 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.211 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.836 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.725 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.29 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Data Not Gamma Distributed at 5% Significance Level |

**Data Not Gamma Distributed at 5% Significance Level**

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 11.55 | k star (bias corrected MLE) | 8.149 |
| Theta hat (MLE) | 0.0158 | Theta star (bias corrected MLE) | 0.0225 |
| nu hat (MLE) | 230.9 | nu star (bias corrected) | 163 |

| | | | |
|---|---|---|---|
| MLE Mean (bias corrected) | 0.183 | MLE Sd (bias corrected) | 0.0641 |
| | | Approximate Chi Square Value (0.05) | 134.5 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 130 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.222 | 95% Adjusted Gamma UCL (use when n<50) | 0.229 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.795 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.295 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level |

**Data Not Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.526 | Mean of logged Data | -1.742 |
| Maximum of Logged Data | -1.427 | SD of logged Data | 0.337 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.233 | 90% Chebyshev (MVUE) UCL | 0.244 |
| 95% Chebyshev (MVUE) UCL | 0.271 | 97.5% Chebyshev (MVUE) UCL | 0.308 |
| 99% Chebyshev (MVUE) UCL | 0.381 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.209 | 95% Jackknife UCL | 0.212 |
| 95% Standard Bootstrap UCL | 0.208 | 95% Bootstrap-t UCL | 0.208 |
| 95% Hall's Bootstrap UCL | 0.204 | 95% Percentile Bootstrap UCL | 0.207 |
| 95% BCA Bootstrap UCL | 0.202 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.23 | 95% Chebyshev(Mean, Sd) UCL | 0.251 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.281 | 99% Chebyshev(Mean, Sd) UCL | 0.339 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 0.212 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

## Site 3 Subsurface Soil

## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.111/12/2019 2:53:00 PM |
| From File | NRL Site 3 subsurface soil.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Arsenic (MG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.28 | Mean | 2.208 |
| Maximum | 5.2 | Median | 1.85 |
| SD | 1.67 | Std. Error of Mean | 0.528 |
| Coefficient of Variation | 0.756 | Skewness | 0.596 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.142 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

#### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 3.176 | 95% Adjusted-CLT UCL (Chen-1995) | 3.183 |
| | | 95% Modified-t UCL (Johnson-1978) | 3.193 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.216 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.739 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.154 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.271 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.596 | k star (bias corrected MLE) | 1.184 |
| Theta hat (MLE) | 1.384 | Theta star (bias corrected MLE) | 1.865 |
| nu hat (MLE) | 31.92 | nu star (bias corrected) | 23.68 |
| MLE Mean (bias corrected) | 2.208 | MLE Sd (bias corrected) | 2.029 |
| | | Approximate Chi Square Value (0.05) | 13.6 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 12.29 |

#### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 3.843 | 95% Adjusted Gamma UCL (use when n<50) | 4.252 |

Site 3 Subsurface Soil

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.944 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.139 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.273 | Mean of logged Data | 0.447 |
| Maximum of Logged Data | 1.649 | SD of logged Data | 0.964 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 6.582 | 90% Chebyshev (MVUE) UCL | 4.58 |
| 95% Chebyshev (MVUE) UCL | 5.595 | 97.5% Chebyshev (MVUE) UCL | 7.003 |
| 99% Chebyshev (MVUE) UCL | 9.769 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 3.077 | 95% Jackknife UCL | 3.176 |
| 95% Standard Bootstrap UCL | 3.022 | 95% Bootstrap-t UCL | 3.34 |
| 95% Hall's Bootstrap UCL | 3.132 | 95% Percentile Bootstrap UCL | 3.061 |
| 95% BCA Bootstrap UCL | 3.12 | | |
| 90% Chebyshev(Mean, Sd) UCL | 3.792 | 95% Chebyshev(Mean, Sd) UCL | 4.51 |
| 97.5% Chebyshev(Mean, Sd) UCL | 5.506 | 99% Chebyshev(Mean, Sd) UCL | 7.463 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 3.176 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Thallium (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| Number of Detects | 8 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.066 | Minimum Non-Detect | 0.14 |
| Maximum Detect | 0.32 | Maximum Non-Detect | 0.17 |
| Variance Detects | 0.00633 | Percent Non-Detects | 20% |
| Mean Detects | 0.168 | SD Detects | 0.0795 |
| Median Detects | 0.16 | CV Detects | 0.473 |
| Skewness Detects | 0.84 | Kurtosis Detects | 0.806 |
| Mean of Logged Detects | -1.883 | SD of Logged Detects | 0.489 |

Site 3 Subsurface Soil

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.94 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.185 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.156 | KM Standard Error of Mean | 0.0247 |
| KM SD | 0.0718 | 95% KM (BCA) UCL | 0.194 |
| 95% KM (t) UCL | 0.201 | 95% KM (Percentile Bootstrap) UCL | 0.197 |
| 95% KM (z) UCL | 0.197 | 95% KM Bootstrap t UCL | 0.211 |
| 90% KM Chebyshev UCL | 0.23 | 95% KM Chebyshev UCL | 0.264 |
| 97.5% KM Chebyshev UCL | 0.31 | 99% KM Chebyshev UCL | 0.402 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.217 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.719 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.166 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.295 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.146 | k star (bias corrected MLE) | 3.299 |
| Theta hat (MLE) | 0.0327 | Theta star (bias corrected MLE) | 0.051 |
| nu hat (MLE) | 82.33 | nu star (bias corrected) | 52.79 |
| Mean (detects) | 0.168 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.066 | Mean | 0.156 |
| Maximum | 0.32 | Median | 0.125 |
| SD | 0.075 | CV | 0.482 |
| k hat (MLE) | 5.363 | k star (bias corrected MLE) | 3.82 |
| Theta hat (MLE) | 0.029 | Theta star (bias corrected MLE) | 0.0407 |
| nu hat (MLE) | 107.3 | nu star (bias corrected) | 76.41 |
| Adjusted Level of Significance (β) | 0.0267 | | |
| Approximate Chi Square Value (76.41, α) | 57.27 | Adjusted Chi Square Value (76.41, β) | 54.4 |
| 95% Gamma Approximate UCL (use when n>=50) | 0.208 | 95% Gamma Adjusted UCL (use when n<50) | 0.219 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.156 | SD (KM) | 0.0718 |
| Variance (KM) | 0.00516 | SE of Mean (KM) | 0.0247 |
| k hat (KM) | 4.712 | k star (KM) | 3.365 |
| nu hat (KM) | 94.23 | nu star (KM) | 67.29 |
| theta hat (KM) | 0.0331 | theta star (KM) | 0.0463 |
| 80% gamma percentile (KM) | 0.219 | 90% gamma percentile (KM) | 0.27 |
| 95% gamma percentile (KM) | 0.317 | 99% gamma percentile (KM) | 0.418 |

Site 3 Subsurface Soil

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (67.29, α) | 49.41 | Adjusted Chi Square Value (67.29, β) | 46.76 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 0.212 | 95% Gamma Adjusted KM-UCL (use when n<50) | 0.224 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.974 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.175 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.156 | Mean in Log Scale | -1.957 |
| SD in Original Scale | 0.0751 | SD in Log Scale | 0.459 |
| 95% t UCL (assumes normality of ROS data) | 0.199 | 95% Percentile Bootstrap UCL | 0.196 |
| 95% BCA Bootstrap UCL | 0.198 | 95% Bootstrap t UCL | 0.218 |
| 95% H-UCL (Log ROS) | 0.218 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -1.96 | KM Geo Mean | 0.141 |
| KM SD (logged) | 0.453 | 95% Critical H Value (KM-Log) | 2.156 |
| KM Standard Error of Mean (logged) | 0.161 | 95% H-UCL (KM -Log) | 0.216 |
| KM SD (logged) | 0.453 | 95% Critical H Value (KM-Log) | 2.156 |
| KM Standard Error of Mean (logged) | 0.161 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 0.15 | Mean in Log Scale | -2.019 |
| SD in Original Scale | 0.08 | SD in Log Scale | 0.52 |
| 95% t UCL (Assumes normality) | 0.196 | 95% H-Stat UCL | 0.224 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

### Nonparametric Distribution Free UCL Statistics

**Detected Data appear Normal Distributed at 5% Significance Level**

### Suggested UCL to Use

95% KM (t) UCL 0.201

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

# Appendix F.2

# Site 4 Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 67-64-1 | Acetone | 2.2E-02 J | 1.0E-01 | MG/KG | CBD-S04-SS03-1012, CBD-S04-SS05-1012 | 6/6 | N/A | 1.0E-01 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 71-43-2 | Benzene | 1.8E-04 J | 1.8E-04 J | MG/KG | CBD-S04-SS03-1012 | 1/6 | 0.00042 - 0.00057 | 1.8E-04 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 2.0E-04 J | 2.0E-04 J | MG/KG | CBD-S04-SS03-1012 | 1/6 | 0.00042 - 0.00057 | 2.0E-04 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 2.6E-04 J | 2.6E-04 J | MG/KG | CBD-S04-SS01-1012 | 1/6 | 0.00021 - 0.00029 | 2.6E-04 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 92-52-4 | 1,1-Biphenyl | 1.3E-02 J | 1.3E-02 J | MG/KG | CBD-S04-SS03-1012 | 1/11 | 0.018 - 0.740 | 1.3E-02 | N/A | 4.7E+00 N | 8.7E-04 | SSL | NO | BSL |
| | 91-57-6 | 2-Methylnaphthalene | 3.2E-02 | 3.2E-02 | MG/KG | CBD-S04-SS03-1012 | 1/11 | 0.0018 - 0.0023 | 3.2E-02 | N/A | 2.4E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 534-52-1 | 4,6-Dinitro-2-methylphenol | 2.3E-02 J | 2.3E-02 J | MG/KG | CBD-S04-SS02-1012 | 1/11 | 0.018 - 2.4 | 2.3E-02 | N/A | 5.1E-01 N | 2.6E-04 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 5.8E-04 J | 3.1E-01 | MG/KG | CBD-S04-SS03-1012 | 6/11 | 0.0011 - 0.0019 | 3.1E-01 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 208-96-8 | Acenaphthylene | 5.6E-04 J | 4.5E-03 J | MG/KG | CBD-S04-SS15-000H | 5/11 | 0.0011 - 0.0019 | 4.5E-03 | N/A | 3.6E+02 N | N/A | | NO | BSL |
| | 120-12-7 | Anthracene | 1.6E-03 J | 5.8E-01 | MG/KG | CBD-S04-SS03-1012 | 7/11 | 0.0018 - 0051 | 5.8E-01 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | **56-55-3** | **Benzo(a)anthracene** | **1.9E-03 J** | **3.1E+00** | **MG/KG** | **CBD-S04-SS03-1012** | **8/11** | **0.0018 - 0051** | **3.1E+00** | **N/A** | **1.1E+00 C** | **1.1E-02** | **SSL** | **YES** | **ASL** |
| | **50-32-8** | **Benzo(a)pyrene** | **8.0E-03 J** | **3.5E+00** | **MG/KG** | **CBD-S04-SS03-1012** | **7/11** | **0.00076 - 0051** | **3.5E+00** | **N/A** | **1.1E-01 C** | **2.9E-02** | **SSL** | **YES** | **ASL** |
| | **205-99-2** | **Benzo(b)fluoranthene** | **1.5E-02** | **3.9E+00** | **MG/KG** | **CBD-S04-SS03-1012** | **7/11** | **0.0037 - 0.0078** | **3.9E+00** | **N/A** | **1.1E+00 C** | **3.0E-01** | **SSL** | **YES** | **ASL** |
| | 191-24-2 | Benzo(g,h,i)perylene | 1.2E-03 J | 8.0E-01 | MG/KG | CBD-S04-SS03-1012 | 8/11 | 0.0018 - 0.247 | 8.0E-01 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 5.3E-03 J | 7.3E-01 | MG/KG | CBD-S04-SS03-1012 | 7/11 | 0.0037 - 0.0051 | 7.3E-01 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 86-74-8 | Carbazole | 3.8E-01 | 3.8E-01 | MG/KG | CBD-S04-SS03-1012 | 1/11 | 0.035 - 0.247 | 3.8E-01 | N/A | N/A | N/A | | NO | NTX |
| | 218-01-9 | Chrysene | 1.5E-03 J | 2.6E+00 | MG/KG | CBD-S04-SS03-1012 | 8/11 | 0.0018 - 0051 | 2.6E+00 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | **53-70-3** | **Dibenz(a,h)anthracene** | **3.8E-03 J** | **2.3E-01 J** | **MG/KG** | **CBD-S04-SS03-1012** | **6/11** | **0.00076 - 0.0078** | **2.3E-01** | **N/A** | **1.1E-01 C** | **9.6E-02** | **SSL** | **YES** | **ASL** |
| | 132-64-9 | Dibenzofuran | 2.2E-03 J | 1.7E-01 | MG/KG | CBD-S04-SS03-1012 | 3/11 | 0.0018 - 0.247 | 1.7E-01 | N/A | 7.3E+00 N | 1.5E-02 | SSL | NO | BSL |
| | 131-11-3 | Dimethyl phthalate | 2.3E-03 J | 2.3E-03 J | MG/KG | CBD-S04-SS02-1012 | 1/11 | 0.0035 - 0.49 | 2.3E-03 | N/A | N/A | N/A | | NO | NTX |
| | 206-44-0 | Fluoranthene | 1.2E-03 J | 4.8E+00 | MG/KG | CBD-S04-SS03-1012 | 9/11 | 0.0011 - 0.0051 | 4.8E+00 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 86-73-7 | Fluorene | 3.2E-03 J | 2.1E-01 | MG/KG | CBD-S04-SS03-1012 | 4/11 | 0.0018 - 0031 | 2.1E-01 | N/A | 2.4E+02 N | 5.4E-01 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 6.7E-03 J | 8.3E-01 | MG/KG | CBD-S04-SS03-1012 | 7/11 | 0.0037 - 0.0078 | 8.3E-01 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 91-20-3 | Naphthalene | 1.1E-03 J | 8.4E-02 | MG/KG | CBD-S04-SS03-1012 | 3/11 | 0.0018 - 0025 | 8.4E-02 | N/A | 3.8E+00 C | 5.4E-04 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 1.2E-03 J | 3.5E+00 | MG/KG | CBD-S04-SS03-1012 | 9/11 | 0.0018 - 0078 | 3.5E+00 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 2.3E-03 J | 4.5E+00 | MG/KG | CBD-S04-SS03-1012 | 8/11 | 0.0037 - 0.0078 | 4.5E+00 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 72-55-9 | 4,4'-DDE | 1.9E-04 J | 5.2E-04 | MG/KG | CBD-S04-SS10-000H | 2/10 | 0.00013 - 0.000236 | 5.2E-04 | N/A | 2.0E+00 C | 1.1E-02 | SSL | NO | BSL |
| | **11096-82-5** | **Aroclor-1260** | **7.2E-03 J** | **2.6E-01** | **MG/KG** | **CBD-S04-SS03-1012** | **4/11** | **0.0065 - 0.015** | **2.6E-01** | **N/A** | **2.4E-01 C** | **5.5E-03** | **SSL** | **YES** | **ASL** |
| | **7429-90-5** | **Aluminum** | **4.4E+03** | **2.1E+04 J** | **MG/KG** | **CBD-S04-SS13P-000H** | **11/11** | **N/A** | **2.1E+04** | **1.3E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 8.4E-02 J | 2.1E+00 | MG/KG | CBD-S04-SS04-1012 | 8/11 | 0.14 - 0.17 | 2.1E+00 | 4.2E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **2.2E+00** | **8.3E+00** | **MG/KG** | **CBD-S04-SS15-000H** | **11/11** | **N/A** | **8.3E+00** | **6.4E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 6.3E+00 | 8.5E+01 | MG/KG | CBD-S04-SS16-000H | 11/11 | N/A | 8.5E+01 | 5.8E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 2.3E-01 J | 8.0E-01 | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 8.0E-01 | 8.1E-01 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 4.4E-02 J | 3.2E-01 | MG/KG | CBD-S04-SS16-000H | 7/11 | 0.14 - 0.17 | 3.2E-01 | 1.7E+00 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 2.1E+02 | 8.9E+02 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 8.9E+02 | 9.4E+03 | N/A | N/A | | NO | NUT |

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18540-29-9 | Chromium (hexavalent) | 5.0E-02 J | 3.5E-01 J | MG/KG | CBD-S04-SS01P-1012 | 4/4 | N/A | 3.5E-01 | 4.0E-01 | 3.0E-01 C | 6.7E-04 | SSL | NO | BSL |
| | 7440-47-3 | Chromium | 7.8E+00 | 3.2E+01 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 3.2E+01 | 3.1E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | 7440-48-4 | Cobalt | 5.5E-01 | 4.0E+00 | MG/KG | CBD-S04-SS05-1012 | 11/11 | N/A | 4.0E+00 | 1.2E+01 | 2.3E+00 N | 2.7E-02 | SSL | NO | BSL |
| | 7440-50-8 | Copper | 2.8E+00 | 4.6E+01 | MG/KG | CBD-S04-SS16-000H | 11/11 | N/A | 4.6E+01 | 2.7E+01 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 57-12-5 | Cyanide | 2.6E-02 J | 2.6E-02 J | MG/KG | CBD-S04-SS06-1012 | 1/6 | 0.055 - 0.057 | 2.6E-02 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
| | 7439-89-6 | Iron | 7.6E+03 | 3.7E+04 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 3.7E+04 | 4.0E+04 | 5.5E+03 N | 3.5E+01 | SSL | NO | BSL |
| | 7439-92-1 | Lead | 3.2E+00 | 1.6E+02 | MG/KG | CBD-S04-SS16-000H | 11/11 | N/A | 1.6E+02 | 5.0E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 4.9E+02 | 1.7E+03 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 1.7E+03 | 3.8E+03 | N/A | N/A | | NO | NUT |
| | 7439-96-5 | Manganese | 6.4E+00 | 1.2E+02 | MG/KG | CBD-S04-SS05-1012 | 11/11 | N/A | 1.2E+02 | 2.0E+02 | 1.8E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 7439-97-6 | Mercury | 6.4E-03 J | 1.8E-01 J | MG/KG | CBD-S04-SS16-000H | 6/11 | 0.017 - 0.17 | 1.8E-01 | 1.9E-01 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 9.9E-01 | 1.1E+01 | MG/KG | CBD-S04-SS16-000H | 11/11 | N/A | 1.1E+01 | 1.2E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 3.5E+02 | 1.2E+03 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 1.2E+03 | 1.5E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 2.2E-01 | 1.3E+00 J- | MG/KG | CBD-S04-SS12-000H | 11/11 | N/A | 1.3E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 3.3E-02 J | 1.6E+00 | MG/KG | CBD-S04-SS16-000H | 8/11 | 0.14 - 0.17 | 1.6E+00 | 1.4E+00 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.9E+01 J+ | 1.9E+01 J+ | MG/KG | CBD-S04-SS13P-000H | 1/11 | 7.2 - 10.4 | 1.9E+01 | 3.1E+02 | N/A | N/A | | NO | NUT |
| | 7440-28-0 | Thallium | 6.5E-02 J | 2.7E-01 | MG/KG | CBD-S04-SS05-1012 | 11/11 | N/A | 2.7E-01 | 1.3E+00 | 7.8E-02 N | 1.4E-03 | SSL | NO | BSL |
| | 7440-62-2 | Vanadium | 1.4E+01 | 3.2E+01 J | MG/KG | CBD-S04-SS13P-000H | 11/11 | N/A | 3.2E+01 | 3.0E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 1.5E+01 | 1.7E+02 J | MG/KG | CBD-S04-SS16-000H | 7/11 | N/A | 1.7E+02 | 7.9E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for acenaphthene used as surrogate for acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium(III) used for chromium since four soil samples were also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
J- = Biased Low
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.1a. Step 2 Surface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) MG/KG | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-6 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 8 / 11 | 3.1E+00 | CBD-S04-SS03-1012 | N/A | 1.1E+00 | N/A | 3E-06 | N/A |
| Benzo(a)pyrene | 7 / 11 | 3.5E+00 | CBD-S04-SS03-1012 | 1.8E+01 | 1.1E-01 | 0.2 | 3E-05 | Developmental |
| Benzo(b)fluoranthene | 7 / 11 | 3.9E+00 | CBD-S04-SS03-1012 | N/A | 1.1E+00 | N/A | 4E-06 | N/A |
| Dibenz(a,h)anthracene | 6 / 11 | 2.3E-01 J | CBD-S04-SS03-1012 | N/A | 1.1E-01 | N/A | 2E-06 | N/A |
| Aroclor-1260 | 4 / 11 | 2.6E-01 | CBD-S04-SS03-1012 | N/A | 2.4E-01 | N/A | 1E-06 | N/A |
| Aluminum | 11 / 11 | 2.1E+04 J | CBD-S04-SS13P-000H | 7.7E+04 | N/A | 0.3 | N/A | Neurological |
| Arsenic | 11 / 11 | 8.3E+00 | CBD-S04-SS15-000H | 3.5E+01 | 6.8E-01 | 0.2 | 1E-05 | Cardiovascular, Dermal |
| **Cumulative Hazard Index[c]** | | | | | | **0.7** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **5E-05** | |

| | |
|---|---|
| Total Developmental HI = | 0.2 |
| Total Neurological HI = | 0.3 |
| Total Cardiovascular HI = | 0.2 |
| Total Dermal HI = | 0.2 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
J = Estimated Value
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency
MG/KG = milligrams per kilogram

**Table 2.1b. Step 3 Surface Soil Screening - Risk Ratio, 95% UCL, Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-6 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 8 / 11 | 3.1E+00 | Maximum | 5 | N/A | 1.1E+00 | N/A | 3E-06 | N/A |
| Benzo(a)pyrene | 7 / 11 | 3.5E+00 | Maximum | 5 | 1.8E+01 | 1.1E-01 | 0.2 | 3E-05 | Developmental |
| Benzo(b)fluoranthene | 7 / 11 | 3.7E+00 | 95% Gamma Adjusted KM-UCL | 1, 3 | N/A | 1.1E+00 | N/A | 3E-06 | N/A |
| Dibenz(a,h)anthracene | 6 / 11 | 2.3E-01 | Maximum | 5 | N/A | 1.1E-01 | N/A | 2E-06 | N/A |
| Aroclor-1260[e] | 4 / 11 | 2.1E-01 | 95% Gamma Adjusted KM-UCL | 1, 3 | N/A | 2.4E-01 | N/A | 9E-07 | N/A |
| Arsenic | 11 / 11 | 5.6E+00 | 95% Student's-t UCL | 1, 2, 3 | 3.5E+01 | 6.8E-01 | 0.2 | 8E-06 | Cardiovascular, Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **0.4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **5E-05** | |

Total Developmental HI = 0.2
Total Cardiovascular HI = 0.2
Total Dermal HI = 0.2

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

[e] The contribution from Aroclor-1260 to the carcinogenic risk is minimal, and therefore, Aroclor-1260 wasn't identified as a COPC based on cumulative carcinogenic risk.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Recommended 95% UCL exceeds maximum detected concentration.

## Table 2.1c. Comparison of Concentrations of COPCs to Background Concentrations - Site 4

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | **7440-38-2** | **Arsenic** | **2.2E+00** | **8.3E+00** | **MG/KG** | **CBD-S04-SS15-000H** | **11/11** | **N/A** | **8.3E+00** | **6.4E+00** | **YES** |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background value is the surface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 20 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 67-64-1 | Acetone | 2.3E-02 | 2.8E-02 J | MG/KG | CBD-S04-SB02-1618 | 2/5 | 0.0052 - 0.012 | 2.8E-02 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 3.2E-04 J | 3.2E-04 J | MG/KG | CBD-S04-SB02-1618 | 1/5 | 0.0026 - 0.0062 | 3.2E-04 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 534-52-1 | 4,6-Dinitro-2-methylphenol | 2.2E-02 J | 2.2E-02 J | MG/KG | CBD-S04-SB04-1012 | 1/10 | 0.019 - 2.26 | 2.2E-02 | N/A | 5.1E-01 N | 2.6E-04 | SSL | NO | BSL |
| | 106-47-8 | 4-Chloroaniline | 1.8E-02 J | 1.8E-02 J | MG/KG | CBD-S04-SB04-1012 | 1/10 | 0.019 - 0.226 | 1.8E-02 | N/A | 2.7E+00 C | 1.6E-04 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 5.6E-02 | 5.6E-02 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.001 - 0.002 | 5.6E-02 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 208-96-8 | Acenaphthylene | 5.0E-03 J | 5.0E-03 J | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.001 - 0.002 | 5.0E-03 | N/A | 3.6E+02 N | N/A | | NO | BSL |
| | 120-12-7 | Anthracene | 1.7E-01 | 1.7E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0019 - 0.005 | 1.7E-01 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | 100-52-7 | Benzaldehyde | 4.7E-02 L | 4.7E-02 L | MG/KG | CBD-S04-SB04-1012 | 1/6 | 0.38 - 0.68 | 4.7E-02 | N/A | 1.7E+02 C | 4.1E-03 | SSL | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 4.9E-01 | 4.9E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0019 - 0.005 | 4.9E-01 | N/A | 1.1E+00 C | 1.1E-02 | SSL | NO | BSL |
| | **50-32-8** | **Benzo(a)pyrene** | **4.7E-01** | **4.7E-01** | **MG/KG** | **CBD-S04-SB16-0810** | **1/10** | **0.00076 - 0.005** | **4.7E-01** | **N/A** | **1.1E-01 C** | **2.9E-02** | **SSL** | **YES** | **ASL** |
| | 205-99-2 | Benzo(b)fluoranthene | 6.2E-01 | 6.2E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0037 - 0.0076 | 6.2E-01 | N/A | 1.1E+00 C | 3.0E-01 | SSL | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 3.4E-01 | 3.4E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0019 - 0.0076 | 3.4E-01 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 2.3E-01 | 2.3E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0037 - 0.005 | 2.3E-01 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 218-01-9 | Chrysene | 1.5E-03 J | 4.7E-01 | MG/KG | CBD-S04-SB16-0810 | 2/10 | 0.0019 - 0.005 | 4.7E-01 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | 53-70-3 | Dibenz(a,h)anthracene | 8.9E-02 | 8.9E-02 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.00076 - 0.0076 | 8.9E-02 | N/A | 1.1E-01 C | 9.6E-02 | SSL | NO | BSL |
| | 131-11-3 | Dimethyl phthalate | 2.4E-03 J | 2.4E-03 J | MG/KG | CBD-S04-SB05-1315 | 1/10 | 0.0037 - 0.45 | 2.4E-03 | N/A | N/A | N/A | | NO | NTX |
| | 206-44-0 | Fluoranthene | 2.7E-03 J | 8.5E-01 | MG/KG | CBD-S04-SB16-0810 | 2/10 | 0.0019 - 0.005 | 8.5E-01 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 86-73-7 | Fluorene | 4.8E-02 | 4.8E-02 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0019 - 0.0031 | 4.8E-02 | N/A | 2.4E+02 N | 5.4E-01 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 4.2E-01 | 4.2E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0037 - 0.0076 | 4.2E-01 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 91-20-3 | Naphthalene | 1.9E-02 | 1.9E-02 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0019 - 0.0042 | 1.9E-02 | N/A | 3.8E+00 C | 5.4E-04 | SSL | NO | BSL |
| | 621-64-7 | n-Nitroso-di-n-propylamine | 4.9E-02 | 4.9E-02 | MG/KG | CBD-S04-SB04-1012 | 1/10 | 0.0037 - 0.226 | 4.9E-02 | N/A | 7.8E-02 C | 8.1E-06 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 1.2E-03 J | 6.3E-01 | MG/KG | CBD-S04-SB16-0810 | 3/10 | 0.0019 - 0.0076 | 6.3E-01 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 108-95-2 | Phenol | 1.9E-03 J | 1.9E-03 J | MG/KG | CBD-S04-SB04-1012 | 1/10 | 0.0037 - 0.226 | 1.9E-03 | N/A | 1.9E+03 N | 3.3E-01 | SSL | NO | BSL |
| | 129-00-0 | Pyrene | 1.9E-03 J | 6.7E-01 | MG/KG | CBD-S04-SB16-0810 | 2/10 | 0.0037 - 0.0076 | 6.7E-01 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 72-54-8 | 4,4'-DDD | 3.5E-04 J | 3.5E-04 J | MG/KG | CBD-S04-SB12-0810 | 1/10 | 0.000123 - 0.000245 | 3.5E-04 | N/A | 1.9E-01 N | 1.5E-03 | SSL | NO | BSL |
| | 72-55-9 | 4,4'-DDE | 5.1E-04 | 8.3E-03 | MG/KG | CBD-S04-SB16-0810 | 2/10 | 0.000123 - 0.000245 | 8.3E-03 | N/A | 2.0E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 50-29-3 | 4,4'-DDT | 7.5E-03 J | 7.5E-03 J | MG/KG | CBD-S04-SB12-0810 | 1/10 | 0.000245 - 0.000491 | 7.5E-03 | N/A | 1.9E+00 C | 7.7E-02 | SSL | NO | BSL |
| | 5103-71-9 | alpha-Chlordane | 2.8E-04 J | 2.8E-04 J | MG/KG | CBD-S04-SB12-0810 | 1/10 | 0.000123 - 0.000245 | 2.8E-04 | N/A | 1.7E+00 C | 2.7E-03 | SSL | NO | BSL |
| | 11096-82-5 | Aroclor-1260 | 1.6E-01 | 1.6E-01 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 0.0062 - 0.015 | 1.6E-01 | N/A | 2.4E-01 C | 5.5E-03 | SSL | NO | BSL |
| | 60-57-1 | Dieldrin | 6.3E-03 J | 6.3E-03 J | MG/KG | CBD-S04-SB12-0810 | 1/10 | 0.000123 - 0.000245 | 6.3E-03 | N/A | 3.4E-02 C | 7.1E-05 | SSL | NO | BSL |
| | **7429-90-5** | **Aluminum** | **1.6E+03** | **8.3E+03 J-** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **8.3E+03** | **1.6E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 5.4E-02 J | 7.9E-01 | MG/KG | CBD-S04-SB16-0810 | 7/10 | 0.13 - 0.18 | 7.9E-01 | 5.5E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **1.6E+00** | **5.7E+00** | **MG/KG** | **CBD-S04-SB15-0810** | **10/10** | **N/A** | **5.7E+00** | **9.8E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 4.1E+00 | 1.5E+02 | MG/KG | CBD-S04-SB16-0810 | 10/10 | N/A | 1.5E+02 | 5.7E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.2E-01 | 1.1E+00 | MG/KG | CBD-S04-SB02-1618 | 10/10 | N/A | 1.1E+00 | 1.2E+00 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | **7440-43-9** | **Cadmium** | **2.7E-02 J** | **1.5E+01** | **MG/KG** | **CBD-S04-SB16-0810** | **8/10** | **0.13 - 0.18** | **1.5E+01** | **8.1E-01** | **7.1E+00 N** | **6.9E-02** | **SSL** | **YES** | **ASL** |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 20 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7440-70-2 | Calcium | 2.3E+01 | 3.7E+03 | MG/KG | CBD-S04-SB16-0810 | 10/10 | N/A | 3.7E+03 | 1.4E+03 | N/A | N/A | | NO | NUT |
| | **18540-29-9** | **Chromium (hexavalent)** | **1.0E-01 J** | **1.5E+00** | **MG/KG** | **CBD-S04-SB01-1820** | **4/4** | **N/A** | **1.5E+00** | **4.9E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |
| | 7440-47-3 | Chromium | 6.5E+00 | 3.3E+01 | MG/KG | CBD-S04-SB16-0810 | 10/10 | N/A | 3.3E+01 | 5.8E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **5.8E-01** | **1.8E+01** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **1.8E+01** | **5.9E+00** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | **7440-50-8** | **Copper** | **8.3E-01** | **4.8E+02** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **4.8E+02** | **7.9E+00** | **3.1E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 57-12-5 | Cyanide | 6.2E-02 J | 6.2E-02 J | MG/KG | CBD-S04-SB04-1012 | 1/5 | 0.056 - 0.06 | 6.2E-02 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **3.5E+03** | **4.6E+04** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **4.6E+04** | **3.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | **7439-92-1** | **Lead** | **1.3E+00** | **6.9E+02** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **6.9E+02** | **1.2E+01** | **4.0E+02 L*** | **1.4E+01** | **SSL** | **YES** | **ASL** |
| | 7439-95-4 | Magnesium | 3.6E+02 | 1.4E+03 | MG/KG | CBD-S04-SB16-0810 | 10/10 | N/A | 1.4E+03 | 3.4E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **2.3E+00** | **5.7E+02** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **5.7E+02** | **2.3E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7439-97-6 | Mercury | 1.1E-02 J | 1.2E+00 | MG/KG | CBD-S04-SB16-0810 | 2/10 | 0.017 - 0.18 | 1.2E+00 | 4.0E-02 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 9.8E-01 | 4.8E+01 | MG/KG | CBD-S04-SB16-0810 | 10/10 | N/A | 4.8E+01 | 1.3E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 2.9E+02 | 4.1E+02 | MG/KG | CBD-S04-SB01-1820 | 10/10 | N/A | 4.1E+02 | 1.6E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 1.8E-01 | 8.3E-01 J- | MG/KG | CBD-S04-SB13-0810 | 6/10 | 0.1 - 0.1 | 8.3E-01 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 2.6E-02 J | 8.6E-01 | MG/KG | CBD-S04-SB16-0810 | 8/10 | 0.13 - 0.18 | 8.6E-01 | 2.3E-01 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.3E+02 | 1.3E+02 | MG/KG | CBD-S04-SB16-0810 | 1/10 | 2.6 - 5.5 | 1.3E+02 | 1.4E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **7.0E-02** | **2.9E-01** | **MG/KG** | **CBD-S04-SB03-1416** | **9/10** | **0.13 - 0.18** | **2.9E-01** | **4.1E-01** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 3.5E+00 | 1.2E+01 | MG/KG | CBD-S04-SB13-0810, CBD-S04-SB16-0810 | 10/10 | N/A | 1.2E+01 | 3.6E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 7.2E+00 | 2.0E+03 | MG/KG | CBD-S04-SB16-0810 | 6/10 | N/A | 2.0E+03 | 6.4E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for acenaphthene used as surrogate for acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for technical chlordane used as surrogate for alpha-chlordane.
RSL value for chromium(III) used for chromium since four soil samples were also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
L, J- = Biased Low
C = Carcinogenic
N = Noncarcinogenic
L* = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.2a. Step 2 Subsurface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (MG/KG) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)pyrene | 1 / 10 | 4.7E-01 | CBD-S04-SB16-0810 | 1.8E+01 | 1.1E-01 | 0.03 | 4E-06 | Developmental |
| Aluminum | 10 / 10 | 8.3E+03 J- | CBD-S04-SB16-0810 | 7.7E+04 | N/A | 0.1 | N/A | Neurological |
| **Arsenic** | **10 / 10** | **5.7E+00** | **CBD-S04-SB15-0810** | **3.5E+01** | **6.8E-01** | **0.2** | **8E-06** | **Cardiovascular, Dermal** |
| Cadmium | 8 / 10 | 1.5E+01 | CBD-S04-SB16-0810 | 7.1E+01 | 2.1E+03 | 0.2 | 7E-09 | Urinary, Kidney |
| **Chromium (hexavalent)** | **4 / 4** | **1.5E+00** | **CBD-S04-SB01-1820** | **2.3E+02** | **3.0E-01** | **0.007** | **5E-06** | **None Reported, Respiratory** |
| **Cobalt** | **10 / 10** | **1.8E+01** | **CBD-S04-SB16-0810** | 2.3E+01 | 4.2E+02 | **0.8** | **4E-08** | **Thyroid, Respiratory** |
| **Copper** | **10 / 10** | **4.8E+02** | **CBD-S04-SB16-0810** | 3.1E+03 | **N/A** | **0.2** | **N/A** | **Gastrointestinal** |
| **Iron** | **10 / 10** | **4.6E+04** | **CBD-S04-SB16-0810** | 5.5E+04 | **N/A** | **0.8** | **N/A** | **Gastrointestinal** |
| Lead[e] | 10 / 10 | 6.9E+02 | CBD-S04-SB16-0810 | N/A | N/A | N/A | N/A | N/A |
| Manganese | 10 / 10 | 5.7E+02 | CBD-S04-SB16-0810 | 1.8E+03 | N/A | 0.3 | N/A | Nervous |
| Thallium | 9 / 10 | 2.9E-01 | CBD-S04-SB03-1416 | 7.8E-01 | N/A | 0.4 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | **3** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **2E-05** | |

| | |
|---|---|
| Total Developmental HI = | 0.03 |
| Total Neurological/Nervous HI = | 0.4 |
| Total Cardiovascular HI = | 0.2 |
| Total Dermal HI = | 0.5 |
| Total Urinary/Kidney HI = | 0.2 |
| Total Respiratory HI = | 0.8 |
| Total Thyroid HI = | 0.8 |
| Total Gastrointestinal HI = | 1 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

[e] Exposure to lead evaluated using the Integrated Exposure Uptake Biokinetic Model.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

### Table 2.2b. Step 3 Subsurface Soil Screening - Risk Ratio, 95% UCL, Site 4

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| **Benzo(a)pyrene** | **1 / 10** | **4.7E-01** | **Maximum** | **7** | **1.8E+01** | **1.1E-01** | **0.03** | **4E-06** | **Developmental** |
| **Arsenic** | **10 / 10** | **3.8E+00** | **95% Student's-t UCL** | **1, 3** | **3.5E+01** | **6.8E-01** | **0.1** | **6E-06** | **Cardiovascular, Dermal** |
| **Chromium (hexavalent)** | **4 / 4** | **1.5E+00** | **Maximum** | **8** | **2.3E+02** | **3.0E-01** | **0.01** | **5E-06** | **None Reported, Respiratory** |
| **Cobalt** | **10 / 10** | **1.4E+01** | **Maximum** | **1** | **2.3E+01** | **4.2E+02** | **0.6** | **3E-08** | **Thyroid, Respiratory** |
| **Copper** | **10 / 10** | **4.8E+02** | **Maximum** | **5** | **3.1E+03** | **N/A** | **0.2** | **N/A** | **Gastrointestinal** |
| **Iron** | **10 / 10** | **2.0E+04** | **95% H-UCL** | **1** | **5.5E+04** | **N/A** | **0.4** | **N/A** | **Gastrointestinal** |
| Lead[e] | 10 / 10 | 7.1E+01 | Mean | 6 | N/A | N/A | N/A | N/A | N/A |
| **Cumulative Hazard Index[c]** | | | | | | | **1** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Developental HI = | 0.03 |
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 0.1 |
| Total Respiratory HI = | 0.6 |
| Total Thyroid HI = | 0.6 |
| Total Gastrointestinal HI = | 0.5 |

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

[e] Exposure to lead evaluated using the Integrated Exposure Uptake Biokinetic Model.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Recommended 95% UCL exceeds maximum detected concentration.
(6) Mean value used as exposure point concentration in lead model.
(7) Maximum detected concentration used because the detection frequency was less than 15 percent.
(8) Sample number insufficient to estimate a UCL; the maximum detected concentration was used.

**Table 2.2c. Comparison of Concentrations of COPCs to Background Concentrations - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 20 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 7440-38-2 | Arsenic | 1.6 | 5.7 | MG/KG | CBD-S04-SB15-0810 | 10/10 | N/A | 5.7E+00 | 9.8E+00 | NO |
| | **18540-29-9** | **Chromium (hexavalent)** | **0.1 J** | **1.5** | **MG/KG** | **CBD-S04-SB01-1820** | **4/4** | **N/A** | **1.5E+00** | **4.9E-01** | **YES** |
| | **7440-48-4** | **Cobalt** | **5.8E-01** | **1.8E+01** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **1.8E+01** | **5.9E+00** | **YES** |
| | **7440-50-8** | **Copper** | **8.3E-01** | **4.8E+02** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **4.8E+02** | **7.9E+00** | **YES** |
| | **7439-89-6** | **Iron** | **3.5E+03** | **4.6E+04** | **MG/KG** | **CBD-S04-SB16-0810** | **10/10** | **N/A** | **4.6E+04** | **3.0E+04** | **YES** |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background value is the subsurface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram

**Table 2.2d. IEUBK- Site 4 Subsurface Soil and Groundwater, Child Resident**

```
        LEAD MODEL FOR WINDOWS Version 1.1

   ==================================================================================
   Model Version: 1.1 Build11
   User Name: Jacobs
   Date: 01/09/2019
   Site Name: Naval Research Laboratory - Chesapeake Bay Detachment
   Operable Unit: Site 4
   Run Mode: Site Risk Assessment
   ---------------------------------------------------------------------------------

# Water Data
mean lead groundwater concentration
# Soil/Dust Data
Mean lead soil concentration
# Maternal Data
value from OLEM Directive 9285.6-56
# GSD, Cutoff and Age Type
12-72 months
   ==================================================================================

   ****** Air ******

   Indoor Air Pb Concentration: 30.000 percent of outdoor.
   Other Air Parameters:

   Age       Time       Ventilation        Lung        Outdoor Air
          Outdoors        Rate         Absorption       Pb Conc
          (hours)      (m³/day)          (%)        (µg Pb/m³)
   ---------------------------------------------------------------------
   .5-1     1.000         2.000          32.000          0.100
   1-2      2.000         3.000          32.000          0.100
   2-3      3.000         5.000          32.000          0.100
   3-4      4.000         5.000          32.000          0.100
   4-5      4.000         5.000          32.000          0.100
   5-6      4.000         7.000          32.000          0.100
   6-7      4.000         7.000          32.000          0.100

   ****** Diet ******

   Age     Diet Intake(µg/day)
   ----------------------------------
   .5-1     2.260
   1-2      1.960
   2-3      2.130
   3-4      2.040
   4-5      1.950
   5-6      2.050
   6-7      2.220
```

```
****** Drinking Water ******

Water Consumption:
Age    Water (L/day)
-----------------------------------
.5-1     0.200
1-2      0.500
2-3      0.520
3-4      0.530
4-5      0.550
5-6      0.580
6-7      0.590

Drinking Water Concentration: 6.850 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 59.490 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age        Soil (µg Pb/g)     House Dust (µg Pb/g)
--------------------------------------------------------
.5-1          70.700          59.490
1-2           70.700          59.490
2-3           70.700          59.490
3-4           70.700          59.490
4-5           70.700          59.490
5-6           70.700          59.490
6-7           70.700          59.490

****** Alternate Intake ******

Age     Alternate (µg Pb/day)
-----------------------------------
2-3     0.000
3-4     0.000
4-5     0.000
5-6     0.000
6-7     0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.600 µg Pb/dL
```

```
****************************************
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****************************************

Year      Air          Diet          Alternate     Water
        (µg/day)     (µg/day)       (µg/day)     (µg/day)
------------------------------------------------------------------
.5-1     0.021        1.088         0.000        0.660
1-2      0.034        0.938         0.000        1.638
2-3      0.062        1.024         0.000        1.713
3-4      0.067        0.987         0.000        1.756
4-5      0.067        0.950         0.000        1.836
5-6      0.093        1.002         0.000        1.942
6-7      0.093        1.087         0.000        1.979

 Year    Soil+Dust       Total        Blood
        (µg/day)     (µg/day)     (µg/dL)
--------------------------------------------------
.5-1     1.585        3.353         1.8
1-2      2.500        5.111         2.1
2-3      2.514        5.313         2.0
3-4      2.528        5.337         1.9
4-5      1.887        4.741         1.6
5-6      1.704        4.742         1.5
6-7      1.612        4.772         1.4
```

**Table 2.3. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 91-57-6 | 2-Methylnaphthalene | 5.4E-03 J | 5.4E-03 J | UG/L | CBD-S04-GW02-0518 | 1/3 | 0.013 - 0.014 | 5.4E-03 | ND | 3.6E+00 N | N/A | | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 3.2E-03 J | 3.2E-03 J | UG/L | CBD-S04-GW02P-0518 | 1/3 | 0.013 - 0.014 | 3.2E-03 | ND | 3.0E-02 C | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 2.1E-02 J | 2.1E-02 J | UG/L | CBD-S04-GW01-0518 | 1/3 | 0.012 - 0.013 | 2.1E-02 | ND | 2.5E+00 C | N/A | | NO | BSL |
| | 218-01-9 | Chrysene | 4.0E-03 J | 6.1E-03 J | UG/L | CBD-S04-GW02-0518 | 2/3 | 0.013 - 0.013 | 6.1E-03 | 1.3E-02 | 2.5E+01 C | N/A | | NO | BSL |
| | 206-44-0 | Fluoranthene | 5.4E-03 J | 6.2E-03 J | UG/L | CBD-S04-GW01-0518 | 2/3 | 0.013 - 0.013 | 6.2E-03 | 2.6E-02 | 8.0E+01 N | N/A | | NO | BSL |
| | 91-20-3 | Naphthalene | 7.5E-03 J | 1.0E-02 J | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 1.0E-02 | 4.1E-02 | 1.7E-01 C | N/A | | NO | BSL |
| | 85-01-8 | Phenanthrene | 1.4E-02 J | 1.4E-02 J | UG/L | CBD-S04-GW02-0518 | 1/3 | 0.021 - 0.023 | 1.4E-02 | 3.8E-02 | 1.8E+02 N | N/A | | NO | BSL |
| | **7429-90-5** | **Aluminum** | **3.1E+01** | **1.3E+04** | **UG/L** | **CBD-S04-GW01-0518** | **3/3** | **N/A** | **1.3E+04** | **5.0E+03** | **2.0E+03 N** | **N/A** | | **YES** | **ASL** |
| | **7440-38-2** | **Arsenic** | **2.1E-01 J** | **1.5E+00** | **UG/L** | **CBD-S04-GW01-0518** | **2/3** | **0.13 - 0.13** | **1.5E+00** | **6.1E+00** | **5.2E-02 C** | **1.0E+01** | **MCL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 3.4E+01 | 4.1E+01 | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 4.1E+01 | 1.6E+02 | 3.8E+02 N | 2.0E+03 | MCL | NO | BSL |
| | 7440-41-7 | Beryllium | 4.3E-01 J | 7.9E-01 J- | UG/L | CBD-S04-GW01-0518 | 2/3 | 0.13 - 0.13 | 7.9E-01 | 3.0E+00 | 2.5E+00 N | 4.0E+00 | MCL | NO | BSL |
| | **7440-43-9** | **Cadmium** | **5.1E-01** | **2.9E+00** | **UG/L** | **CBD-S04-GW01-0518** | **3/3** | **N/A** | **2.9E+00** | **6.4E+01** | **9.2E-01 N** | **5.0E+00** | **MCL** | **YES** | **ASL** |
| | 7440-70-2 | Calcium | 4.3E+03 | 2.2E+04 | UG/L | CBD-S04-GW03-0518 | 3/3 | N/A | 2.2E+04 | 1.3E+05 | N/A | N/A | | NO | NUT |
| | **7440-47-3** | **Chromium** | **2.4E-01 J** | **5.7E+00** | **UG/L** | **CBD-S04-GW01-0518** | **3/3** | **N/A** | **5.7E+00** | **2.5E+01** | **3.5E-02 C** | **1.0E+02** | **MCL** | **YES** | **ASL** |
| | **7440-48-4** | **Cobalt** | **2.2E+00** | **9.8E+00** | **UG/L** | **CBD-S04-GW01-0518** | **3/3** | **N/A** | **9.8E+00** | **4.0E+01** | **6.0E-01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-50-8 | Copper | 7.2E-01 | 6.9E+00 | UG/L | CBD-S04-GW01-0518 | 2/3 | 0.42 - 0.42 | 6.9E+00 | 1.1E+01 | 8.0E+01 N | 1.3E+03 | MCL | NO | BSL |
| | **7439-89-6** | **Iron** | **2.6E+02** | **2.8E+03** | **UG/L** | **CBD-S04-GW01-0518** | **2/3** | **7.8 - 7.8** | **2.8E+03** | **2.3E+04** | **1.4E+03 N** | **N/A** | | **YES** | **ASL** |
| | 7439-92-1 | Lead | 1.8E+00 J- | 1.8E+00 J- | UG/L | CBD-S04-GW01-0518 | 1/3 | 0.13 - 0.13 | 1.8E+00 | 1.4E+00 | 1.5E+01 L* | 1.5E+01 | MCL | NO | BSL |
| | 7439-95-4 | Magnesium | 2.6E+03 | 1.0E+04 | UG/L | CBD-S04-GW03-0518 | 3/3 | N/A | 1.0E+04 | 3.8E+04 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **1.3E+01** | **1.2E+02** | **UG/L** | **CBD-S04-GW03-0518** | **3/3** | **N/A** | **1.2E+02** | **4.0E+03** | **4.3E+01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-02-0 | Nickel | 8.0E+00 | 1.3E+01 | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 1.3E+01 | 2.6E+02 | 3.9E+01 N | N/A | | NO | BSL |
| | 7440-09-7 | Potassium | 2.3E+03 | 2.8E+03 | UG/L | CBD-S04-GW01-0518, CBD-S04-GW03-0518 | 3/3 | N/A | 2.8E+03 | 1.2E+04 | N/A | N/A | | NO | NUT |
| | 7440-23-5 | Sodium | 5.5E+03 | 1.3E+04 | UG/L | CBD-S04-GW03-0518 | 3/3 | N/A | 1.3E+04 | 5.5E+04 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **2.0E-01 J** | **5.4E-01 J** | **UG/L** | **CBD-S04-GW01-0518** | **2/3** | **0.5 - 0.5** | **5.4E-01** | **3.1E+00** | **2.0E-02 N** | **2.0E+00** | **MCL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 6.1E-02 J | 4.6E+00 | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 4.6E+00 | 4.7E+00 | 8.6E+00 N | N/A | | NO | BSL |
| | 7440-66-6 | Zinc | 2.3E+01 | 1.2E+02 | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 1.2E+02 | 3.2E+02 | 6.0E+02 N | N/A | | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value (95 percent upper tolerance limit).

[4] USEPA. November, 2018. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Tap Water RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium (hexavalent) used for chromium.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J- = Estimated Value, Potential low bias
C = Carcinogenic
N = Noncarcinogenic
MCL = USEPA Maximum Contaminant Level
L* = Lead screening level from November 2019 RSL Table
UG/L = Micrograms per liter
N/A = Not available/not applicable
ND = Not detected

**Table 2.3a. Step 2 Groundwater Screening - Risk Ratio, Maximum Detected Concentration, Site 4**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (UG/L) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Tap Water RSL HQ=1 | Carcinogenic Tap Water RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| **Aluminum** | **3 / 3** | **1.3E+04** | **CBD-S04-GW01-0518** | **2.0E+04** | N/A | **0.7** | N/A | **Neurological** |
| ***Arsenic*** | ***2 / 3*** | ***1.5E+00*** | ***CBD-S04-GW01-0518*** | ***6.0E+00*** | ***5.2E-02*** | ***0.3*** | ***3E-05*** | ***Cardiovascular, Dermal*** |
| Cadmium | 3 / 3 | 2.9E+00 | CBD-S04-GW01-0518 | 9.2E+00 | N/A | 0.3 | N/A | Urinary, Kidney |
| ***Chromium*** | ***3 / 3*** | ***5.7E+00*** | ***CBD-S04-GW01-0518*** | ***4.4E+01*** | ***3.5E-02*** | ***0.1*** | ***2E-04*** | ***None Reported, Respiratory*** |
| ***Cobalt*** | ***3 / 3*** | ***9.8E+00*** | ***CBD-S04-GW01-0518*** | ***6.0E+00*** | ***N/A*** | ***2*** | ***N/A*** | ***Thyroid, Respiratory*** |
| Iron | 2 / 3 | 2.8E+03 | CBD-S04-GW01-0518 | 1.4E+04 | N/A | 0.2 | N/A | Gastrointestinal |
| **Manganese** | **3 / 3** | **1.2E+02** | **CBD-S04-GW03-0518** | **4.3E+02** | **N/A** | **0.3** | **N/A** | **Nervous** |
| ***Thallium*** | ***2 / 3*** | ***5.4E-01 J*** | ***CBD-S04-GW01-0518*** | ***2.0E-01*** | ***N/A*** | ***3*** | ***N/A*** | ***Dermal*** |
| **Cumulative Hazard Index[c]** | | | | | | **6** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **2E-04** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.9 |
| Total Cardiovascular HI = | 0.3 |
| Total Dermal HI = | **3** |
| Total Urinary/Kidney HI = | 0.3 |
| Total Thyroid = | 2 |
| Total Respiratory HI = | 2 |
| Total Gastrointestinal HI = | 0.2 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as COPCs based on Navy criteria are indicated by bold text.
Constituents selected as COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
UG/L = micrograms per liter

MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

## Table 2.3b. Comparison of Concentrations of COPCs to Background Concentrations - Site 4

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration | Qualifier | Maximum [1] Concentration | Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening [2] | Background Value [3] | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | **7429-90-5** | **Aluminum** | **3.1E+01** | | **1.3E+04** | | **UG/L** | **CBD-S04-GW01-0518** | **3/3** | N/A | 1.3E+04 | 5.0E+03 | **YES** |
| | 7440-38-2 | Arsenic | 2.1E-01 | J | 1.5E+00 | | UG/L | CBD-S04-GW01-0518 | 2/3 | 0.13 - 0.13 | 1.5E+00 | 6.1E+00 | NO |
| | 7440-47-3 | Chromium | 2.4E-01 | J | 5.7E+00 | | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 5.7E+00 | 2.5E+01 | NO |
| | 7440-48-4 | Cobalt | 2.2E+00 | | 9.8E+00 | | UG/L | CBD-S04-GW01-0518 | 3/3 | N/A | 9.8E+00 | 4.0E+01 | NO |
| | 7439-96-5 | Manganese | 1.3E+01 | | 1.2E+02 | | UG/L | CBD-S04-GW03-0518 | 3/3 | N/A | 1.2E+02 | 4.0E+03 | NO |
| | 7440-28-0 | Thallium | 2.0E-01 | J | 5.4E-01 | J | UG/L | CBD-S04-GW01-0518 | 2/3 | 0.5 - 0.5 | 5.4E-01 | 3.1E+00 | NO |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background value is the surface soil background threshold value (BTV).

COPC = Chemical of Potential Concern
UG/L = microgram per liter
N/A = not applicable

## Table Lead.1
## RAGS D IEUBK LEAD WORKSHEET
## Child (Age 12 – 72 Months)
Expanded Site Investigation Report - Site 4
Naval Research Laboratory - Chesapeake Bay Detachment, Chesapeake Beach, Maryland

### 1. Lead Screening Questions

| Medium | Lead Concentration Used in Model Run | | Basis for Lead Concentration Used For Model Run | Lead Screening Concentration | | Basis for Lead Screening Level |
|---|---|---|---|---|---|---|
| | Value | Units | | Value | Units | |
| Subsurface Soil | 70.7 | mg/kg | Average Detected Value in Soil | 400 | mg/kg | Recommended Soil Screening Level |
| Water | 6.85 | µg/L | Average of Detected Concentrations in Groundwater | 15 | µg/L | Recommended Drinking Water Action Level |

### 2. Lead Model Questions

| Question | Response for Residential Lead Model |
|---|---|
| What lead model (version and date was used)? | Lead Model for Windows, Version 1.1 Build 11 (February, 2010) |
| Where are the input values located in the risk assessment report? | Located in IEUBKwin OUTPUT (Attached as Table Lead.1b and Figure Lead 1) |
| What range of media concentrations were used for the model? | 1.3 – 690 mg/kg (subsurface soil)<br>0.74 – 18 µg/L (groundwater) |
| What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics? | Arithmetic Mean Concentration, Arithmetic mean of detected concentrations only for groundwater. For subsurface soil, all samples had detected concentrations; Data are located in Appendix D. |
| Was soil sample taken from top 2 cm? If not, why? | Yes, however since no exceedances of screening level in surface soil only evaluated subsurface soil in IEUBK. |
| Was soil sample sieved? What size screen was used? If not sieved, provide rationale. | No – Samples were collected for multiple analyses. |
| What was the point of exposure/location? | Site 4 |
| Where are the output values located in the risk assessment report? | IEUBKwin OUTPUT (Attached as Table Lead.1b and Figure Lead.1) |
| Was the model run using default values only? | No – Assumed site-specific arithmetic mean concentration of lead in subsurface soil and groundwater, and maternal blood lead concentration of 0.6 µg Pb/dL. |
| Was the default soil bioavailability used? | Yes -- Default is 30% |
| Was the default soil ingestion rate used? | Yes -- Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day |
| If non-default values were used, where is the rationale for the values located in the risk assessment report? | Section 5. |

### 3. Final Result

| Medium | Result | Comment/PRG [1] |
|---|---|---|
| Subsurface soil and groundwater | 70.7 mg/kg lead in subsurface soil and 6.85 µg/L lead in groundwater results in 0.015 % of children above a blood lead level of 10 µg/dL. Geometric mean blood lead = 1.82 µg/dL. This is below the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 µg/dL blood lead. | PRG not calculated. |

**1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see [www.epa.gov/superfund/programs/lead](www.epa.gov/superfund/programs/lead)**

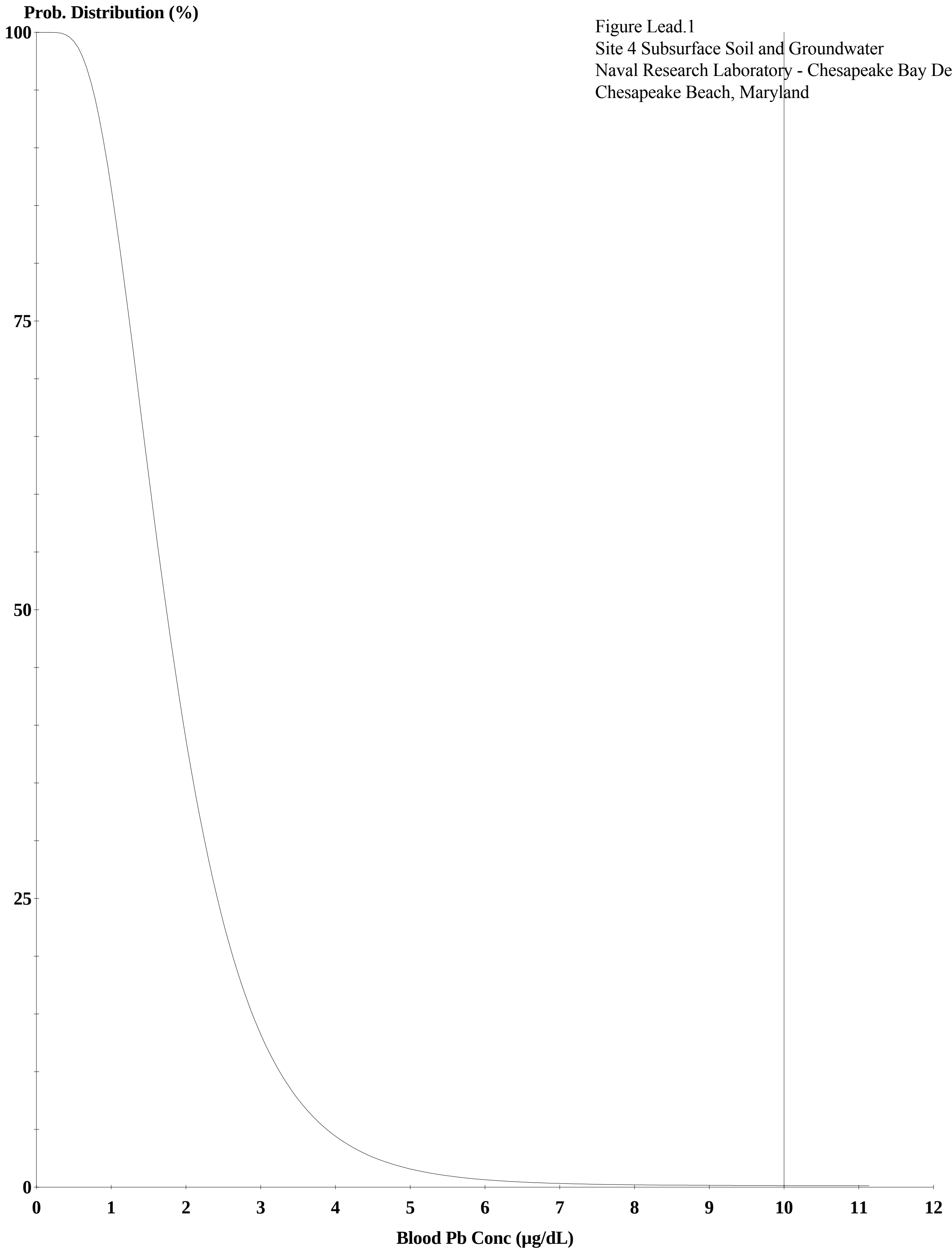

Figure Lead.1
Site 4 Subsurface Soil and Groundwater
Naval Research Laboratory - Chesapeake Bay Detachment,
Chesapeake Beach, Maryland

**Cutoff = 10.000 µg/dl**
**Geo Mean = 1.822**
**GSD = 1.600**
**% Above = 0.015**

**Age Range = User Designated: Ages 12 - 72 months**

**Run Mode = Site Risk Assessment**

## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/3/2019 5:49:00 PM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Benzo(a)anthracene (UG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 9 |
| Number of Detects | 8 | Number of Non-Detects | 3 |
| Number of Distinct Detects | 8 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 1.9 | Minimum Non-Detect | 1.9 |
| Maximum Detect | 3100 | Maximum Non-Detect | 5.1 |
| Variance Detects | 1165738 | Percent Non-Detects | 27.27% |
| Mean Detects | 430.8 | SD Detects | 1080 |
| Median Detects | 39 | CV Detects | 2.506 |
| Skewness Detects | 2.816 | Kurtosis Detects | 7.948 |
| Mean of Logged Detects | 3.786 | SD of Logged Detects | 2.211 |

#### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.458 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.478 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

#### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 313.8 | KM Standard Error of Mean | 284.4 |
| KM SD | 882.2 | 95% KM (BCA) UCL | 869.2 |
| 95% KM (t) UCL | 829.2 | 95% KM (Percentile Bootstrap) UCL | 861.5 |
| 95% KM (z) UCL | 781.5 | 95% KM Bootstrap t UCL | 9605 |
| 90% KM Chebyshev UCL | 1167 | 95% KM Chebyshev UCL | 1553 |
| 97.5% KM Chebyshev UCL | 2090 | 99% KM Chebyshev UCL | 3143 |

#### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.895 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.797 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.324 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.317 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

#### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.302 | k star (bias corrected MLE) | 0.272 |
| Theta hat (MLE) | 1426 | Theta star (bias corrected MLE) | 1583 |
| nu hat (MLE) | 4.834 | nu star (bias corrected) | 4.354 |
| Mean (detects) | 430.8 | | |

#### Gamma ROS Statistics using Imputed Non-Detects

## Site 4 Surface Soil

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 313.3 |
| Maximum | 3100 | Median | 19 |
| SD | 925.5 | CV | 2.954 |
| k hat (MLE) | 0.177 | k star (bias corrected MLE) | 0.189 |
| Theta hat (MLE) | 1775 | Theta star (bias corrected MLE) | 1658 |
| nu hat (MLE) | 3.884 | nu star (bias corrected) | 4.158 |
| Adjusted Level of Significance (β) | 0.0278 | | |
| Approximate Chi Square Value (4.16, α) | 0.785 | Adjusted Chi Square Value (4.16, β) | 0.58 |
| 95% Gamma Approximate UCL (use when n>=50) | 1659 | 95% Gamma Adjusted UCL (use when n<50) | 2244 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 313.8 | SD (KM) | 882.2 |
| Variance (KM) | 778314 | SE of Mean (KM) | 284.4 |
| k hat (KM) | 0.127 | k star (KM) | 0.153 |
| nu hat (KM) | 2.783 | nu star (KM) | 3.358 |
| theta hat (KM) | 2480 | theta star (KM) | 2056 |
| 80% gamma percentile (KM) | 346.4 | 90% gamma percentile (KM) | 932.7 |
| 95% gamma percentile (KM) | 1721 | 99% gamma percentile (KM) | 4002 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.36, α) | 0.486 | Adjusted Chi Square Value (3.36, β) | 0.346 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2169 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3049 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.958 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.818 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.165 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.283 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 313.4 | Mean in Log Scale | 2.374 |
| SD in Original Scale | 925.4 | SD in Log Scale | 3.071 |
| 95% t UCL (assumes normality of ROS data) | 819.1 | 95% Percentile Bootstrap UCL | 870.9 |
| 95% BCA Bootstrap UCL | 1168 | 95% Bootstrap t UCL | 9642 |
| 95% H-UCL (Log ROS) | 2038137 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.928 | KM Geo Mean | 18.69 |
| KM SD (logged) | 2.252 | 95% Critical H Value (KM-Log) | 5.733 |
| KM Standard Error of Mean (logged) | 0.726 | 95% H-UCL (KM -Log) | 13976 |
| KM SD (logged) | 2.252 | 95% Critical H Value (KM-Log) | 5.733 |
| KM Standard Error of Mean (logged) | 0.726 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 313.7 | Mean in Log Scale | 2.829 |

Site 4 Surface Soil

| | | | |
|---|---|---|---|
| SD in Original Scale | 925.3 | SD in Log Scale | 2.484 |
| 95% t UCL (Assumes normality) | 819.4 | 95% H-Stat UCL | 51154 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 99% KM (Chebyshev) UCL | 3143 |

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Benzo(a)pyrene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 11 |
| Number of Detects | 7 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 8 | Minimum Non-Detect | 0.77 |
| Maximum Detect | 3500 | Maximum Non-Detect | 5.1 |
| Variance Detects | 1691268 | Percent Non-Detects | 36.36% |
| Mean Detects | 553.7 | SD Detects | 1300 |
| Median Detects | 71 | CV Detects | 2.349 |
| Skewness Detects | 2.635 | Kurtosis Detects | 6.955 |
| Mean of Logged Detects | 4.309 | SD of Logged Detects | 1.982 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.491 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.47 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 352.6 | KM Standard Error of Mean | 324.6 |
| KM SD | 996.6 | 95% KM (BCA) UCL | 986.3 |
| 95% KM (t) UCL | 940.9 | 95% KM (Percentile Bootstrap) UCL | 977 |
| 95% KM (z) UCL | 886.5 | 95% KM Bootstrap t UCL | 12860 |
| 90% KM Chebyshev UCL | 1326 | 95% KM Chebyshev UCL | 1767 |
| 97.5% KM Chebyshev UCL | 2380 | 99% KM Chebyshev UCL | 3582 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.96 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.778 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.34 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.334 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

Site 4 Surface Soil

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.337 | k star (bias corrected MLE) | 0.288 |
| Theta hat (MLE) | 1643 | Theta star (bias corrected MLE) | 1924 |
| nu hat (MLE) | 4.719 | nu star (bias corrected) | 4.03 |
| Mean (detects) | 553.7 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 352.4 |
| Maximum | 3500 | Median | 21 |
| SD | 1045 | CV | 2.967 |
| k hat (MLE) | 0.159 | k star (bias corrected MLE) | 0.176 |
| Theta hat (MLE) | 2218 | Theta star (bias corrected MLE) | 2000 |
| nu hat (MLE) | 3.495 | nu star (bias corrected) | 3.875 |
| Adjusted Level of Significance (β) | 0.0278 | | |
| Approximate Chi Square Value (3.88, α) | 0.673 | Adjusted Chi Square Value (3.88, β) | 0.491 |
| 95% Gamma Approximate UCL (use when n>=50) | 2029 | 95% Gamma Adjusted UCL (use when n<50) | 2781 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 352.6 | SD (KM) | 996.6 |
| Variance (KM) | 993261 | SE of Mean (KM) | 324.6 |
| k hat (KM) | 0.125 | k star (KM) | 0.152 |
| nu hat (KM) | 2.754 | nu star (KM) | 3.337 |
| theta hat (KM) | 2817 | theta star (KM) | 2325 |
| 80% gamma percentile (KM) | 387.3 | 90% gamma percentile (KM) | 1047 |
| 95% gamma percentile (KM) | 1937 | 99% gamma percentile (KM) | 4512 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.34, α) | 0.479 | Adjusted Chi Square Value (3.34, β) | 0.34 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2458 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3458 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.899 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.218 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 352.5 | Mean in Log Scale | 2.47 |
| SD in Original Scale | 1045 | SD in Log Scale | 2.978 |
| 95% t UCL (assumes normality of ROS data) | 923.8 | 95% Percentile Bootstrap UCL | 979.1 |
| 95% BCA Bootstrap UCL | 1297 | 95% Bootstrap t UCL | 12993 |
| 95% H-UCL (Log ROS) | 1097911 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.647 | KM Geo Mean | 14.12 |
| KM SD (logged) | 2.641 | 95% Critical H Value (KM-Log) | 6.643 |

**Site 4 Surface Soil**

| | | | |
|---|---|---|---|
| KM Standard Error of Mean (logged) | 0.86 | 95% H-UCL (KM -Log) | 118701 |
| KM SD (logged) | 2.641 | 95% Critical H Value (KM-Log) | 6.643 |
| KM Standard Error of Mean (logged) | 0.86 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 353 | Mean in Log Scale | 2.855 |
| SD in Original Scale | 1045 | SD in Log Scale | 2.578 |
| 95% t UCL (Assumes normality) | 924.1 | 95% H-Stat UCL | 96293 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 97.5% KM (Chebyshev) UCL | 2380 | 99% KM (Chebyshev) UCL | 3582 |

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Benzo(b)fluoranthene (UG/KG)**

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 9 |
| Number of Detects | 7 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 7 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 15 | Minimum Non-Detect | 3.8 |
| Maximum Detect | 3900 | Maximum Non-Detect | 7.8 |
| Variance Detects | 2074805 | Percent Non-Detects | 36.36% |
| Mean Detects | 639.3 | SD Detects | 1440 |
| Median Detects | 80 | CV Detects | 2.253 |
| Skewness Detects | 2.626 | Kurtosis Detects | 6.919 |
| Mean of Logged Detects | 4.743 | SD of Logged Detects | 1.811 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.504 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.458 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 408.2 | KM Standard Error of Mean | 360.5 |
| KM SD | 1107 | 95% KM (BCA) UCL | 1100 |
| 95% KM (t) UCL | 1062 | 95% KM (Percentile Bootstrap) UCL | 1101 |
| 95% KM (z) UCL | 1001 | 95% KM Bootstrap t UCL | 10716 |
| 90% KM Chebyshev UCL | 1490 | 95% KM Chebyshev UCL | 1979 |
| 97.5% KM Chebyshev UCL | 2659 | 99% KM Chebyshev UCL | 3995 |

Site 4 Surface Soil

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.918 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.77 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.322 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.332 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data follow Appr. Gamma Distribution at 5% Significance Level**

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.385 | k star (bias corrected MLE) | 0.315 |
| Theta hat (MLE) | 1659 | Theta star (bias corrected MLE) | 2026 |
| nu hat (MLE) | 5.396 | nu star (bias corrected) | 4.417 |
| Mean (detects) | 639.3 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 406.8 |
| Maximum | 3900 | Median | 38 |
| SD | 1161 | CV | 2.855 |
| k hat (MLE) | 0.163 | k star (bias corrected MLE) | 0.179 |
| Theta hat (MLE) | 2499 | Theta star (bias corrected MLE) | 2273 |
| nu hat (MLE) | 3.581 | nu star (bias corrected) | 3.938 |
| Adjusted Level of Significance (β) | 0.0278 | | |
| Approximate Chi Square Value (3.94, α) | 0.697 | Adjusted Chi Square Value (3.94, β) | 0.51 |
| 95% Gamma Approximate UCL (use when n>=50) | 2297 | 95% Gamma Adjusted UCL (use when n<50) | 3140 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 408.2 | SD (KM) | 1107 |
| Variance (KM) | 1225163 | SE of Mean (KM) | 360.5 |
| k hat (KM) | 0.136 | k star (KM) | 0.16 |
| nu hat (KM) | 2.992 | nu star (KM) | 3.509 |
| theta hat (KM) | 3001 | theta star (KM) | 2559 |
| 80% gamma percentile (KM) | 466.3 | 90% gamma percentile (KM) | 1220 |
| 95% gamma percentile (KM) | 2219 | 99% gamma percentile (KM) | 5083 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.51, α) | 0.538 | Adjusted Chi Square Value (3.51, β) | 0.385 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 2662 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3716 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.904 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.803 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.187 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.304 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 407.3 | Mean in Log Scale | 3.018 |
| SD in Original Scale | 1161 | SD in Log Scale | 2.824 |

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| | | | |
|---|---|---|---|
| 95% t UCL (assumes normality of ROS data) | 1042 | 95% Percentile Bootstrap UCL | 1102 |
| 95% BCA Bootstrap UCL | 1454 | 95% Bootstrap t UCL | 10796 |
| 95% H-UCL (Log ROS) | 610682 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 3.504 | KM Geo Mean | 33.24 |
| KM SD (logged) | 2.116 | 95% Critical H Value (KM-Log) | 5.419 |
| KM Standard Error of Mean (logged) | 0.689 | 95% H-UCL (KM -Log) | 11708 |
| KM SD (logged) | 2.116 | 95% Critical H Value (KM-Log) | 5.419 |
| KM Standard Error of Mean (logged) | 0.689 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 407.7 | Mean in Log Scale | 3.317 |
| SD in Original Scale | 1161 | SD in Log Scale | 2.433 |
| 95% t UCL (Assumes normality) | 1042 | 95% H-Stat UCL | 60718 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% KM Bootstrap t UCL | 10716 | a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) | 3716 |

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Dibenz(a,h)anthracene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 10 |
| Number of Detects | 6 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 6 | Number of Distinct Non-Detects | 5 |
| Minimum Detect | 3.8 | Minimum Non-Detect | 0.77 |
| Maximum Detect | 230 | Maximum Non-Detect | 7.8 |
| Variance Detects | 8123 | Percent Non-Detects | 45.45% |
| Mean Detects | 47.53 | SD Detects | 90.13 |
| Median Detects | 6.15 | CV Detects | 1.896 |
| Skewness Detects | 2.365 | Kurtosis Detects | 5.645 |
| Mean of Logged Detects | 2.591 | SD of Logged Detects | 1.596 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.582 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.393 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.325 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 26.75 | KM Standard Error of Mean | 21.44 |
| KM SD | 64.9 | 95% KM (BCA) UCL | 69.13 |
| 95% KM (t) UCL | 65.61 | 95% KM (Percentile Bootstrap) UCL | 67.02 |
| 95% KM (z) UCL | 62.01 | 95% KM Bootstrap t UCL | 634.6 |
| 90% KM Chebyshev UCL | 91.07 | 95% KM Chebyshev UCL | 120.2 |
| 97.5% KM Chebyshev UCL | 160.6 | 99% KM Chebyshev UCL | 240.1 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.885 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.736 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.37 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.349 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.5 | k star (bias corrected MLE) | 0.361 |
| Theta hat (MLE) | 95.06 | Theta star (bias corrected MLE) | 131.6 |
| nu hat (MLE) | 6 | nu star (bias corrected) | 4.333 |
| Mean (detects) | 47.53 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 25.93 |
| Maximum | 230 | Median | 3.8 |
| SD | 68.39 | CV | 2.637 |
| k hat (MLE) | 0.189 | k star (bias corrected MLE) | 0.198 |
| Theta hat (MLE) | 137.4 | Theta star (bias corrected MLE) | 131.1 |
| nu hat (MLE) | 4.151 | nu star (bias corrected) | 4.352 |
| Adjusted Level of Significance (β) | 0.0278 | | |
| Approximate Chi Square Value (4.35, α) | 0.866 | Adjusted Chi Square Value (4.35, β) | 0.646 |
| 95% Gamma Approximate UCL (use when n>=50) | 130.4 | 95% Gamma Adjusted UCL (use when n<50) | 174.7 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 26.75 | SD (KM) | 64.9 |
| Variance (KM) | 4213 | SE of Mean (KM) | 21.44 |
| k hat (KM) | 0.17 | k star (KM) | 0.184 |
| nu hat (KM) | 3.736 | nu star (KM) | 4.051 |
| theta hat (KM) | 157.5 | theta star (KM) | 145.3 |
| 80% gamma percentile (KM) | 33.65 | 90% gamma percentile (KM) | 80.75 |
| 95% gamma percentile (KM) | 140.7 | 99% gamma percentile (KM) | 308.2 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (4.05, α) | 0.742 | Adjusted Chi Square Value (4.05, β) | 0.546 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 146.1 | 95% Gamma Adjusted KM-UCL (use when n<50) | 198.5 |

### Lognormal GOF Test on Detected Observations Only

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| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.8 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.788 | Detected Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.327 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.325 | Detected Data Not Lognormal at 5% Significance Level | |

Detected Data appear Approximate Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 26.38 | Mean in Log Scale | 1.264 |
| SD in Original Scale | 68.21 | SD in Log Scale | 1.98 |
| 95% t UCL (assumes normality of ROS data) | 63.65 | 95% Percentile Bootstrap UCL | 65.31 |
| 95% BCA Bootstrap UCL | 88.44 | 95% Bootstrap t UCL | 733.2 |
| 95% H-UCL (Log ROS) | 616.4 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 1.493 | KM Geo Mean | 4.449 |
| KM SD (logged) | 1.703 | 95% Critical H Value (KM-Log) | 4.482 |
| KM Standard Error of Mean (logged) | 0.583 | 95% H-UCL (KM -Log) | 212.3 |
| KM SD (logged) | 1.703 | 95% Critical H Value (KM-Log) | 4.482 |
| KM Standard Error of Mean (logged) | 0.583 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 26.99 | Mean in Log Scale | 1.681 |
| SD in Original Scale | 67.97 | SD in Log Scale | 1.647 |
| 95% t UCL (Assumes normality) | 64.13 | 95% H-Stat UCL | 201.7 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 97.5% KM (Chebyshev) UCL | 160.6 | 99% KM (Chebyshev) UCL | 240.1 |

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Aroclor-1260 (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 9 |
| Number of Detects | 4 | Number of Non-Detects | 7 |
| Number of Distinct Detects | 4 | Number of Distinct Non-Detects | 5 |
| Minimum Detect | 7.2 | Minimum Non-Detect | 6.5 |
| Maximum Detect | 260 | Maximum Non-Detect | 15 |
| Variance Detects | 14919 | Percent Non-Detects | 63.64% |
| Mean Detects | 77.05 | SD Detects | 122.1 |
| Median Detects | 20.5 | CV Detects | 1.585 |
| Skewness Detects | 1.982 | Kurtosis Detects | 3.943 |
| Mean of Logged Detects | 3.39 | SD of Logged Detects | 1.531 |

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### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.681 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.421 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 32.19 | KM Standard Error of Mean | 25.15 |
| KM SD | 72.24 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 77.78 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 73.56 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 107.6 | 95% KM Chebyshev UCL | 141.8 |
| 97.5% KM Chebyshev UCL | 189.3 | 99% KM Chebyshev UCL | 282.4 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.556 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.675 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.392 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.407 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.641 | k star (bias corrected MLE) | 0.327 |
| Theta hat (MLE) | 120.2 | Theta star (bias corrected MLE) | 235.6 |
| nu hat (MLE) | 5.13 | nu star (bias corrected) | 2.616 |
| Mean (detects) | 77.05 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 28.02 |
| Maximum | 260 | Median | 0.01 |
| SD | 77.37 | CV | 2.761 |
| k hat (MLE) | 0.152 | k star (bias corrected MLE) | 0.171 |
| Theta hat (MLE) | 183.9 | Theta star (bias corrected MLE) | 163.5 |
| nu hat (MLE) | 3.353 | nu star (bias corrected) | 3.772 |
| Adjusted Level of Significance (β) | 0.0278 | | |
| Approximate Chi Square Value (3.77, α) | 0.634 | Adjusted Chi Square Value (3.77, β) | 0.46 |
| 95% Gamma Approximate UCL (use when n>=50) | 166.8 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 32.19 | SD (KM) | 72.24 |
| Variance (KM) | 5219 | SE of Mean (KM) | 25.15 |
| k hat (KM) | 0.199 | k star (KM) | 0.205 |
| nu hat (KM) | 4.369 | nu star (KM) | 4.511 |
| theta hat (KM) | 162.1 | theta star (KM) | 157 |
| 80% gamma percentile (KM) | 42.97 | 90% gamma percentile (KM) | 97.37 |

| | | | |
|---|---|---|---|
| 95% gamma percentile (KM) | 164.8 | 99% gamma percentile (KM) | 349.7 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (4.51, α) | 0.933 | Adjusted Chi Square Value (4.51, β) | 0.701 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 155.6 | 95% Gamma Adjusted KM-UCL (use when n<50) | 207.1 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.893 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.748 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.316 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.375 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 28.32 | Mean in Log Scale | 0.55 |
| SD in Original Scale | 77.26 | SD in Log Scale | 2.494 |
| 95% t UCL (assumes normality of ROS data) | 70.54 | 95% Percentile Bootstrap UCL | 73.97 |
| 95% BCA Bootstrap UCL | 98.98 | 95% Bootstrap t UCL | 387.7 |
| 95% H-UCL (Log ROS) | 5568 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.43 | KM Geo Mean | 11.35 |
| KM SD (logged) | 1.08 | 95% Critical H Value (KM-Log) | 3.154 |
| KM Standard Error of Mean (logged) | 0.376 | 95% H-UCL (KM -Log) | 59.78 |
| KM SD (logged) | 1.08 | 95% Critical H Value (KM-Log) | 3.154 |
| KM Standard Error of Mean (logged) | 0.376 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 31.14 | Mean in Log Scale | 2.2 |
| SD in Original Scale | 76.18 | SD in Log Scale | 1.3 |
| 95% t UCL (Assumes normality) | 72.77 | 95% H-Stat UCL | 92.42 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

### Nonparametric Distribution Free UCL Statistics

**Detected Data appear Gamma Distributed at 5% Significance Level**

### Suggested UCL to Use

| | | | |
|---|---|---|---|
| 95% KM Bootstrap t UCL | N/A | a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) | 207.1 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Arsenic (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 11 | Number of Distinct Observations | 11 |
| | | Number of Missing Observations | 0 |
| Minimum | 2.2 | Mean | 4.509 |

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| | | | |
|---|---|---|---|
| Maximum | 8.3 | Median | 3.5 |
| SD | 2.085 | Std. Error of Mean | 0.629 |
| Coefficient of Variation | 0.462 | Skewness | 0.801 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.889 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.231 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 5.649 | 95% Adjusted-CLT UCL (Chen-1995) | 5.706 |
| | | 95% Modified-t UCL (Johnson-1978) | 5.674 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.405 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.731 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.21 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.256 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 5.518 | k star (bias corrected MLE) | 4.074 |
| Theta hat (MLE) | 0.817 | Theta star (bias corrected MLE) | 1.107 |
| nu hat (MLE) | 121.4 | nu star (bias corrected) | 89.62 |
| MLE Mean (bias corrected) | 4.509 | MLE Sd (bias corrected) | 2.234 |
| | | Approximate Chi Square Value (0.05) | 68.79 |
| Adjusted Level of Significance | 0.0278 | Adjusted Chi Square Value | 65.82 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 5.874 | 95% Adjusted Gamma UCL (use when n<50) | 6.139 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.936 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.85 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.184 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.251 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.788 | Mean of logged Data | 1.413 |
| Maximum of Logged Data | 2.116 | SD of logged Data | 0.45 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 6.136 | 90% Chebyshev (MVUE) UCL | 6.362 |
| 95% Chebyshev (MVUE) UCL | 7.205 | 97.5% Chebyshev (MVUE) UCL | 8.376 |
| 99% Chebyshev (MVUE) UCL | 10.68 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 5.543 | 95% Jackknife UCL | 5.649 |
| 95% Standard Bootstrap UCL | 5.484 | 95% Bootstrap-t UCL | 5.995 |
| 95% Hall's Bootstrap UCL | 5.889 | 95% Percentile Bootstrap UCL | 5.573 |
| 95% BCA Bootstrap UCL | 5.655 | | |
| 90% Chebyshev(Mean, Sd) UCL | 6.395 | 95% Chebyshev(Mean, Sd) UCL | 7.25 |
| 97.5% Chebyshev(Mean, Sd) UCL | 8.436 | 99% Chebyshev(Mean, Sd) UCL | 10.77 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 5.649 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/3/2019 7:55:01 PM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Cobalt (MG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.58 | Mean | 4.97 |
| Maximum | 18 | Median | 1.85 |
| SD | 6.32 | Std. Error of Mean | 1.998 |
| Coefficient of Variation | 1.272 | Skewness | 1.357 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.73 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.375 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

#### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 8.633 | 95% Adjusted-CLT UCL (Chen-1995) | 9.173 |
| | | 95% Modified-t UCL (Johnson-1978) | 8.776 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.846 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.756 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.304 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.276 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.778 | k star (bias corrected MLE) | 0.611 |
| Theta hat (MLE) | 6.389 | Theta star (bias corrected MLE) | 8.131 |
| nu hat (MLE) | 15.56 | nu star (bias corrected) | 12.22 |
| MLE Mean (bias corrected) | 4.97 | MLE Sd (bias corrected) | 6.357 |
| | | Approximate Chi Square Value (0.05) | 5.375 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 4.611 |

#### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 11.3 | 95% Adjusted Gamma UCL (use when n<50) | 13.18 |

#### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.867 | **Shapiro Wilk Lognormal GOF Test** |

| | | |
|---|---|---|
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.229 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.545 | Mean of logged Data | 0.838 |
| Maximum of Logged Data | 2.89 | SD of logged Data | 1.295 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 26.88 | 90% Chebyshev (MVUE) UCL | 10.81 |
| 95% Chebyshev (MVUE) UCL | 13.57 | 97.5% Chebyshev (MVUE) UCL | 17.41 |
| 99% Chebyshev (MVUE) UCL | 24.96 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 8.257 | 95% Jackknife UCL | 8.633 |
| 95% Standard Bootstrap UCL | 8.098 | 95% Bootstrap-t UCL | 11.18 |
| 95% Hall's Bootstrap UCL | 7.885 | 95% Percentile Bootstrap UCL | 8.318 |
| 95% BCA Bootstrap UCL | 8.905 | | |
| 90% Chebyshev(Mean, Sd) UCL | 10.97 | 95% Chebyshev(Mean, Sd) UCL | 13.68 |
| 97.5% Chebyshev(Mean, Sd) UCL | 17.45 | 99% Chebyshev(Mean, Sd) UCL | 24.85 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Chebyshev (Mean, Sd) UCL | 13.68 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Copper (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.83 | Mean | 49.62 |
| Maximum | 480 | Median | 1.8 |
| SD | 151.2 | Std. Error of Mean | 47.82 |
| Coefficient of Variation | 3.047 | Skewness | 3.162 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.37 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.521 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

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| 95% Normal UCL | | 95% UCLs (Adjusted for Skewness) | |
|---|---|---|---|
| 95% Student's-t UCL | 137.3 | 95% Adjusted-CLT UCL (Chen-1995) | 179.4 |
| | | 95% Modified-t UCL (Johnson-1978) | 145.3 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 2.773 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.834 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.51 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.291 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.251 | k star (bias corrected MLE) | 0.243 |
| Theta hat (MLE) | 197.3 | Theta star (bias corrected MLE) | 204.5 |
| nu hat (MLE) | 5.029 | nu star (bias corrected) | 4.854 |
| MLE Mean (bias corrected) | 49.62 | MLE Sd (bias corrected) | 100.7 |
| | | Approximate Chi Square Value (0.05) | 1.085 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 0.812 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 221.9 | 95% Adjusted Gamma UCL (use when n<50) | 296.8 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.576 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.382 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.186 | Mean of logged Data | 1.082 |
| Maximum of Logged Data | 6.174 | SD of logged Data | 1.83 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 330.5 | 90% Chebyshev (MVUE) UCL | 31.89 |
| 95% Chebyshev (MVUE) UCL | 41.19 | 97.5% Chebyshev (MVUE) UCL | 54.1 |
| 99% Chebyshev (MVUE) UCL | 79.46 | | |

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 128.3 | 95% Jackknife UCL | 137.3 |
| 95% Standard Bootstrap UCL | 123.1 | 95% Bootstrap-t UCL | 15172 |
| 95% Hall's Bootstrap UCL | 5857 | 95% Percentile Bootstrap UCL | 145.2 |
| 95% BCA Bootstrap UCL | 193.2 | | |
| 90% Chebyshev(Mean, Sd) UCL | 193.1 | 95% Chebyshev(Mean, Sd) UCL | 258.1 |
| 97.5% Chebyshev(Mean, Sd) UCL | 348.3 | 99% Chebyshev(Mean, Sd) UCL | 525.4 |

### Suggested UCL to Use

| | |
|---|---|
| 99% Chebyshev (Mean, Sd) UCL | 525.4 |

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Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Iron (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 3500 | Mean | 10570 |
| Maximum | 46000 | Median | 5700 |
| SD | 12949 | Std. Error of Mean | 4095 |
| Coefficient of Variation | 1.225 | Skewness | 2.772 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.567 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.373 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 18077 | 95% Adjusted-CLT UCL (Chen-1995) | 21141 |
| | | 95% Modified-t UCL (Johnson-1978) | 18675 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 1.249 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.739 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.308 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.271 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.514 | k star (bias corrected MLE) | 1.127 |
| Theta hat (MLE) | 6981 | Theta star (bias corrected MLE) | 9382 |
| nu hat (MLE) | 30.28 | nu star (bias corrected) | 22.53 |
| MLE Mean (bias corrected) | 10570 | MLE Sd (bias corrected) | 9958 |
| | | Approximate Chi Square Value (0.05) | 12.74 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 11.48 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 18697 | 95% Adjusted Gamma UCL (use when n<50) | 20751 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.806 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.255 | **Lilliefors Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |

Data appear Approximate Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 8.161 | Mean of logged Data | 8.901 |
| Maximum of Logged Data | 10.74 | SD of logged Data | 0.77 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 19527 | 90% Chebyshev (MVUE) UCL | 16733 |
| 95% Chebyshev (MVUE) UCL | 19998 | 97.5% Chebyshev (MVUE) UCL | 24531 |
| 99% Chebyshev (MVUE) UCL | 33434 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 17306 | 95% Jackknife UCL | 18077 |
| 95% Standard Bootstrap UCL | 16868 | 95% Bootstrap-t UCL | 61150 |
| 95% Hall's Bootstrap UCL | 47645 | 95% Percentile Bootstrap UCL | 17660 |
| 95% BCA Bootstrap UCL | 21380 | | |
| 90% Chebyshev(Mean, Sd) UCL | 22855 | 95% Chebyshev(Mean, Sd) UCL | 28420 |
| 97.5% Chebyshev(Mean, Sd) UCL | 36143 | 99% Chebyshev(Mean, Sd) UCL | 51314 |

### Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 19527 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

## Lead (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
| | | Number of Missing Observations | 0 |
| Minimum | 1.3 | Mean | 70.67 |
| Maximum | 690 | Median | 1.8 |
| SD | 217.6 | Std. Error of Mean | 68.81 |
| Coefficient of Variation | 3.079 | Skewness | 3.162 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.368 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.523 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

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Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 196.8 | 95% Adjusted-CLT UCL (Chen-1995) | 257.4 |
| | | 95% Modified-t UCL (Johnson-1978) | 208.3 |

### Gamma GOF Test

| | | | |
|---|---|---|---|
| A-D Test Statistic | 3.065 | **Anderson-Darling Gamma GOF Test** | |
| 5% A-D Critical Value | 0.841 | Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.539 | **Kolmogorov-Smirnov Gamma GOF Test** | |
| 5% K-S Critical Value | 0.292 | Data Not Gamma Distributed at 5% Significance Level | |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.234 | k star (bias corrected MLE) | 0.23 |
| Theta hat (MLE) | 302.1 | Theta star (bias corrected MLE) | 306.7 |
| nu hat (MLE) | 4.678 | nu star (bias corrected) | 4.608 |
| MLE Mean (bias corrected) | 70.67 | MLE Sd (bias corrected) | 147.2 |
| | | Approximate Chi Square Value (0.05) | 0.976 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 0.722 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 333.8 | 95% Adjusted Gamma UCL (use when n<50) | 451.1 |

### Lognormal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.475 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.449 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level | |

Data Not Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.262 | Mean of logged Data | 1.189 |
| Maximum of Logged Data | 6.537 | SD of logged Data | 1.891 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 499.4 | 90% Chebyshev (MVUE) UCL | 39.23 |
| 95% Chebyshev (MVUE) UCL | 50.78 | 97.5% Chebyshev (MVUE) UCL | 66.82 |
| 99% Chebyshev (MVUE) UCL | 98.33 | | |

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 183.9 | 95% Jackknife UCL | 196.8 |
| 95% Standard Bootstrap UCL | 175.4 | 95% Bootstrap-t UCL | 47818 |
| 95% Hall's Bootstrap UCL | 20413 | 95% Percentile Bootstrap UCL | 208.2 |
| 95% BCA Bootstrap UCL | 277.1 | | |
| 90% Chebyshev(Mean, Sd) UCL | 277.1 | 95% Chebyshev(Mean, Sd) UCL | 370.6 |
| 97.5% Chebyshev(Mean, Sd) UCL | 500.4 | 99% Chebyshev(Mean, Sd) UCL | 755.4 |

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**Suggested UCL to Use**

| | |
|---|---|
| 99% Chebyshev (Mean, Sd) UCL | 755.4 |

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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## UCL Statistics for Uncensored Full Data Sets

|  |  |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.111/21/2019 12:32:48 PM |
| From File | S4ArsenicProUCLInput.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Arsenic (MG/KG)

#### General Statistics

|  |  |  |  |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 8 |
|  |  | Number of Missing Observations | 0 |
| Minimum | 1.6 | Mean | 2.98 |
| Maximum | 5.7 | Median | 2.7 |
| SD | 1.374 | Std. Error of Mean | 0.435 |
| Coefficient of Variation | 0.461 | Skewness | 0.79 |

#### Normal GOF Test

|  |  |  |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.891 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.215 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

#### Assuming Normal Distribution

|  |  |  |  |
|---|---|---|---|
| **95% Normal UCL** |  | **95% UCLs (Adjusted for Skewness)** |  |
| 95% Student's-t UCL | 3.777 | 95% Adjusted-CLT UCL (Chen-1995) | 3.811 |
|  |  | 95% Modified-t UCL (Johnson-1978) | 3.795 |

#### Gamma GOF Test

|  |  |  |
|---|---|---|
| A-D Test Statistic | 0.438 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.729 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.203 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

#### Gamma Statistics

|  |  |  |  |
|---|---|---|---|
| k hat (MLE) | 5.529 | k star (bias corrected MLE) | 3.937 |
| Theta hat (MLE) | 0.539 | Theta star (bias corrected MLE) | 0.757 |
| nu hat (MLE) | 110.6 | nu star (bias corrected) | 78.74 |
| MLE Mean (bias corrected) | 2.98 | MLE Sd (bias corrected) | 1.502 |
|  |  | Approximate Chi Square Value (0.05) | 59.3 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 56.37 |

#### Assuming Gamma Distribution

|  |  |  |  |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 3.957 | 95% Adjusted Gamma UCL (use when n<50) | 4.162 |

#### Lognormal GOF Test

|  |  |  |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.913 | **Shapiro Wilk Lognormal GOF Test** |

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| | | |
|---|---|---|
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.179 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.47 | Mean of logged Data | 0.999 |
| Maximum of Logged Data | 1.74 | SD of logged Data | 0.453 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 4.166 | 90% Chebyshev (MVUE) UCL | 4.273 |
| 95% Chebyshev (MVUE) UCL | 4.861 | 97.5% Chebyshev (MVUE) UCL | 5.678 |
| 99% Chebyshev (MVUE) UCL | 7.281 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 3.695 | 95% Jackknife UCL | 3.777 |
| 95% Standard Bootstrap UCL | 3.662 | 95% Bootstrap-t UCL | 3.977 |
| 95% Hall's Bootstrap UCL | 3.8 | 95% Percentile Bootstrap UCL | 3.67 |
| 95% BCA Bootstrap UCL | 3.77 | | |
| 90% Chebyshev(Mean, Sd) UCL | 4.284 | 95% Chebyshev(Mean, Sd) UCL | 4.874 |
| 97.5% Chebyshev(Mean, Sd) UCL | 5.694 | 99% Chebyshev(Mean, Sd) UCL | 7.304 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 3.777 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/4/2019 9:29:26 AM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Aluminum (UG/L)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 5 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 0 |
| Minimum | 24 | Mean | 4600 |
| Maximum | 13000 | Median | 44 |
| SD | 6349 | Std. Error of Mean | 2839 |
| Coefficient of Variation | 1.38 | Skewness | 0.742 |

**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1**

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.751 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.762 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.363 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.343 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 10653 | 95% Adjusted-CLT UCL (Chen-1995) | 10277 |
| | | 95% Modified-t UCL (Johnson-1978) | 10810 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.767 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.751 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.376 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.383 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data follow Appr. Gamma Distribution at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.268 | k star (bias corrected MLE) | 0.241 |
| Theta hat (MLE) | 17159 | Theta star (bias corrected MLE) | 19121 |
| nu hat (MLE) | 2.681 | nu star (bias corrected) | 2.406 |
| MLE Mean (bias corrected) | 4600 | MLE Sd (bias corrected) | 9378 |
| | | Approximate Chi Square Value (0.05) | 0.221 |
| Adjusted Level of Significance | 0.0086 | Adjusted Chi Square Value | 0.0882 |

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### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 50168 | 95% Adjusted Gamma UCL (use when n<50) | 125524 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.747 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.762 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.335 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.343 | Data appear Lognormal at 5% Significance Level |

**Data appear Approximate Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 3.178 | Mean of logged Data | 5.814 |
| Maximum of Logged Data | 9.473 | SD of logged Data | 3.224 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 1.933E+15 | 90% Chebyshev (MVUE) UCL | 21537 |
| 95% Chebyshev (MVUE) UCL | 28691 | 97.5% Chebyshev (MVUE) UCL | 38620 |
| 99% Chebyshev (MVUE) UCL | 58125 | | |

### Nonparametric Distribution Free UCL Statistics

**Data appear to follow a Discernible Distribution at 5% Significance Level**

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 9270 | 95% Jackknife UCL | 10653 |
| 95% Standard Bootstrap UCL | 8830 | 95% Bootstrap-t UCL | 3241161 |
| 95% Hall's Bootstrap UCL | 3619781 | 95% Percentile Bootstrap UCL | 9166 |
| 95% BCA Bootstrap UCL | 9169 | | |
| 90% Chebyshev(Mean, Sd) UCL | 13117 | 95% Chebyshev(Mean, Sd) UCL | 16976 |
| 97.5% Chebyshev(Mean, Sd) UCL | 22331 | 99% Chebyshev(Mean, Sd) UCL | 32850 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Adjusted Gamma UCL | 125524 |

**Recommended UCL exceeds the maximum observation**

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic (UG/L)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 5 | Number of Distinct Observations | 5 |
| Number of Detects | 3 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 0.21 | Minimum Non-Detect | 0.13 |
| Maximum Detect | 17 | Maximum Non-Detect | 0.5 |
| Variance Detects | 87.3 | Percent Non-Detects | 40% |

Site 4 Groundwater

| | | | |
|---|---|---|---|
| Mean Detects | 6.237 | SD Detects | 9.344 |
| Median Detects | 1.5 | CV Detects | 1.498 |
| Skewness Detects | 1.695 | Kurtosis Detects | N/A |
| Mean of Logged Detects | 0.559 | SD of Logged Detects | 2.201 |

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.807 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.361 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 3.802 | KM Standard Error of Mean | 3.625 |
| KM SD | 6.619 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 11.53 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 9.765 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 14.68 | 95% KM Chebyshev UCL | 19.61 |
| 97.5% KM Chebyshev UCL | 26.44 | 99% KM Chebyshev UCL | 39.88 |

### Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.5 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 12.48 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 2.998 | nu star (bias corrected) | N/A |
| Mean (detects) | 6.237 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 3.746 |
| Maximum | 17 | Median | 0.21 |
| SD | 7.435 | CV | 1.985 |
| k hat (MLE) | 0.251 | k star (bias corrected MLE) | 0.234 |
| Theta hat (MLE) | 14.92 | Theta star (bias corrected MLE) | 16.02 |
| nu hat (MLE) | 2.511 | nu star (bias corrected) | 2.338 |
| Adjusted Level of Significance (β) | 0.0086 | | |
| Approximate Chi Square Value (2.34, α) | 0.207 | Adjusted Chi Square Value (2.34, β) | 0.0843 |

Site 4 Groundwater

| | | | |
|---|---|---|---|
| 95% Gamma Approximate UCL (use when n>=50) | 42.37 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 3.802 | SD (KM) | 6.619 |
| Variance (KM) | 43.81 | SE of Mean (KM) | 3.625 |
| k hat (KM) | 0.33 | k star (KM) | 0.265 |
| nu hat (KM) | 3.299 | nu star (KM) | 2.653 |
| theta hat (KM) | 11.52 | theta star (KM) | 14.33 |
| 80% gamma percentile (KM) | 5.633 | 90% gamma percentile (KM) | 11.36 |
| 95% gamma percentile (KM) | 18.08 | 99% gamma percentile (KM) | 35.81 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (2.65, α) | 0.278 | Adjusted Chi Square Value (2.65, β) | 0.105 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 36.35 | 95% Gamma Adjusted KM-UCL (use when n<50) | 95.66 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.996 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.195 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 3.752 | Mean in Log Scale | -1.271 |
| SD in Original Scale | 7.431 | SD in Log Scale | 3.017 |
| 95% t UCL (assumes normality of ROS data) | 10.84 | 95% Percentile Bootstrap UCL | 10.21 |
| 95% BCA Bootstrap UCL | 10.54 | 95% Bootstrap t UCL | 278.3 |
| 95% H-UCL (Log ROS) | 4.211E+10 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.433 | KM Geo Mean | 0.649 |
| KM SD (logged) | 1.852 | 95% Critical H Value (KM-Log) | 8.714 |
| KM Standard Error of Mean (logged) | 1.017 | 95% H-UCL (KM -Log) | 11531 |
| KM SD (logged) | 1.852 | 95% Critical H Value (KM-Log) | 8.714 |
| KM Standard Error of Mean (logged) | 1.017 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 3.805 | Mean in Log Scale | -0.488 |
| SD in Original Scale | 7.399 | SD in Log Scale | 2.17 |
| 95% t UCL (Assumes normality) | 10.86 | 95% H-Stat UCL | 394889 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 95% KM (t) UCL | 11.53 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Chromium (UG/L)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 5 | Number of Distinct Observations | 5 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.24 | Mean | 19.86 |
| Maximum | 92 | Median | 0.87 |
| SD | 40.39 | Std. Error of Mean | 18.06 |
| Coefficient of Variation | 2.034 | Skewness | 2.219 |

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.594 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.762 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.437 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.343 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 58.37 | 95% Adjusted-CLT UCL (Chen-1995) | 68.72 |
| | | 95% Modified-t UCL (Johnson-1978) | 61.35 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.594 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.738 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.308 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.379 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.311 | k star (bias corrected MLE) | 0.258 |
| Theta hat (MLE) | 63.75 | Theta star (bias corrected MLE) | 76.98 |
| nu hat (MLE) | 3.115 | nu star (bias corrected) | 2.579 |
| MLE Mean (bias corrected) | 19.86 | MLE Sd (bias corrected) | 39.1 |
| | | Approximate Chi Square Value (0.05) | 0.26 |
| Adjusted Level of Significance | 0.0086 | Adjusted Chi Square Value | 0.0997 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 197.3 | 95% Adjusted Gamma UCL (use when n<50) | 513.6 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.903 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.762 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.251 | **Lilliefors Lognormal GOF Test** |

| | | | |
|---|---|---|---|
| 5% Lilliefors Critical Value | 0.343 | Data appear Lognormal at 5% Significance Level | |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -1.427 | Mean of logged Data | 0.788 |
| Maximum of Logged Data | 4.522 | SD of logged Data | 2.398 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 26484348 | 90% Chebyshev (MVUE) UCL | 44.9 |
| 95% Chebyshev (MVUE) UCL | 59.34 | 97.5% Chebyshev (MVUE) UCL | 79.39 |
| 99% Chebyshev (MVUE) UCL | 118.8 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 49.57 | 95% Jackknife UCL | 58.37 |
| 95% Standard Bootstrap UCL | 46.5 | 95% Bootstrap-t UCL | 2814 |
| 95% Hall's Bootstrap UCL | 1640 | 95% Percentile Bootstrap UCL | 55.34 |
| 95% BCA Bootstrap UCL | 56.51 | | |
| 90% Chebyshev(Mean, Sd) UCL | 74.05 | 95% Chebyshev(Mean, Sd) UCL | 98.6 |
| 97.5% Chebyshev(Mean, Sd) UCL | 132.7 | 99% Chebyshev(Mean, Sd) UCL | 199.6 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Adjusted Gamma UCL | 513.6 |

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Lead (UG/L)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 5 | Number of Distinct Observations | 4 |
| Number of Detects | 3 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.74 | Minimum Non-Detect | 0.13 |
| Maximum Detect | 18 | Maximum Non-Detect | 0.13 |
| Variance Detects | 93.58 | Percent Non-Detects | 40% |
| Mean Detects | 6.847 | SD Detects | 9.674 |
| Median Detects | 1.8 | CV Detects | 1.413 |
| Skewness Detects | 1.709 | Kurtosis Detects | N/A |
| Mean of Logged Detects | 1.059 | SD of Logged Detects | 1.647 |

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.

For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).

Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.796 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.366 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 4.16 | KM Standard Error of Mean | 3.805 |
| KM SD | 6.947 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 12.27 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 10.42 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 15.57 | 95% KM Chebyshev UCL | 20.75 |
| 97.5% KM Chebyshev UCL | 27.92 | 99% KM Chebyshev UCL | 42.02 |

### Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.699 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 9.795 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 4.194 | nu star (bias corrected) | N/A |
| Mean (detects) | 6.847 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 4.112 |
| Maximum | 18 | Median | 0.74 |
| SD | 7.798 | CV | 1.896 |
| k hat (MLE) | 0.268 | k star (bias corrected MLE) | 0.241 |
| Theta hat (MLE) | 15.34 | Theta star (bias corrected MLE) | 17.1 |
| nu hat (MLE) | 2.68 | nu star (bias corrected) | 2.405 |
| Adjusted Level of Significance (β) | 0.0086 | | |
| Approximate Chi Square Value (2.41, α) | 0.221 | Adjusted Chi Square Value (2.41, β) | 0.0881 |
| 95% Gamma Approximate UCL (use when n>=50) | 44.85 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 4.16 | SD (KM) | 6.947 |
| Variance (KM) | 48.26 | SE of Mean (KM) | 3.805 |
| k hat (KM) | 0.359 | k star (KM) | 0.277 |
| nu hat (KM) | 3.586 | nu star (KM) | 2.768 |
| theta hat (KM) | 11.6 | theta star (KM) | 15.03 |
| 80% gamma percentile (KM) | 6.243 | 90% gamma percentile (KM) | 12.38 |
| 95% gamma percentile (KM) | 19.52 | 99% gamma percentile (KM) | 38.28 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (2.77, α) | 0.307 | Adjusted Chi Square Value (2.77, β) | 0.115 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 37.5 | 95% Gamma Adjusted KM-UCL (use when n<50) | 99.83 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.939 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.279 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 4.118 | Mean in Log Scale | -0.97 |
| SD in Original Scale | 7.794 | SD in Log Scale | 3.075 |
| 95% t UCL (assumes normality of ROS data) | 11.55 | 95% Percentile Bootstrap UCL | 10.8 |
| 95% BCA Bootstrap UCL | 11.31 | 95% Bootstrap t UCL | 80.42 |
| 95% H-UCL (Log ROS) | 1.538E+11 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.181 | KM Geo Mean | 0.835 |
| KM SD (logged) | 1.841 | 95% Critical H Value (KM-Log) | 8.664 |
| KM Standard Error of Mean (logged) | 1.009 | 95% H-UCL (KM -Log) | 13247 |
| KM SD (logged) | 1.841 | 95% Critical H Value (KM-Log) | 8.664 |
| KM Standard Error of Mean (logged) | 1.009 | | |

### DL/2 Statistics

| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
|---|---|---|---|
| Mean in Original Scale | 4.134 | Mean in Log Scale | -0.458 |
| SD in Original Scale | 7.784 | SD in Log Scale | 2.381 |
| 95% t UCL (Assumes normality) | 11.55 | 95% H-Stat UCL | 6120330 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 95% KM (t) UCL | 12.27 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

# Appendix F.3
# Site 5 Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: CurrentFuture
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 67-64-1 | Acetone | 9.8E-02 | 4.0E-01 J | MG/KG | CBD-S05-SS02-1012 | 6/6 | N/A | 4.0E-01 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 71-43-2 | Benzene | 3.2E-04 J | 3.2E-04 J | MG/KG | CBD-S05-SS06-1012 | 1/6 | 0.00044 - 0.00064 | 3.2E-04 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
| | 79-20-9 | Methyl acetate | 3.1E-02 | 3.1E-02 | MG/KG | CBD-S05-SS05-1012 | 1/5 | N/A | 3.1E-02 | N/A | 7.8E+03 N | 4.1E-01 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 2.4E-04 J | 1.8E-03 J | MG/KG | CBD-S05-SS05-1012 | 6/6 | N/A | 1.8E-03 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 2.6E-04 J | 2.6E-04 J | MG/KG | CBD-S05-SS02-1012 | 1/6 | 0.00022 - 0.00033 | 2.6E-04 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 91-57-6 | 2-Methylnaphthalene | 1.3E-02 J | 3.3E-01 J | MG/KG | CBD-S05-SS03-1012 | 3/18 | 0.0017 - 0.1 | 3.3E-01 | N/A | 2.4E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 9.5E-04 J | 2.6E+00 | MG/KG | CBD-S05-SS03-1012 | 12/18 | 0.0011 - 0.1 | 2.6E+00 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 208-96-8 | Acenaphthylene | 8.3E-04 J | 1.5E-02 J | MG/KG | CBD-S05-SS15-000H | 11/18 | 0.0011 - 0.1 | 1.5E-02 | N/A | 3.6E+02 N | N/A | | NO | BSL |
| | 120-12-7 | Anthracene | 3.2E-03 J | 6.4E+00 | MG/KG | CBD-S05-SS03-1012 | 12/18 | 0.0017 - 0.0052 | 6.4E+00 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | **56-55-3** | **Benzo(a)anthracene** | **4.8E-03 J** | **3.0E+01** | **MG/KG** | **CBD-S05-SS03-1012** | **16/18** | **0.0017 - 0.0052** | **3.0E+01** | **N/A** | **1.1E+00 C** | **1.1E-02** | **SSL** | **YES** | **ASL** |
| | **50-32-8** | **Benzo(a)pyrene** | **5.2E-03 J** | **3.7E+00** | **MG/KG** | **CBD-S05-SS03-1012** | **16/18** | **0.0034 - 0.233** | **3.7E+00** | **N/A** | **1.1E-01 C** | **2.9E-02** | **SSL** | **YES** | **ASL** |
| | **205-99-2** | **Benzo(b)fluoranthene** | **6.6E-03 J** | **3.2E+01** | **MG/KG** | **CBD-S05-SS03-1012** | **16/18** | **0.0034 - 0.233** | **3.2E+01** | **N/A** | **1.1E+00 C** | **3.0E-01** | **SSL** | **YES** | **ASL** |
| | 191-24-2 | Benzo(g,h,i)perylene | 2.9E-03 J | 1.3E+01 | MG/KG | CBD-S05-SS03-1012 | 16/18 | 0.0017 - 0.1 | 1.3E+01 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 3.3E-03 J | 1.1E+01 | MG/KG | CBD-S05-SS03-1012 | 15/18 | 0.0034 - 0.233 | 1.1E+01 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 85-68-7 | Butylbenzylphthalate | 6.1E-02 J | 6.1E-02 J | MG/KG | CBD-S05-SS01P-1012 | 1/18 | 0.0034 - 0.308 | 6.1E-02 | N/A | 2.9E+02 C | 2.4E-01 | SSL | NO | BSL |
| | 86-74-8 | Carbazole | 6.4E-02 J | 3.1E+00 J | MG/KG | CBD-S05-SS03-1012 | 2/18 | 0.034 - 2 | 3.1E+00 | N/A | N/A | N/A | | NO | NTX |
| | 218-01-9 | Chrysene | 4.9E-03 J | 2.6E+01 | MG/KG | CBD-S05-SS03-1012 | 16/18 | 0.0017 - 0.1 | 2.6E+01 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | **53-70-3** | **Dibenz(a,h)anthracene** | **4.6E-03 J** | **4.2E-01 J** | **MG/KG** | **CBD-S05-SS03-1012** | **13/18** | **0.0034 - 0.2** | **4.2E-01** | **N/A** | **1.1E-01 C** | **9.6E-02** | **SSL** | **YES** | **ASL** |
| | 132-64-9 | Dibenzofuran | 3.9E-02 | 1.2E+00 | MG/KG | CBD-S05-SS03-1012 | 2/18 | 0.0017 - 0.308 | 1.2E+00 | N/A | 7.3E+00 N | 1.5E-02 | SSL | NO | BSL |
| | 131-11-3 | Dimethyl phthalate | 2.6E-03 J | 2.6E-03 J | MG/KG | CBD-S05-SS04-1012 | 1/18 | 0.034 - 0.62 | 2.6E-03 | N/A | N/A | N/A | | NO | NTX |
| | 84-74-2 | Di-n-butylphthalate | 1.3E-01 J | 1.3E-01 J | MG/KG | CBD-S05-SS21-000H | 1/18 | 0.017 - 1 | 1.3E-01 | N/A | 6.3E+02 N | 2.3E-01 | SSL | NO | BSL |
| | 206-44-0 | Fluoranthene | 1.0E-03 J | 4.5E+01 | MG/KG | CBD-S05-SS03-1012 | 17/18 | 0.0017 - 0.1 | 4.5E+01 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 86-73-7 | Fluorene | 1.7E-03 J | 2.1E+00 | MG/KG | CBD-S05-SS03-1012 | 12/18 | 0.0017 - 0.1 | 2.1E+00 | N/A | 2.4E+02 N | 5.4E-01 | SSL | NO | BSL |
| | **193-39-5** | **Indeno(1,2,3-cd)pyrene** | **4.9E-03 J** | **1.3E+01** | **MG/KG** | **CBD-S05-SS03-1012** | **14/18** | **0.0034 - 0.2** | **1.3E+01** | **N/A** | **1.1E+00 C** | **9.8E-01** | **SSL** | **YES** | **ASL** |
| | 91-20-3 | Naphthalene | 2.1E-02 | 1.5E+00 | MG/KG | CBD-S05-SS03-1012 | 4/18 | 0.0017 - 0.1 | 1.5E+00 | N/A | 3.8E+00 C | 5.4E-04 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 3.5E-03 J | 2.7E+01 | MG/KG | CBD-S05-SS03-1012 | 16/18 | 0.0017 - 0.1 | 2.7E+01 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 7.3E-03 J | 4.8E+01 | MG/KG | CBD-S05-SS03-1012 | 16/18 | 0.0034 - 0.2 | 4.8E+01 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 72-54-8 | 4,4'-DDD | 6.9E-04 | 5.2E-03 J- | MG/KG | CBD-S05-SS09-000H | 4/17 | 0.000121 - 0.000464 | 5.2E-03 | N/A | 1.9E-01 N | 1.5E-03 | SSL | NO | BSL |
| | 72-55-9 | 4,4'-DDE | 4.3E-04 J- | 1.5E-01 | MG/KG | CBD-S05-SS10-000H | 7/17 | 0.000121 - 0.000464 | 1.5E-01 | N/A | 2.0E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 50-29-3 | 4,4'-DDT | 1.5E-03 J | 1.8E-01 | MG/KG | CBD-S05-SS10-000H | 4/17 | 0.000241 - 0.000928 | 1.8E-01 | N/A | 1.9E+00 C | 7.7E-02 | SSL | NO | BSL |
| | 5103-71-9 | alpha-Chlordane | 2.7E-04 J | 6.2E-04 | MG/KG | CBD-S05-SS23-000H | 2/17 | 0.000121 - 0.000464 | 6.2E-04 | N/A | 1.7E+00 C | 2.7E-03 | SSL | NO | BSL |
| | 11097-69-1 | Aroclor-1254 | 9.1E-03 J | 4.6E-02 | MG/KG | CBD-S05-SS03-1012 | 3/18 | 0.0062 - 0.023 | 4.6E-02 | N/A | 1.2E-01 N | 2.0E-03 | SSL | NO | BSL |
| | 11096-82-5 | Aroclor-1260 | 5.6E-03 J | 8.0E-02 | MG/KG | CBD-S05-SS03-1012 | 4/18 | 0.0062 - 0.023 | 8.0E-02 | N/A | 2.4E-01 C | 5.5E-03 | SSL | NO | BSL |

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: CurrentFuture
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **7429-90-5** | **Aluminum** | **2.3E+03** | **1.5E+04 J** | **MG/KG** | **CBD-S05-SS18-000H** | **18/18** | **N/A** | **1.5E+04** | **1.3E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 5.6E-02 J | 2.4E+00 | MG/KG | CBD-S05-SS03-1012 | 11/18 | 0.14 - 0.2 | 2.4E+00 | 4.2E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **9.1E-01** | **6.0E+00** | **MG/KG** | **CBD-S05-SS13P-000H** | **18/18** | **N/A** | **6.0E+00** | **6.4E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 6.0E+00 | 7.6E+01 | MG/KG | CBD-S05-SS21-000H | 18/18 | N/A | 7.6E+01 | 5.8E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.5E-01 | 1.4E+00 | MG/KG | CBD-S05-SS06-1012 | 17/18 | 0.32 - 0.32 | 1.4E+00 | 8.1E-01 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 3.3E-02 J | 1.2E+00 | MG/KG | CBD-S05-SS21-000H | 15/18 | 0.14 - 0.2 | 1.2E+00 | 1.7E+00 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 2.5E+01 J | 6.3E+03 | MG/KG | CBD-S05-SS21-000H | 18/18 | N/A | 6.3E+03 | 9.4E+03 | N/A | N/A | | NO | NUT |
| | 18540-29-9 | Chromium (hexavalent) | 1.7E-01 J | 1.7E-01 J | MG/KG | CBD-S05-SS01-1012 | 1/1 | N/A | 1.7E-01 | 4.0E-01 | 3.0E-01 C | 6.7E-04 | SSL | NO | BSL |
| | 7440-47-3 | Chromium | 4.4E+00 | 2.4E+01 | MG/KG | CBD-S05-SS17-000H | 18/18 | N/A | 2.4E+01 | 3.1E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **7.0E-01** | **6.9E+00** | **MG/KG** | **CBD-S05-SS06-1012** | **18/18** | **N/A** | **6.9E+00** | **1.2E+01** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.7E+00 | 2.3E+02 | MG/KG | CBD-S05-SS03-1012 | 18/18 | N/A | 2.3E+02 | 2.7E+01 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 57-12-5 | Cyanide | 3.2E-02 J | 6.5E-02 J | MG/KG | CBD-S05-SS03-1012 | 5/6 | 0.054 - 0.062 | 6.5E-02 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **2.6E+03** | **2.8E+04 J** | **MG/KG** | **CBD-S05-SS18-000H** | **17/18** | **N/A** | **2.8E+04** | **4.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 2.9E+00 | 2.7E+02 | MG/KG | CBD-S05-SS21-000H | 18/18 | N/A | 2.7E+02 | 5.0E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 2.2E+02 | 2.4E+03 | MG/KG | CBD-S05-SS17-000H | 18/18 | N/A | 2.4E+03 | 3.8E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **1.3E+01** | **2.9E+02** | **MG/KG** | **CBD-S05-SS21-000H** | **18/18** | **N/A** | **2.9E+02** | **2.0E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7439-97-6 | Mercury | 6.6E-03 J | 3.5E-01 J | MG/KG | CBD-S05-SS21-000H | 8/18 | 0.017 - 0.34 | 3.5E-01 | 1.9E-01 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 1.4E+00 | 2.6E+01 | MG/KG | CBD-S05-SS18-000H,<br>CBD-S05-SS18P-000H | 18/18 | N/A | 2.6E+01 | 1.2E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 1.8E+02 | 1.6E+03 | MG/KG | CBD-S05-SS17-000H | 18/18 | N/A | 1.6E+03 | 1.5E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 1.0E-01 | 1.5E+00 | MG/KG | CBD-S05-SS13P-000H | 16/18 | 0.28 - 0.28 | 1.5E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 7.6E-02 | 1.0E+00 | MG/KG | CBD-S05-SS18-000H | 18/18 | N/A | 1.0E+00 | 1.4E+00 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.3E+01 J+ | 4.1E+01 J+ | MG/KG | CBD-S05-SS17-000H | 8/18 | 4.7 - 16 | 4.1E+01 | 3.1E+02 | N/A | N/A | | NO | NUT |

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: CurrentFuture
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **7440-28-0** | **Thallium** | **4.5E-02 J** | **1.8E-01 J** | **MG/KG** | **CBD-S05-SS12-000H,<br>CBD-S05-SS20-000H** | **15/18** | **0.14 - 0.14** | **1.8E-01** | **1.3E+00** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | **7440-62-2** | **Vanadium** | **6.0E+00** | **3.8E+02** | **MG/KG** | **CBD-S05-SS23-000H** | **18/18** | **N/A** | **3.8E+02** | **3.0E+01** | **3.9E+01 N** | **8.6E+00** | **SSL** | **YES** | **ASL** |
| | 7440-66-6 | Zinc | 5.9E+00 | 2.8E+02 | MG/KG | CBD-S05-SS21-000H | 13/18 | N/A | 2.8E+02 | 7.9E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for acenaphthene used as surrogate for acenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for technical chlordane used as surrogate for alpha-chlordane.
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalent).
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
J- = Biased Low
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.1a. Step 2 Surface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) MG/KG | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| **Benzo(a)anthracene** | **16 / 18** | **3.0E+01** | **CBD-S05-SS03-1012** | **N/A** | **1.1E+00** | **N/A** | **3E-05** | **N/A** |
| **Benzo(a)pyrene** | **16 / 18** | **3.7E+00** | **CBD-S05-SS03-1012** | **1.8E+01** | **1.1E-01** | **0.2** | **3E-05** | **Developmental** |
| **Benzo(b)fluoranthene** | **16 / 18** | **3.2E+01** | **CBD-S05-SS03-1012** | **N/A** | **1.1E+00** | **N/A** | **3E-05** | **N/A** |
| **Dibenz(a,h)anthracene** | **13 / 18** | **4.2E-01 J** | **CBD-S05-SS03-1012** | **N/A** | **1.1E-01** | **N/A** | **4E-06** | **N/A** |
| **Indeno(1,2,3-cd)pyrene** | **14 / 18** | **1.3E+01** | **CBD-S05-SS03-1012** | **N/A** | **1.1E+00** | **N/A** | **1E-05** | **N/A** |
| Aluminum | 18 / 18 | 1.5E+04 J | CBD-S05-SS18-000H | 7.7E+04 | N/A | 0.2 | N/A | Neurological |
| **Arsenic** | **18 / 18** | **6.0E+00** | **CBD-S05-SS13P-000H** | **3.5E+01** | **6.8E-01** | **0.2** | **9E-06** | **Cardiovascular, Dermal** |
| Cobalt | 18 / 18 | 6.9E+00 | CBD-S05-SS06-1012 | 2.3E+01 | 4.2E+02 | 0.3 | 2E-08 | Thyroid,Respiratory |
| Iron | 17 / 18 | 2.8E+04 J | CBD-S05-SS18-000H | 5.5E+04 | N/A | 0.5 | N/A | Gastrointestinal |
| Manganese | 18 / 18 | 2.9E+02 | CBD-S05-SS21-000H | 1.8E+03 | N/A | 0.2 | N/A | Nervous |
| Thallium | 15 / 18 | 1.8E-01 J | CBD-S05-SS12-000H, CBD-S05-SS20-000H | 7.8E-01 | N/A | 0.2 | N/A | Dermal |
| **Vanadium** | **18 / 18** | **3.8E+02** | **CBD-S05-SS23-000H** | 3.9E+02 | **N/A** | **1** | **N/A** | **Hair** |
| **Cumulative Hazard Index[c]** | | | | | | **3** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-04** | |

| | |
|---|---|
| Total Developmental HI = | 0.2 |
| Total Neurological/Nervous HI = | 0.4 |
| Total Cardiovascular HI = | 0.2 |
| Total Dermal HI = | 0.4 |
| Total Thyroid HI = | 0.3 |
| Total Respiratory HI = | 0.3 |
| Total Gastrointestinal HI = | 0.5 |
| Total Hair HI = | 1 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

| | |
|---|---|
| COPC = Chemical of Potential Concern | MG/KG = milligrams per kilogram |
| ELCR = Excess Lifetime Cancer Risk | MDE = Maryland Department of the Environment |
| HI = Hazard Index | N/A = Not available/not applicable |
| HQ = Hazard Quotient | RSL = Regional Screening Levels, November 2019 |
| J = Estimated Value | USEPA = US Environmental Protection Agency |

**Table 2.1b. Step 3 Surface Soil Screening - Risk Ratio, 95% UCL, Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| **Benzo(a)anthracene** | **16 / 18** | **1.8E+01** | **99% KM (Chebyshev) UCL** | **1** | **N/A** | **1.1E+00** | **N/A** | **2E-05** | **N/A** |
| **Benzo(a)pyrene** | **16 / 18** | **1.4E+00** | **95% Gamma Adjusted KM-UCL** | **1, 3** | **1.8E+01** | **1.1E-01** | **0.1** | **1E-05** | **Developmental** |
| **Benzo(b)fluoranthene** | **16 / 18** | **2.0E+01** | **99% KM Chebyshev UCL** | **1** | **N/A** | **1.1E+00** | **N/A** | **2E-05** | **N/A** |
| **Dibenz(a,h)anthracene** | **13 / 18** | **1.6E-01** | **95% Gamma Adjusted KM-UCL** | **1, 3** | **N/A** | **1.1E-01** | **N/A** | **1E-06** | **N/A** |
| **Indeno(1,2,3-cd)pyrene** | **14 / 18** | **8.1E+00** | **99% KM Chebyshev UCL** | **1** | **N/A** | **1.1E+00** | **N/A** | **7E-06** | **N/A** |
| **Arsenic** | **18 / 18** | **7.7E+00** | **95% Student's-t UCL** | **3** | **3.5E+01** | **6.8E-01** | **0.2** | **1E-05** | **Cardiovascular, Dermal** |
| Vanadium | 18 / 18 | 5.4E+01 | 95% H-UCL | 1 | 3.9E+02 | N/A | 0.1 | N/A | Hair |
| **Cumulative Hazard Index[c]** | | | | | | | **0.4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **7E-05** | |

| | |
|---|---|
| Total Developmental HI = | 0.1 |
| Total Dermal HI = | 0.2 |
| Total Cardiovascular HI = | 0.2 |
| Total Hair HI = | 0.1 |

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Recommended 95% UCL exceeds maximum detected concentration.

**Table 2.1c. Comparison of Concentrations of COPCs to Background Concentrations - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening [2] | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 7440-38-2 | Arsenic | 9.1E-01 | 6.0E+00 | MG/KG | CBD-S05-SS13P-000H | 18/18 | N/A | 6.0E+00 | 6.4E+00 | NO |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background value is the surface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 22 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 78-93-3 | 2-Butanone | 2.1E-01 J | 2.1E-01 J | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.0005 - 0.0006 | 2.1E-01 | N/A | 2.7E+03 N | 1.2E-01 | SSL | NO | BSL |
| | 67-64-1 | Acetone | 1.6E-02 | 4.3E-01 J | MG/KG | CBD-S05-SB03-1820 | 4/5 | 0.005 - 0.006 | 4.3E-01 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 71-43-2 | Benzene | 2.0E-04 J | 2.0E-04 J | MG/KG | CBD-S05-SB04-2022 | 1/5 | 0.0005 - 0.0006 | 2.0E-04 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
| | 100-41-4 | Ethylbenzene | 3.1E-01 | 3.1E-01 | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.0005 - 0.0006 | 3.1E-01 | N/A | 5.8E+00 C | 1.7E-03 | SSL | NO | BSL |
| | 98-82-8 | Isopropylbenzene | 2.6E+00 | 2.6E+00 | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.00025 - 0.0003 | 2.6E+00 | N/A | 1.9E+02 N | 7.4E-02 | SSL | NO | BSL |
| | m&pXYLENE | m- and p-Xylene | 3.9E-01 | 3.9E-01 | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.0005 - 0.0006 | 3.9E-01 | N/A | 5.8E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 79-20-9 | Methyl acetate | 2.0E-03 J | 1.3E+00 | MG/KG | CBD-S05-SB03-1820 | 2/5 | 0.0005 - 0.0006 | 1.3E+00 | N/A | 7.8E+03 N | 4.1E-01 | SSL | NO | BSL |
| | 108-87-2 | Methylcyclohexane | 1.6E-01 J | 1.6E-01 J | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.0005 - 0.0006 | 1.6E-01 | N/A | 6.1E+01 N | N/A | | NO | BSL |
| | 95-47-6 | o-Xylene | 6.5E-01 | 6.5E-01 | MG/KG | CBD-S05-SB03-1820 | 1/5 | 0.00025 - 0.0003 | 6.5E-01 | N/A | 6.5E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 7.5E-04 J | 7.5E-04 J | MG/KG | CBD-S05-SB04-2022 | 1/5 | 0.0005 - 0.0006 | 7.5E-04 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 76-13-1 | Trichlorofluoromethane (Freon-11) | 4.3E-04 J | 4.3E-04 J | MG/KG | CBD-S05-SB05-2022 | 1/5 | 0.00025 - 0.0003 | 4.3E-04 | N/A | 6.7E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 92-52-4 | 1,1-Biphenyl | 4.5E-02 | 4.5E-02 | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.02 - 0.8 | 4.5E-02 | N/A | 4.7E+00 N | 8.7E-04 | SSL | NO | BSL |
| | 91-57-6 | 2-Methylnaphthalene | 7.2E-01 | 7.2E-01 | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.002 - 0.0079 | 7.2E-01 | N/A | 2.4E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 9.3E-02 | 9.3E-02 | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.0012 - 0.002 | 9.3E-02 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 120-12-7 | Anthracene | 2.4E-03 J | 2.4E-03 J | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.002 - 0.0058 | 2.4E-03 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 2.1E-03 J | 5.6E-03 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0058 | 5.6E-03 | N/A | 1.1E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 205-99-2 | Benzo(b)fluoranthene | 4.5E-03 J | 1.0E-02 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.0039 - 0.0089 | 1.0E-02 | N/A | 1.1E+00 C | 3.0E-01 | SSL | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 2.8E-03 J | 1.3E-02 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0089 | 1.3E-02 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 3.6E-03 J | 4.0E-03 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.0039 - 0.0059 | 4.0E-03 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 218-01-9 | Chrysene | 3.4E-03 J | 5.2E-03 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0058 | 5.2E-03 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | 53-70-3 | Dibenz(a,h)anthracene | 3.4E-03 J | 3.4E-03 J | MG/KG | CBD-S05-SB15-0810 | 1/10 | 0.00079 - 0.0089 | 3.4E-03 | N/A | 1.1E-01 C | 9.6E-02 | SSL | NO | BSL |
| | 132-64-9 | Dibenzofuran | 5.9E-02 | 5.9E-02 | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.002 - 0.266 | 5.9E-02 | N/A | 7.3E+00 N | 1.5E-02 | SSL | NO | BSL |
| | 131-11-3 | Dimethyl phthalate | 2.3E-03 J | 2.3E-03 J | MG/KG | CBD-S05-SB01-2022 | 1/10 | 0.0039 - 0.266 | 2.3E-03 | N/A | N/A | N/A | | NO | NTX |
| | 206-44-0 | Fluoranthene | 4.2E-03 J | 4.4E-03 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0058 | 4.4E-03 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 86-73-7 | Fluorene | 1.1E-03 J | 2.5E-02 | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0036 | 2.5E-02 | N/A | 2.4E+02 N | 5.4E-01 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 3.7E-03 J | 6.8E-03 J | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.0039 - 0.0089 | 6.8E-03 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 91-20-3 | Naphthalene | 8.9E-04 J | 8.2E-02 | MG/KG | CBD-S05-SB03-1820 | 2/10 | 0.002 - 0.0027 | 8.2E-02 | N/A | 3.8E+00 C | 5.4E-04 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 1.2E-03 J | 1.3E-02 J | MG/KG | CBD-S05-SB03-1820 | 3/10 | 0.002 - 0.0089 | 1.3E-02 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 1.3E-02 J | 1.3E-02 J | MG/KG | CBD-S05-SB03-1820 | 1/10 | 0.0039 - 0.0089 | 1.3E-02 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | 309-00-2 | Aldrin | 8.8E-04 J | 8.8E-04 J | MG/KG | CBD-S05-SB12-0810 | 1/10 | 0.000136 - 0.000272 | 8.8E-04 | N/A | 3.9E-02 C | 1.5E-04 | SSL | NO | BSL |
| | 33213-65-9 | Endosulfan II | 2.7E-04 J | 2.7E-04 J | MG/KG | CBD-S05-SB15-0810 | 1/10 | 0.000136 - 0.000272 | 2.7E-04 | N/A | 4.7E+01 N | 1.4E-01 | SSL | NO | BSL |
| | **7429-90-5** | **Aluminum** | **1.8E+03** | **1.5E+04** | **MG/KG** | **CBD-S05-SB15-0810** | **10/10** | **N/A** | **1.5E+04** | **1.6E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 1.3E-01 | 3.3E-01 | MG/KG | CBD-S05-SB03-1820 | 5/10 | 0.15 - 0.17 | 3.3E-01 | 5.5E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **2.6E+00** | **1.3E+01** | **MG/KG** | **CBD-S05-SB16-0810** | **10/10** | **N/A** | **1.3E+01** | **9.8E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 4.3E+00 | 4.9E+01 | MG/KG | CBD-S05-SB14-0810 | 10/10 | N/A | 4.9E+01 | 5.7E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 22 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7440-41-7 | Beryllium | 2.5E-01 J | 3.6E+00 | MG/KG | CBD-S05-SB04-2022 | 10/10 | N/A | 3.6E+00 | 1.2E+00 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 1.9E-01 | 4.6E-01 | MG/KG | CBD-S05-SB04-2022 | 5/10 | 0.15 - 0.17 | 4.6E-01 | 8.1E-01 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 4.6E+01 | 4.5E+02 | MG/KG | CBD-S05-SB05-2022 | 10/10 | N/A | 4.5E+02 | 1.4E+03 | N/A | N/A | | NO | NUT |
| | 7440-47-3 | Chromium | 7.4E+00 | 3.0E+01 | MG/KG | CBD-S05-SB12P-0810 | 10/10 | N/A | 3.0E+01 | 5.8E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **7.7E-01** | **1.1E+02** | **MG/KG** | **CBD-S05-SB04-2022** | **10/10** | **N/A** | **1.1E+02** | **5.9E+00** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.0E+00 | 8.5E+00 | MG/KG | CBD-S05-SB12P-0810 | 10/10 | N/A | 8.5E+00 | 7.9E+00 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **3.8E+03** | **4.6E+04** | **MG/KG** | **CBD-S05-SB16-0810** | **10/10** | **N/A** | **4.6E+04** | **3.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 1.6E+00 | 1.1E+01 | MG/KG | CBD-S05-SB12P-0810 | 10/10 | N/A | 1.1E+01 | 1.2E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 5.6E+02 | 2.1E+03 | MG/KG | CBD-S05-SB14-0810 | 10/10 | N/A | 2.1E+03 | 3.4E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **5.0E+00** | **2.9E+02** | **MG/KG** | **CBD-S05-SB04-2022** | **10/10** | **N/A** | **2.9E+02** | **2.3E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7440-02-0 | Nickel | 1.2E+00 | 3.2E+01 | MG/KG | CBD-S05-SB04-2022 | 10/10 | N/A | 3.2E+01 | 1.3E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 3.8E+02 | 1.4E+03 | MG/KG | CBD-S05-SB14-0810 | 10/10 | N/A | 1.4E+03 | 1.6E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 7.1E-02 J | 1.3E+00 | MG/KG | CBD-S05-SB14-0810 | 10/10 | N/A | 1.3E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 2.3E-02 J | 2.9E-01 | MG/KG | CBD-S05-SB03-1820 | 6/10 | 0.15 - 0.17 | 2.9E-01 | 2.3E-01 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.5E+01 J+ | 4.4E+01 J+ | MG/KG | CBD-S05-SB15-0810 | 6/10 | N/A | 4.4E+01 | 1.4E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **9.2E-02 J** | **3.1E-01** | **MG/KG** | **CBD-S05-SB04-2022** | **10/10** | **N/A** | **3.1E-01** | **4.1E-01** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 4.6E+00 | 2.4E+01 | MG/KG | CBD-S05-SB13-0810 | 10/10 | N/A | 2.4E+01 | 3.6E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 1.0E+01 J | 7.8E+01 | MG/KG | CBD-S05-SB01P-2022 | 6/10 | N/A | 7.8E+01 | 6.4E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for xylenes used for m- and p-xylene.
RSL value for n-hexane used as surrogate for methylcyclohexane.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for endosulfan used as surrogate for endosulfan II.
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalent). Chromium (hexavalent) not detected in the soil sample.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.2a. Step 2 Subsurface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (MG/KG) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 10 / 10 | 1.5E+04 | CBD-S05-SB15-0810 | 7.70E+04 | N/A | 0.2 | N/A | Neurological |
| **Arsenic** | **10 / 10** | **1.3E+01** | **CBD-S05-SB16-0810** | **3.50E+01** | **6.8E-01** | **0.4** | **2E-05** | **Cardiovascular, Dermal** |
| ***Cobalt*** | ***10 / 10*** | ***1.1E+02*** | ***CBD-S05-SB04-2022*** | ***2.30E+01*** | ***4.2E+02*** | ***5*** | ***3E-07*** | ***Thyroid, Respiratory*** |
| **Iron** | **10 / 10** | **4.6E+04** | **CBD-S05-SB16-0810** | **5.50E+04** | **N/A** | **0.8** | **N/A** | **Gastrointestinal** |
| Manganese | 10 / 10 | 2.9E+02 | CBD-S05-SB04-2022 | 1.80E+03 | N/A | 0.2 | N/A | Nervous |
| **Thallium** | **10 / 10** | **3.1E-01** | **CBD-S05-SB04-2022** | **7.80E-01** | **N/A** | **0.4** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **7** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **2E-05** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.4 |
| Total Cardiovascular HI = | 0.4 |
| Total Dermal HI = | 0.8 |
| Total Thyroid HI = | 5 |
| Total Respiratory HI = | 5 |
| Total Gastrointestinal HI = | 0.8 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

**Table 2.2b. Step 3 Subsurface Soil Screening - Risk Ratio, 95% UCL, Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 10 / 10 | 7.7E+00 | 95% Student's-t UCL | 1, 2, 3 | 3.5E+01 | 6.8E-01 | 0.2 | 1E-05 | Cardiovascular, Dermal |
| ***Cobalt*** | ***10 / 10*** | ***6.1E+01*** | ***95% Chebyshev(Mean, Sd) UCL*** | ***1*** | ***2.3E+01*** | ***4.2E+02*** | ***3*** | ***1E-07*** | ***Thyroid, Respiratory*** |
| **Iron** | **10 / 10** | **3.7E+04** | **95% Chebyshev(Mean, Sd) UCL** | **4** | **5.5E+04** | **N/A** | **0.7** | **N/A** | **Gastrointestinal** |
| Thallium | 10 / 10 | 2.1E-01 | 95% Student's-t UCL | 1 | 7.8E-01 | N/A | 0.3 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **1E-05** | |

Total Cardiovascular HI = 0.2
Total Dermal HI = 0.5
Total Thyroid HI = 3
Total Respiratory HI = 3
Total Gastrointestinal HI = 0.7

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Recommended 95% UCL exceeds maximum detected concentration.

**Table 2.2c. Comparison of Concentrations of COPCs to Background Concentrations - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 22 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | **7440-48-4** | **Cobalt** | **7.7E-01** | **1.1E+02** | **MG/KG** | **CBD-S05-SB04-2022** | **10/10** | **N/A** | **1.1E+02** | **5.9E+00** | **YES** |
| | **7439-89-6** | **Iron** | **3.8E+03** | **4.6E+04** | **MG/KG** | **CBD-S05-SB16-0810** | **10/10** | **N/A** | **4.6E+04** | **3.0E+04** | **YES** |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background value is the surface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram

**Table 2.3. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 75-15-0 | Carbon disulfide | 1.0E+00 | 1.5E+00 | UG/L | CBD-S05-GW03-0418 | 2/3 | 1 - 1 | 1.5E+00 | N/A | 8.1E+01 N | N/A | | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 4.6E-03 J | 9.0E-03 J | UG/L | CBD-S05-GW02-0418 | 2/3 | 0.012 - 0.012 | 9.0E-03 | ND | 3.0E-02 C | N/A | | NO | BSL |
| | 218-01-9 | Chrysene | 6.5E-03 J | 9.5E-03 J | UG/L | CBD-S05-GW02-0418 | 2/3 | 0.012 - 0.012 | 9.5E-03 | 1.3E-02 | 2.5E+01 C | N/A | | NO | BSL |
| | 206-44-0 | Fluoranthene | 5.1E-03 J | 8.5E-03 J | UG/L | CBD-S05-GW02-0418 | 3/3 | 0.02 - 0.02 | 8.5E-03 | 2.6E-02 | 8.0E+01 N | N/A | | NO | BSL |
| | 7429-90-5 | Aluminum | 2.6E+01 J+ | 4.3E+02 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 4.3E+02 | 5.0E+03 | 2.0E+03 N | N/A | | NO | BSL |
| | **7440-38-2** | **Arsenic** | **1.6E-01 J** | **7.7E-01** | **UG/L** | **CBD-S05-GW02-0418** | **3/3** | **N/A** | **7.7E-01** | **6.1E+00** | **5.2E-02 C** | **1.0E+01** | **MCL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 2.9E+01 | 6.0E+01 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 6.0E+01 | 1.6E+02 | 3.8E+02 N | 2.0E+03 | MCL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.5E-01 J | 1.5E-01 J | UG/L | CBD-S05-GW02-0418 | 1/3 | 0.13 - 0.13 | 1.5E-01 | 3.0E+00 | 2.5E+00 N | 4.0E+00 | MCL | NO | BSL |
| | 7440-43-9 | Cadmium | 5.0E-01 | 8.1E-01 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 8.1E-01 | 6.4E+01 | 9.2E-01 N | 5.0E+00 | MCL | NO | BSL |
| | 7440-70-2 | Calcium | 6.2E+04 | 1.6E+05 | UG/L | CBD-S05-GW01-0418 | 3/3 | N/A | 1.6E+05 | 1.3E+05 | N/A | N/A | | NO | NUT |
| | **7440-47-3** | **Chromium** | **5.2E-01** | **1.1E+00** | **UG/L** | **CBD-S05-GW02-0418** | **2/3** | **0.3 - 0.3** | **1.1E+00** | **2.5E+01** | **3.5E-02 C** | **1.0E+02** | **MCL** | **YES** | **ASL** |
| | **7440-48-4** | **Cobalt** | **1.0E+00** | **6.5E+00** | **UG/L** | **CBD-S05-GW03-0418** | **3/3** | **N/A** | **6.5E+00** | **4.0E+01** | **6.0E-01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-50-8 | Copper | 3.3E-01 J | 8.2E-01 | UG/L | CBD-S05-GW02-0418 | 2/3 | 0.3 - 0.3 | 8.2E-01 | 1.1E+01 | 8.0E+01 N | 1.3E+03 | MCL | NO | BSL |
| | 7439-89-6 | Iron | 4.8E+01 | 4.8E+02 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 4.8E+02 | 2.3E+04 | 1.4E+03 N | N/A | | NO | BSL |
| | 7439-92-1 | Lead | 4.2E-01 J | 4.2E-01 J | UG/L | CBD-S05-GW02-0418 | 1/3 | 0.13 - 0.13 | 4.2E-01 | 1.4E+00 | 1.5E+01 L | 1.5E+01 | MCL | NO | BSL |
| | 7439-95-4 | Magnesium | 2.7E+03 | 7.8E+03 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 7.8E+03 | 3.8E+04 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **2.9E+01** | **5.6E+01** | **UG/L** | **CBD-S05-GW02-0418** | **3/3** | **N/A** | **5.6E+01** | **4.0E+03** | **4.3E+01 N** | **N/A** | | **YES** | **ASL** |
| | 7440-02-0 | Nickel | 4.4E+00 | 2.1E+01 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 2.1E+01 | 2.6E+02 | 3.9E+01 N | N/A | | NO | BSL |
| | 7440-09-7 | Potassium | 1.2E+03 | 2.4E+03 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 2.4E+03 | 1.2E+04 | N/A | | | NO | NUT |
| | 7440-23-5 | Sodium | 5.7E+03 | 6.7E+03 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 6.7E+03 | 5.5E+04 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **1.6E-01 J** | **1.6E-01 J** | **UG/L** | **CBD-S05-GW03-0418** | **1/3** | **0.5 - 0.5** | **1.6E-01** | **3.1E+00** | **2.0E-02 N** | **2.0E+00** | **MCL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 4.7E-01 J | 1.5E+00 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 1.5E+00 | 4.7E+00 | 8.6E+00 N | N/A | | NO | BSL |
| | 7440-66-6 | Zinc | 3.0E+00 J+ | 3.0E+01 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 3.0E+01 | 3.2E+02 | 6.0E+02 N | N/A | | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory groundwater background threshold value (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Tap Water RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for chromium (hexavalent) used for chromium.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MCL = USEPA Maximum Contaminant Level
UG/L = Micrograms per liter
N/A = Not available/not applicable
ND = Not detected

**Table 2.3a. Step 2 Groundwater Screening - Risk Ratio, Maximum Detected Concentration, Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Tap Water RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| **Metals (UG/L)** | | | | | | | | |
| **Arsenic** | **3 / 3** | **7.7E-01** | **CBD-S05-GW02-0418** | **6.0E+00** | **5.2E-02** | **0.1** | **1E-05** | **Cardiovascular, Dermal** |
| Chromium | 2 / 3 | 1.1E+00 | CBD-S05-GW02-0418 | 2.2E+04 | | 0.0001 | N/A | No effects observed |
| **Cobalt** | **3 / 3** | **6.5E+00** | **CBD-S05-GW03-0418** | **6.0E+00** | **N/A** | **1** | **N/A** | **Thyroid, Respiratory** |
| Manganese | 3 / 3 | 5.6E+01 | CBD-S05-GW02-0418 | 4.3E+02 | N/A | 0.1 | N/A | Nervous |
| **Thallium** | **1 / 3** | **1.6E-01 J** | **CBD-S05-GW03-0418** | **2.0E-01** | **N/A** | **1** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **2** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.1 |
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 1 |
| Total Thyroid HI = | 1 |
| Total Respiratory HI = | 1 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of Hazard Indices for each constituent.

[d] Cumulative Cancer Risk equals sum of Cancer Risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern

HI = Hazard Index

UG/L = micrograms per liter

NA = Not available/not applicable

RSL = Regional Screening Levels, November 2019

MDE = Maryland Department of the Environment

USEPA = US Environmental Protection Agency

**Table 2.3b. Comparison of Concentrations of COPCs to Background Concentrations - Site 5**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Groundwater | 7440-38-2 | Arsenic | 1.6E-01 J | 7.7E-01 | UG/L | CBD-S05-GW02-0418 | 3/3 | N/A | 7.7E-01 | 6.1E+00 | NO |
| | 7440-48-4 | Cobalt | 1.0E+00 | 6.5E+00 | UG/L | CBD-S05-GW03-0418 | 3/3 | N/A | 6.5E+00 | 4.0E+01 | NO |
| | 7440-28-0 | Thallium | 1.6E-01 J | 1.6E-01 J | UG/L | CBD-S05-GW03-0418 | 1/3 | 0.5 - 0.5 | 1.6E-01 | 3.1E+00 | NO |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background value is the surface soil background threshold value (BTV).

COPC = Chemical of Potential Concern
UG/L = microgram per liter
N/A = not applicable

Site 5 Surface Soil

## UCL Statistics for Data Sets with Non-Detects

User Selected Options

| | |
|---|---|
| Date/Time of Computation | ProUCL 5.11/4/2019 11:45:51 AM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

## Benzo(a)anthracene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 18 |
| Number of Detects | 16 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 16 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 4.8 | Minimum Non-Detect | 1.8 |
| Maximum Detect | 30000 | Maximum Non-Detect | 4.6 |
| Variance Detects | 55588455 | Percent Non-Detects | 11.11% |
| Mean Detects | 2081 | SD Detects | 7456 |
| Median Detects | 85 | CV Detects | 3.583 |
| Skewness Detects | 3.981 | Kurtosis Detects | 15.89 |
| Mean of Logged Detects | 4.388 | SD of Logged Detects | 2.377 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.305 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.463 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 1850 | KM Standard Error of Mean | 1664 |
| KM SD | 6837 | 95% KM (BCA) UCL | 5176 |
| 95% KM (t) UCL | 4746 | 95% KM (Percentile Bootstrap) UCL | 5124 |
| 95% KM (z) UCL | 4588 | 95% KM Bootstrap t UCL | 87187 |
| 90% KM Chebyshev UCL | 6843 | 95% KM Chebyshev UCL | 9105 |
| 97.5% KM Chebyshev UCL | 12245 | 99% KM Chebyshev UCL | 18411 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 2.087 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.873 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.296 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.237 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.222 | k star (bias corrected MLE) | 0.222 |
| Theta hat (MLE) | 9355 | Theta star (bias corrected MLE) | 9357 |
| nu hat (MLE) | 7.119 | nu star (bias corrected) | 7.117 |
| Mean (detects) | 2081 | | |

Site 5 Surface Soil

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 1850 |
| Maximum | 30000 | Median | 53.5 |
| SD | 7036 | CV | 3.803 |
| k hat (MLE) | 0.181 | k star (bias corrected MLE) | 0.188 |
| Theta hat (MLE) | 10232 | Theta star (bias corrected MLE) | 9856 |
| nu hat (MLE) | 6.508 | nu star (bias corrected) | 6.757 |
| Adjusted Level of Significance (β) | 0.0357 | | |
| Approximate Chi Square Value (6.76, α) | 2.038 | Adjusted Chi Square Value (6.76, β) | 1.799 |
| 95% Gamma Approximate UCL (use when n>=50) | 6133 | 95% Gamma Adjusted UCL (use when n<50) | 6948 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 1850 | SD (KM) | 6837 |
| Variance (KM) | 46750729 | SE of Mean (KM) | 1664 |
| k hat (KM) | 0.0732 | k star (KM) | 0.098 |
| nu hat (KM) | 2.636 | nu star (KM) | 3.53 |
| theta hat (KM) | 25270 | theta star (KM) | 18869 |
| 80% gamma percentile (KM) | 1247 | 90% gamma percentile (KM) | 4883 |
| 95% gamma percentile (KM) | 10750 | 99% gamma percentile (KM) | 29679 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.53, α) | 0.545 | Adjusted Chi Square Value (3.53, β) | 0.449 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 11976 | 95% Gamma Adjusted KM-UCL (use when n<50) | 14531 |

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.925 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 1850 | Mean in Log Scale | 3.776 |
| SD in Original Scale | 7036 | SD in Log Scale | 2.855 |
| 95% t UCL (assumes normality of ROS data) | 4735 | 95% Percentile Bootstrap UCL | 5142 |
| 95% BCA Bootstrap UCL | 6869 | 95% Bootstrap t UCL | 86365 |
| 95% H-UCL (Log ROS) | 153164 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 3.965 | KM Geo Mean | 52.74 |
| KM SD (logged) | 2.476 | 95% Critical H Value (KM-Log) | 5.192 |
| KM Standard Error of Mean (logged) | 0.603 | 95% H-UCL (KM -Log) | 25598 |
| KM SD (logged) | 2.476 | 95% Critical H Value (KM-Log) | 5.192 |
| KM Standard Error of Mean (logged) | 0.603 | | |

Site 5 Surface Soil

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 1850 | Mean in Log Scale | 3.94 |
| SD in Original Scale | 7036 | SD in Log Scale | 2.589 |
| 95% t UCL (Assumes normality) | 4735 | 95% H-Stat UCL | 43661 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 99% KM (Chebyshev) UCL | 18411 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Benzo(a)pyrene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 16 |
| Number of Detects | 16 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 14 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 5.2 | Minimum Non-Detect | 3.5 |
| Maximum Detect | 3700 | Maximum Non-Detect | 4.6 |
| Variance Detects | 907809 | Percent Non-Detects | 11.11% |
| Mean Detects | 454.6 | SD Detects | 952.8 |
| Median Detects | 96.5 | CV Detects | 2.096 |
| Skewness Detects | 3.082 | Kurtosis Detects | 9.945 |
| Mean of Logged Detects | 4.587 | SD of Logged Detects | 1.858 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.521 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.365 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 404.5 | KM Standard Error of Mean | 214.5 |
| KM SD | 881.3 | 95% KM (BCA) UCL | 791.4 |
| 95% KM (t) UCL | 777.7 | 95% KM (Percentile Bootstrap) UCL | 778.6 |
| 95% KM (z) UCL | 757.4 | 95% KM Bootstrap t UCL | 2204 |
| 90% KM Chebyshev UCL | 1048 | 95% KM Chebyshev UCL | 1340 |
| 97.5% KM Chebyshev UCL | 1744 | 99% KM Chebyshev UCL | 2539 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.793 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.812 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.186 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.229 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.425 | k star (bias corrected MLE) | 0.387 |
| Theta hat (MLE) | 1069 | Theta star (bias corrected MLE) | 1175 |
| nu hat (MLE) | 13.6 | nu star (bias corrected) | 12.39 |
| Mean (detects) | 454.6 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 404.1 |
| Maximum | 3700 | Median | 84 |
| SD | 907 | CV | 2.244 |
| k hat (MLE) | 0.285 | k star (bias corrected MLE) | 0.275 |
| Theta hat (MLE) | 1416 | Theta star (bias corrected MLE) | 1470 |
| nu hat (MLE) | 10.27 | nu star (bias corrected) | 9.894 |
| Adjusted Level of Significance (β) | 0.0357 | | |
| Approximate Chi Square Value (9.89, α) | 3.875 | Adjusted Chi Square Value (9.89, β) | 3.521 |
| 95% Gamma Approximate UCL (use when n>=50) | 1032 | 95% Gamma Adjusted UCL (use when n<50) | 1136 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 404.5 | SD (KM) | 881.3 |
| Variance (KM) | 776609 | SE of Mean (KM) | 214.5 |
| k hat (KM) | 0.211 | k star (KM) | 0.213 |
| nu hat (KM) | 7.585 | nu star (KM) | 7.654 |
| theta hat (KM) | 1920 | theta star (KM) | 1903 |
| 80% gamma percentile (KM) | 549.5 | 90% gamma percentile (KM) | 1223 |
| 95% gamma percentile (KM) | 2051 | 99% gamma percentile (KM) | 4307 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (7.65, α) | 2.536 | Adjusted Chi Square Value (7.65, β) | 2.262 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1221 | 95% Gamma Adjusted KM-UCL (use when n<50) | 1369 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.138 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 404.3 | Mean in Log Scale | 4.101 |
| SD in Original Scale | 906.9 | SD in Log Scale | 2.246 |
| 95% t UCL (assumes normality of ROS data) | 776.1 | 95% Percentile Bootstrap UCL | 786.1 |
| 95% BCA Bootstrap UCL | 979.7 | 95% Bootstrap t UCL | 2118 |
| 95% H-UCL (Log ROS) | 10080 | | |

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### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 4.216 | KM Geo Mean | 67.77 |
| KM SD (logged) | 1.993 | 95% Critical H Value (KM-Log) | 4.302 |
| KM Standard Error of Mean (logged) | 0.485 | 95% H-UCL (KM -Log) | 3953 |
| KM SD (logged) | 1.993 | 95% Critical H Value (KM-Log) | 4.302 |
| KM Standard Error of Mean (logged) | 0.485 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 404.3 | Mean in Log Scale | 4.154 |
| SD in Original Scale | 906.9 | SD in Log Scale | 2.152 |
| 95% t UCL (Assumes normality) | 776.2 | 95% H-Stat UCL | 7073 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) | 1369 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Benzo(b)fluoranthene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 16 |
| Number of Detects | 16 | Number of Non-Detects | 2 |
| Number of Distinct Detects | 14 | Number of Distinct Non-Detects | 2 |
| Minimum Detect | 6.6 | Minimum Non-Detect | 3.5 |
| Maximum Detect | 32000 | Maximum Non-Detect | 7 |
| Variance Detects | 63049419 | Percent Non-Detects | 11.11% |
| Mean Detects | 2302 | SD Detects | 7940 |
| Median Detects | 118.5 | CV Detects | 3.45 |
| Skewness Detects | 3.965 | Kurtosis Detects | 15.8 |
| Mean of Logged Detects | 4.86 | SD of Logged Detects | 2.245 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.317 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.447 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 2047 | KM Standard Error of Mean | 1773 |
| KM SD | 7284 | 95% KM (BCA) UCL | 5595 |
| 95% KM (t) UCL | 5131 | 95% KM (Percentile Bootstrap) UCL | 5548 |
| 95% KM (z) UCL | 4963 | 95% KM Bootstrap t UCL | 67199 |
| 90% KM Chebyshev UCL | 7366 | 95% KM Chebyshev UCL | 9776 |
| 97.5% KM Chebyshev UCL | 13121 | 99% KM Chebyshev UCL | 19690 |

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### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 1.926 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.862 | Detected Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.296 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.236 | Detected Data Not Gamma Distributed at 5% Significance Level |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.247 | k star (bias corrected MLE) | 0.242 |
| Theta hat (MLE) | 9320 | Theta star (bias corrected MLE) | 9499 |
| nu hat (MLE) | 7.903 | nu star (bias corrected) | 7.755 |
| Mean (detects) | 2302 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 2046 |
| Maximum | 32000 | Median | 73.5 |
| SD | 7496 | CV | 3.663 |
| k hat (MLE) | 0.194 | k star (bias corrected MLE) | 0.199 |
| Theta hat (MLE) | 10557 | Theta star (bias corrected MLE) | 10305 |
| nu hat (MLE) | 6.978 | nu star (bias corrected) | 7.148 |
| Adjusted Level of Significance (β) | 0.0357 | | |
| Approximate Chi Square Value (7.15, α) | 2.252 | Adjusted Chi Square Value (7.15, β) | 1.998 |
| 95% Gamma Approximate UCL (use when n>=50) | 6494 | 95% Gamma Adjusted UCL (use when n<50) | 7322 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 2047 | SD (KM) | 7284 |
| Variance (KM) | 53062451 | SE of Mean (KM) | 1773 |
| k hat (KM) | 0.0789 | k star (KM) | 0.103 |
| nu hat (KM) | 2.842 | nu star (KM) | 3.701 |
| theta hat (KM) | 25927 | theta star (KM) | 19905 |
| 80% gamma percentile (KM) | 1478 | 90% gamma percentile (KM) | 5509 |
| 95% gamma percentile (KM) | 11858 | 99% gamma percentile (KM) | 32060 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.70, α) | 0.607 | Adjusted Chi Square Value (3.70, β) | 0.503 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 12471 | 95% Gamma Adjusted KM-UCL (use when n<50) | 15054 |

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.946 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.887 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.11 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.213 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

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### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 2046 | Mean in Log Scale | 4.338 |
| SD in Original Scale | 7496 | SD in Log Scale | 2.613 |
| 95% t UCL (assumes normality of ROS data) | 5120 | 95% Percentile Bootstrap UCL | 5491 |
| 95% BCA Bootstrap UCL | 7371 | 95% Bootstrap t UCL | 68200 |
| 95% H-UCL (Log ROS) | 73319 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 4.483 | KM Geo Mean | 88.47 |
| KM SD (logged) | 2.313 | 95% Critical H Value (KM-Log) | 4.886 |
| KM Standard Error of Mean (logged) | 0.563 | 95% H-UCL (KM -Log) | 19869 |
| KM SD (logged) | 2.313 | 95% Critical H Value (KM-Log) | 4.886 |
| KM Standard Error of Mean (logged) | 0.563 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 2046 | Mean in Log Scale | 4.421 |
| SD in Original Scale | 7496 | SD in Log Scale | 2.469 |
| 95% t UCL (Assumes normality) | 5120 | 95% H-Stat UCL | 38874 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 99% KM (Chebyshev) UCL | 19690 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Dibenz(a,h)anthracene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 17 |
| Number of Detects | 13 | Number of Non-Detects | 5 |
| Number of Distinct Detects | 13 | Number of Distinct Non-Detects | 4 |
| Minimum Detect | 4.6 | Minimum Non-Detect | 3.5 |
| Maximum Detect | 420 | Maximum Non-Detect | 8 |
| Variance Detects | 15932 | Percent Non-Detects | 27.78% |
| Mean Detects | 79.41 | SD Detects | 126.2 |
| Median Detects | 25 | CV Detects | 1.59 |
| Skewness Detects | 2.165 | Kurtosis Detects | 4.189 |
| Mean of Logged Detects | 3.374 | SD of Logged Detects | 1.463 |

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.644 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Detected Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.343 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Detected Data Not Normal at 5% Significance Level |

Detected Data Not Normal at 5% Significance Level

## Site 5 Surface Soil

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 58.39 | KM Standard Error of Mean | 26.62 |
| KM SD | 108.5 | 95% KM (BCA) UCL | 105.5 |
| 95% KM (t) UCL | 104.7 | 95% KM (Percentile Bootstrap) UCL | 103.4 |
| 95% KM (z) UCL | 102.2 | 95% KM Bootstrap t UCL | 205.1 |
| 90% KM Chebyshev UCL | 138.2 | 95% KM Chebyshev UCL | 174.4 |
| 97.5% KM Chebyshev UCL | 224.6 | 99% KM Chebyshev UCL | 323.2 |

### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.758 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.781 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.229 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.248 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.615 | k star (bias corrected MLE) | 0.525 |
| Theta hat (MLE) | 129.1 | Theta star (bias corrected MLE) | 151.4 |
| nu hat (MLE) | 16 | nu star (bias corrected) | 13.64 |
| Mean (detects) | 79.41 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 57.35 |
| Maximum | 420 | Median | 16 |
| SD | 112.2 | CV | 1.956 |
| k hat (MLE) | 0.246 | k star (bias corrected MLE) | 0.242 |
| Theta hat (MLE) | 232.9 | Theta star (bias corrected MLE) | 236.8 |
| nu hat (MLE) | 8.864 | nu star (bias corrected) | 8.72 |
| Adjusted Level of Significance (β) | 0.0357 | | |
| Approximate Chi Square Value (8.72, α) | 3.159 | Adjusted Chi Square Value (8.72, β) | 2.845 |
| 95% Gamma Approximate UCL (use when n>=50) | 158.3 | 95% Gamma Adjusted UCL (use when n<50) | 175.8 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 58.39 | SD (KM) | 108.5 |
| Variance (KM) | 11770 | SE of Mean (KM) | 26.62 |
| k hat (KM) | 0.29 | k star (KM) | 0.278 |
| nu hat (KM) | 10.43 | nu star (KM) | 10.02 |
| theta hat (KM) | 201.6 | theta star (KM) | 209.7 |
| 80% gamma percentile (KM) | 87.79 | 90% gamma percentile (KM) | 173.6 |
| 95% gamma percentile (KM) | 273.5 | 99% gamma percentile (KM) | 535.5 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (10.02, α) | 3.957 | Adjusted Chi Square Value (10.02, β) | 3.598 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 147.9 | 95% Gamma Adjusted KM-UCL (use when n<50) | 162.7 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.932 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.866 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.147 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.234 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 57.75 | Mean in Log Scale | 2.498 |
| SD in Original Scale | 112 | SD in Log Scale | 1.928 |
| 95% t UCL (assumes normality of ROS data) | 103.7 | 95% Percentile Bootstrap UCL | 101.9 |
| 95% BCA Bootstrap UCL | 117.2 | 95% Bootstrap t UCL | 198.3 |
| 95% H-UCL (Log ROS) | 551.3 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 2.802 | KM Geo Mean | 16.48 |
| KM SD (logged) | 1.51 | 95% Critical H Value (KM-Log) | 3.452 |
| KM Standard Error of Mean (logged) | 0.371 | 95% H-UCL (KM -Log) | 182.6 |
| KM SD (logged) | 1.51 | 95% Critical H Value (KM-Log) | 3.452 |
| KM Standard Error of Mean (logged) | 0.371 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 58.06 | Mean in Log Scale | 2.68 |
| SD in Original Scale | 111.8 | SD in Log Scale | 1.696 |
| 95% t UCL (Assumes normality) | 103.9 | 95% H-Stat UCL | 289.8 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) | 162.7 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Indeno(1,2,3-cd)pyrene (UG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 17 |
| Number of Detects | 14 | Number of Non-Detects | 4 |
| Number of Distinct Detects | 14 | Number of Distinct Non-Detects | 3 |
| Minimum Detect | 4.9 | Minimum Non-Detect | 3.5 |
| Maximum Detect | 13000 | Maximum Non-Detect | 7 |
| Variance Detects | 11803256 | Percent Non-Detects | 22.22% |
| Mean Detects | 1126 | SD Detects | 3436 |
| Median Detects | 86.5 | CV Detects | 3.052 |
| Skewness Detects | 3.677 | Kurtosis Detects | 13.64 |
| Mean of Logged Detects | 4.629 | SD of Logged Detects | 2.069 |

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### Normal GOF Test on Detects Only

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.363 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.418 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.226 | Detected Data Not Normal at 5% Significance Level | |

Detected Data Not Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 876.2 | KM Standard Error of Mean | 723.2 |
| KM SD | 2957 | 95% KM (BCA) UCL | 2280 |
| 95% KM (t) UCL | 2134 | 95% KM (Percentile Bootstrap) UCL | 2252 |
| 95% KM (z) UCL | 2066 | 95% KM Bootstrap t UCL | 17890 |
| 90% KM Chebyshev UCL | 3046 | 95% KM Chebyshev UCL | 4029 |
| 97.5% KM Chebyshev UCL | 5393 | 99% KM Chebyshev UCL | 8072 |

### Gamma GOF Tests on Detected Observations Only

| | | | |
|---|---|---|---|
| A-D Test Statistic | 1.562 | **Anderson-Darling GOF Test** | |
| 5% A-D Critical Value | 0.837 | Detected Data Not Gamma Distributed at 5% Significance Level | |
| K-S Test Statistic | 0.285 | **Kolmogorov-Smirnov GOF** | |
| 5% K-S Critical Value | 0.248 | Detected Data Not Gamma Distributed at 5% Significance Level | |

Detected Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.289 | k star (bias corrected MLE) | 0.275 |
| Theta hat (MLE) | 3889 | Theta star (bias corrected MLE) | 4093 |
| nu hat (MLE) | 8.103 | nu star (bias corrected) | 7.7 |
| Mean (detects) | 1126 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.01 | Mean | 875.4 |
| Maximum | 13000 | Median | 42.5 |
| SD | 3043 | CV | 3.476 |
| k hat (MLE) | 0.178 | k star (bias corrected MLE) | 0.186 |
| Theta hat (MLE) | 4906 | Theta star (bias corrected MLE) | 4713 |
| nu hat (MLE) | 6.424 | nu star (bias corrected) | 6.686 |
| Adjusted Level of Significance (β) | 0.0357 | | |
| Approximate Chi Square Value (6.69, α) | 2 | Adjusted Chi Square Value (6.69, β) | 1.764 |
| 95% Gamma Approximate UCL (use when n>=50) | 2927 | 95% Gamma Adjusted UCL (use when n<50) | 3319 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 876.2 | SD (KM) | 2957 |
| Variance (KM) | 8742150 | SE of Mean (KM) | 723.2 |
| k hat (KM) | 0.0878 | k star (KM) | 0.11 |
| nu hat (KM) | 3.162 | nu star (KM) | 3.968 |
| theta hat (KM) | 9977 | theta star (KM) | 7949 |
| 80% gamma percentile (KM) | 694 | 90% gamma percentile (KM) | 2419 |
| 95% gamma percentile (KM) | 5048 | 99% gamma percentile (KM) | 13250 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (3.97, α) | 0.709 | Adjusted Chi Square Value (3.97, β) | 0.592 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 4903 | 95% Gamma Adjusted KM-UCL (use when n<50) | 5872 |

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.953 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.874 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.129 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.226 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 875.7 | Mean in Log Scale | 3.573 |
| SD in Original Scale | 3043 | SD in Log Scale | 2.733 |
| 95% t UCL (assumes normality of ROS data) | 2123 | 95% Percentile Bootstrap UCL | 2268 |
| 95% BCA Bootstrap UCL | 3066 | 95% Bootstrap t UCL | 18061 |
| 95% H-UCL (Log ROS) | 63914 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 3.884 | KM Geo Mean | 48.6 |
| KM SD (logged) | 2.245 | 95% Critical H Value (KM-Log) | 4.761 |
| KM Standard Error of Mean (logged) | 0.549 | 95% H-UCL (KM -Log) | 8071 |
| KM SD (logged) | 2.245 | 95% Critical H Value (KM-Log) | 4.761 |
| KM Standard Error of Mean (logged) | 0.549 | | |

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 875.9 | Mean in Log Scale | 3.767 |
| SD in Original Scale | 3043 | SD in Log Scale | 2.46 |
| 95% t UCL (Assumes normality) | 2123 | 95% H-Stat UCL | 19395 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

### Nonparametric Distribution Free UCL Statistics

**Detected Data appear Lognormal Distributed at 5% Significance Level**

### Suggested UCL to Use

| | |
|---|---|
| 99% KM (Chebyshev) UCL | 8072 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Site 5 Surface Soil

Vanadium (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 18 | Number of Distinct Observations | 14 |
| | | Number of Missing Observations | 0 |
| Minimum | 6 | Mean | 38.63 |
| Maximum | 380 | Median | 18 |
| SD | 85.78 | Std. Error of Mean | 20.22 |
| Coefficient of Variation | 2.221 | Skewness | 4.147 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.354 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.897 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.438 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.202 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 73.8 | 95% Adjusted-CLT UCL (Chen-1995) | 93 |
| | | 95% Modified-t UCL (Johnson-1978) | 77.09 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 2.229 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.775 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.288 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.211 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.821 | k star (bias corrected MLE) | 0.721 |
| Theta hat (MLE) | 47.05 | Theta star (bias corrected MLE) | 53.56 |
| nu hat (MLE) | 29.56 | nu star (bias corrected) | 25.96 |
| MLE Mean (bias corrected) | 38.63 | MLE Sd (bias corrected) | 45.48 |
| | | Approximate Chi Square Value (0.05) | 15.35 |
| Adjusted Level of Significance | 0.0357 | Adjusted Chi Square Value | 14.57 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 65.33 | 95% Adjusted Gamma UCL (use when n<50) | 68.83 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.837 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.897 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.16 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.202 | Data appear Lognormal at 5% Significance Level |

Data appear Approximate Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 1.792 | Mean of logged Data | 2.934 |
| Maximum of Logged Data | 5.94 | SD of logged Data | 0.96 |

Site 5 Surface Soil

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 54.32 | 90% Chebyshev (MVUE) UCL | 50.31 |
| 95% Chebyshev (MVUE) UCL | 60.07 | 97.5% Chebyshev (MVUE) UCL | 73.61 |
| 99% Chebyshev (MVUE) UCL | 100.2 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 71.88 | 95% Jackknife UCL | 73.8 |
| 95% Standard Bootstrap UCL | 70.64 | 95% Bootstrap-t UCL | 269.1 |
| 95% Hall's Bootstrap UCL | 222.6 | 95% Percentile Bootstrap UCL | 78.77 |
| 95% BCA Bootstrap UCL | 100.2 | | |
| 90% Chebyshev(Mean, Sd) UCL | 99.28 | 95% Chebyshev(Mean, Sd) UCL | 126.8 |
| 97.5% Chebyshev(Mean, Sd) UCL | 164.9 | 99% Chebyshev(Mean, Sd) UCL | 239.8 |

### Suggested UCL to Use

| | |
|---|---|
| 95% H-UCL | 54.32 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

### UCL Statistics for Uncensored Full Data Sets

User Selected Options

| | |
|---|---|
| Date/Time of Computation | ProUCL 5.111/7/2019 10:20:54 AM |
| From File | UCLInput_a.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

## Site 5 Surface Soil

## Arsenic (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 2.6 | Mean | 5.79 |
| Maximum | 13 | Median | 5.1 |
| SD | 3.338 | Std. Error of Mean | 1.056 |
| Coefficient of Variation | 0.576 | Skewness | 1.287 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.867 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.227 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

**Data appear Normal at 5% Significance Level**

### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 7.725 | 95% Adjusted-CLT UCL (Chen-1995) | 7.985 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.796 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.316 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.73 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.156 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.268 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.877 | k star (bias corrected MLE) | 2.78 |
| Theta hat (MLE) | 1.493 | Theta star (bias corrected MLE) | 2.082 |
| nu hat (MLE) | 77.54 | nu star (bias corrected) | 55.61 |
| MLE Mean (bias corrected) | 5.79 | MLE Sd (bias corrected) | 3.472 |
| | | Approximate Chi Square Value (0.05) | 39.47 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 37.12 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 8.157 | 95% Adjusted Gamma UCL (use when n<50) | 8.674 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.131 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

**Data appear Lognormal at 5% Significance Level**

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.956 | Mean of logged Data | 1.622 |
| Maximum of Logged Data | 2.565 | SD of logged Data | 0.537 |

**Site 5 Surface Soil**

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 8.785 | 90% Chebyshev (MVUE) UCL | 8.748 |
| 95% Chebyshev (MVUE) UCL | 10.1 | 97.5% Chebyshev (MVUE) UCL | 11.98 |
| 99% Chebyshev (MVUE) UCL | 15.68 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 7.526 | 95% Jackknife UCL | 7.725 |
| 95% Standard Bootstrap UCL | 7.471 | 95% Bootstrap-t UCL | 8.866 |
| 95% Hall's Bootstrap UCL | 16.08 | 95% Percentile Bootstrap UCL | 7.53 |
| 95% BCA Bootstrap UCL | 7.9 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8.957 | 95% Chebyshev(Mean, Sd) UCL | 10.39 |
| 97.5% Chebyshev(Mean, Sd) UCL | 12.38 | 99% Chebyshev(Mean, Sd) UCL | 16.29 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 7.725 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Site 5 Subsurface Soil

# UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/4/2019 1:17:33 PM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

## Arsenic (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 2.6 | Mean | 5.79 |
| Maximum | 13 | Median | 5.1 |
| SD | 3.338 | Std. Error of Mean | 1.056 |
| Coefficient of Variation | 0.576 | Skewness | 1.287 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.867 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.227 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 7.725 | 95% Adjusted-CLT UCL (Chen-1995) | 7.985 |
| | | 95% Modified-t UCL (Johnson-1978) | 7.796 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.316 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.73 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.156 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.268 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.877 | k star (bias corrected MLE) | 2.78 |
| Theta hat (MLE) | 1.493 | Theta star (bias corrected MLE) | 2.082 |
| nu hat (MLE) | 77.54 | nu star (bias corrected) | 55.61 |
| MLE Mean (bias corrected) | 5.79 | MLE Sd (bias corrected) | 3.472 |
| | | Approximate Chi Square Value (0.05) | 39.47 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 37.12 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 8.157 | 95% Adjusted Gamma UCL (use when n<50) | 8.674 |

Site 5 Subsurface Soil

### Lognormal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.947 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.131 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 0.956 | Mean of logged Data | 1.622 |
| Maximum of Logged Data | 2.565 | SD of logged Data | 0.537 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 8.785 | 90% Chebyshev (MVUE) UCL | 8.748 |
| 95% Chebyshev (MVUE) UCL | 10.1 | 97.5% Chebyshev (MVUE) UCL | 11.98 |
| 99% Chebyshev (MVUE) UCL | 15.68 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 7.526 | 95% Jackknife UCL | 7.725 |
| 95% Standard Bootstrap UCL | 7.445 | 95% Bootstrap-t UCL | 8.864 |
| 95% Hall's Bootstrap UCL | 16.13 | 95% Percentile Bootstrap UCL | 7.5 |
| 95% BCA Bootstrap UCL | 7.74 | | |
| 90% Chebyshev(Mean, Sd) UCL | 8.957 | 95% Chebyshev(Mean, Sd) UCL | 10.39 |
| 97.5% Chebyshev(Mean, Sd) UCL | 12.38 | 99% Chebyshev(Mean, Sd) UCL | 16.29 |

### Suggested UCL to Use

95% Student's-t UCL 7.725

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cobalt (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.77 | Mean | 13.82 |
| Maximum | 110 | Median | 2.25 |
| SD | 33.91 | Std. Error of Mean | 10.72 |
| Coefficient of Variation | 2.454 | Skewness | 3.124 |

### Normal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.431 | **Shapiro Wilk GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.447 | **Lilliefors GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level | |

Data Not Normal at 5% Significance Level

Site 5 Subsurface Soil

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 33.47 | 95% Adjusted-CLT UCL (Chen-1995) | 42.77 |
| | | 95% Modified-t UCL (Johnson-1978) | 35.24 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 1.475 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.786 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.311 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.283 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.452 | k star (bias corrected MLE) | 0.383 |
| Theta hat (MLE) | 30.56 | Theta star (bias corrected MLE) | 36.06 |
| nu hat (MLE) | 9.042 | nu star (bias corrected) | 7.663 |
| MLE Mean (bias corrected) | 13.82 | MLE Sd (bias corrected) | 22.32 |
| | | Approximate Chi Square Value (0.05) | 2.541 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 2.059 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 41.66 | 95% Adjusted Gamma UCL (use when n<50) | 51.43 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.843 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.191 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.261 | Mean of logged Data | 1.199 |
| Maximum of Logged Data | 4.7 | SD of logged Data | 1.463 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 72.11 | 90% Chebyshev (MVUE) UCL | 19.96 |
| 95% Chebyshev (MVUE) UCL | 25.33 | 97.5% Chebyshev (MVUE) UCL | 32.79 |
| 99% Chebyshev (MVUE) UCL | 47.45 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 31.45 | 95% Jackknife UCL | 33.47 |
| 95% Standard Bootstrap UCL | 30.44 | 95% Bootstrap-t UCL | 288 |
| 95% Hall's Bootstrap UCL | 152.9 | 95% Percentile Bootstrap UCL | 34.83 |
| 95% BCA Bootstrap UCL | 46.02 | | |
| 90% Chebyshev(Mean, Sd) UCL | 45.98 | 95% Chebyshev(Mean, Sd) UCL | 60.56 |
| 97.5% Chebyshev(Mean, Sd) UCL | 80.78 | 99% Chebyshev(Mean, Sd) UCL | 120.5 |

## Site 5 Subsurface Soil

### Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 60.56

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Iron (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 3800 | Mean | 16100 |
| Maximum | 46000 | Median | 8550 |
| SD | 14872 | Std. Error of Mean | 4703 |
| Coefficient of Variation | 0.924 | Skewness | 0.999 |

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.819 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.27 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 24721 | 95% Adjusted-CLT UCL (Chen-1995) | 25423 |
| | | 95% Modified-t UCL (Johnson-1978) | 24969 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.784 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.742 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.288 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.272 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 1.324 | k star (bias corrected MLE) | 0.993 |
| Theta hat (MLE) | 12160 | Theta star (bias corrected MLE) | 16206 |
| nu hat (MLE) | 26.48 | nu star (bias corrected) | 19.87 |
| MLE Mean (bias corrected) | 16100 | MLE Sd (bias corrected) | 16153 |
| | | Approximate Chi Square Value (0.05) | 10.76 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 9.61 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 29744 | 95% Adjusted Gamma UCL (use when n<50) | 33289 |

Site 5 Subsurface Soil

### Lognormal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.838 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.269 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level | |

Data Not Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | 8.243 | Mean of logged Data | 9.264 |
| Maximum of Logged Data | 10.74 | SD of logged Data | 0.986 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 47091 | 90% Chebyshev (MVUE) UCL | 31830 |
| 95% Chebyshev (MVUE) UCL | 38966 | 97.5% Chebyshev (MVUE) UCL | 48871 |
| 99% Chebyshev (MVUE) UCL | 68328 | | |

### Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 23836 | 95% Jackknife UCL | 24721 |
| 95% Standard Bootstrap UCL | 23677 | 95% Bootstrap-t UCL | 26954 |
| 95% Hall's Bootstrap UCL | 24210 | 95% Percentile Bootstrap UCL | 23800 |
| 95% BCA Bootstrap UCL | 24790 | | |
| 90% Chebyshev(Mean, Sd) UCL | 30209 | 95% Chebyshev(Mean, Sd) UCL | 36600 |
| 97.5% Chebyshev(Mean, Sd) UCL | 45470 | 99% Chebyshev(Mean, Sd) UCL | 62894 |

### Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 36600

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Site 5 Subsurface Soil

## UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.111/7/2019 11:15:26 AM |
| From File | UCLInput_bck at end_b.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Thallium (MG/KG)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.092 | Mean | 0.17 |
| Maximum | 0.31 | Median | 0.16 |
| SD | 0.0601 | Std. Error of Mean | 0.019 |
| Coefficient of Variation | 0.353 | Skewness | 1.368 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.902 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.171 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 0.205 | 95% Adjusted-CLT UCL (Chen-1995) | 0.21 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.206 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.239 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.725 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.123 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 10.02 | k star (bias corrected MLE) | 7.084 |
| Theta hat (MLE) | 0.017 | Theta star (bias corrected MLE) | 0.024 |
| nu hat (MLE) | 200.5 | nu star (bias corrected) | 141.7 |
| MLE Mean (bias corrected) | 0.17 | MLE Sd (bias corrected) | 0.0639 |
| | | Approximate Chi Square Value (0.05) | 115.2 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 111 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.209 | 95% Adjusted Gamma UCL (use when n<50) | 0.217 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.979 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.131 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.386 | Mean of logged Data | -1.821 |
| Maximum of Logged Data | -1.171 | SD of logged Data | 0.331 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.213 | 90% Chebyshev (MVUE) UCL | 0.224 |
| 95% Chebyshev (MVUE) UCL | 0.248 | 97.5% Chebyshev (MVUE) UCL | 0.282 |
| 99% Chebyshev (MVUE) UCL | 0.348 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.201 | 95% Jackknife UCL | 0.205 |
| 95% Standard Bootstrap UCL | 0.2 | 95% Bootstrap-t UCL | 0.219 |
| 95% Hall's Bootstrap UCL | 0.359 | 95% Percentile Bootstrap UCL | 0.202 |
| 95% BCA Bootstrap UCL | 0.208 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.227 | 95% Chebyshev(Mean, Sd) UCL | 0.253 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.289 | 99% Chebyshev(Mean, Sd) UCL | 0.359 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Student's-t UCL | 0.205 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

# Appendix F.4
# Site 7 Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 78-93-3 | 2-Butanone | 1.0E-03 J | 8.7E-03 J | MG/KG | CBD-S07-SS08-1012 | 9/9 | 0.00043 - 0.0007 | 8.7E-03 | N/A | 2.7E+03 N | 1.2E-01 | SSL | NO | BSL |
| | 591-78-6 | 2-Hexanone | 5.5E-04 J | 5.5E-04 J | MG/KG | CBD-S07-SS05-1012 | 1/9 | 0.00043 - 0.0007 | 5.5E-04 | N/A | 2.0E+01 N | 8.8E-04 | SSL | NO | BSL |
| | 67-64-1 | Acetone | 1.2E-02 J | 2.5E-01 J | MG/KG | CBD-S07-SS05-1012 | 9/9 | N/A | 2.5E-01 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | m&pXYLENE | m- and p-Xylene | 4.0E-04 J | 4.0E-04 J | MG/KG | CBD-S07-SS03-1012 | 1/9 | 0.00043 - 0.0007 | 4.0E-04 | N/A | 5.8E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 79-20-9 | Methyl acetate | 8.1E-03 | 8.1E-03 | MG/KG | CBD-S07-SS05-1012 | 1/9 | N/A | 8.1E-03 | N/A | 7.8E+03 N | 4.1E-01 | SSL | NO | BSL |
| | 95-47-6 | o-Xylene | 1.5E-04 J | 1.5E-04 J | MG/KG | CBD-S07-SS03-1012 | 1/9 | 0.00021 - 0.00035 | 1.5E-04 | N/A | 6.5E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 2.9E-03 | 2.9E-03 | MG/KG | CBD-S07-SS01-1012 | 1/9 | 0.00043 - 0.0007 | 2.9E-03 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 11097-69-1 | Aroclor-1254 | 5.0E-02 | 5.0E-02 | MG/KG | CBD-S07-SS07-1012, CBD-S07-SS08-1012 | 2/17 | 0.006 - 0.076 | 5.0E-02 | N/A | 1.2E-01 N | 2.0E-03 | SSL | NO | BSL |
| | **11096-82-5** | **Aroclor-1260** | **4.2E-03 J** | **9.4E-01** | **MG/KG** | **CBD-S07-SS01P-1012** | **11/17** | **0.006 - 0.076** | **9.4E-01** | **N/A** | **2.4E-01 C** | **5.5E-03** | **SSL** | **YES** | **ASL** |
| | 7429-90-5 | Aluminum | 2.6E+03 | 6.6E+03 | MG/KG | CBD-S07-SS01-1012, CBD-S07-SS03-1012, CBD-S07-SS21P-000H | 17/17 | N/A | 6.6E+03 | 1.3E+04 | 7.7E+03 N | 3.0E+03 | SSL | NO | BSL |
| | 7440-36-0 | Antimony | 6.3E-02 J | 4.0E-01 | MG/KG | CBD-S07-SS07-1012 | 12/17 | 0.13 - 0.19 | 4.0E-01 | 4.2E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **1.3E+00** | **3.5E+00** | **MG/KG** | **CBD-S07-SS07-1012, CBD-S07-SS27-000H** | **17/17** | **N/A** | **3.5E+00** | **6.4E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 6.4E+00 | 3.3E+01 | MG/KG | CBD-S07-SS07-1012 | 17/17 | N/A | 3.3E+01 | 5.8E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.5E-01 | 4.7E-01 J | MG/KG | CBD-S07-SS21P-000H | 17/17 | N/A | 4.7E-01 | 8.1E-01 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 2.4E-02 J | 5.2E-01 | MG/KG | CBD-S07-SS07-1012 | 13/17 | 0.13 - 0.19 | 5.2E-01 | 1.7E+00 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 1.5E+02 | 4.0E+05 | MG/KG | CBD-S07-SS26-000H | 17/17 | N/A | 4.0E+05 | 9.4E+03 | N/A | N/A | | NO | NUT |
| | **18540-29-9** | **Chromium (hexavalent)** | **3.0E-01 J** | **3.0E-01 J** | **MG/KG** | **CBD-S07-SS01P-1012** | **1/1** | **N/A** | **3.0E-01** | **4.0E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |
| | 7440-47-3 | Chromium | 5.0E+00 | 2.6E+01 | MG/KG | CBD-S07-SS20-000H | 17/17 | N/A | 2.6E+01 | 3.1E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **9.3E-01** | **2.8E+00** | **MG/KG** | **CBD-S07-SS21P-000H** | **17/17** | **N/A** | **2.8E+00** | **1.2E+01** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 2.2E+00 | 1.5E+01 J | MG/KG | CBD-S07-SS21-000H | 17/17 | N/A | 1.5E+01 | 2.7E+01 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 57-12-5 | Cyanide | 2.7E-02 J | 3.2E-01 | MG/KG | CBD-S07-SS07-1012 | 5/9 | 0.053 - 0.058 | 3.2E-01 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **3.9E+03** | **1.5E+04** | **MG/KG** | **CBD-S07-SS07-1012** | **17/17** | **N/A** | **1.5E+04** | **4.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 2.7E+00 | 8.2E+01 | MG/KG | CBD-S07-SS20-000H | 17/17 | N/A | 8.2E+01 | 5.0E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 2.1E+02 | 6.3E+05 | MG/KG | CBD-S07-SS26-000H | 17/17 | N/A | 6.3E+05 | 3.8E+03 | N/A | N/A | | NO | NUT |
| | 7439-96-5 | Manganese | 1.6E+01 | 1.3E+02 | MG/KG | CBD-S07-SS07-1012 | 17/17 | N/A | 1.3E+02 | 2.0E+02 | 1.8E+02 N | 2.8E+00 | SSL | NO | BSL |
| | 7439-97-6 | Mercury | 6.2E-03 J | 4.7E-02 J | MG/KG | CBD-S07-SS07-1012 | 8/17 | 0.017 - 0.19 | 4.7E-02 | 1.9E-01 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 1.2E+00 | 2.4E+01 | MG/KG | CBD-S07-SS27-000H | 17/17 | N/A | 2.4E+01 | 1.2E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 2.4E+02 | 4.3E+05 | MG/KG | CBD-S07-SS26-000H | 17/17 | N/A | 4.3E+05 | 1.5E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 3.4E-01 | 1.0E+00 | MG/KG | S07-SS27-000H | 9/17 | N/A | 1.0E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 1.9E-02 J | 1.4E-01 J | MG/KG | CBD-S07-SS20-000H | 11/17 | 0.13 - 0.19 | 1.4E-01 | 1.4E+00 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 8.8E+00 J+ | 4.9E+03 | MG/KG | CBD-S07-SS26-000H | 7/17 | 5.9 - 25 | 4.9E+03 | 3.1E+02 | N/A | N/A | | NO | NUT |

## Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 7

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **7440-28-0** | **Thallium** | **4.2E-02 J** | **2.4E-01 J** | **MG/KG** | **CBD-S07-SS21P-000H** | **15/17** | **0.13 - 0.19** | **2.4E-01** | **1.3E+00** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | **7440-62-2** | **Vanadium** | **6.9E+00** | **1.2E+02** | **MG/KG** | **CBD-S07-SS27-000H** | **17/17** | **N/A** | **1.2E+02** | **3.0E+01** | **3.9E+01 N** | **8.6E+00** | **SSL** | **YES** | **ASL** |
| | 7440-66-6 | Zinc | 5.3E+00 | 2.6E+02 | MG/KG | CBD-S07-SS07-1012 | 17/17 | N/A | 2.6E+02 | 7.9E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.1a. Step 2 Surface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| **Step 1 COPC** | **Detection Frequency** | **Maximum Detected Concentration (Qualifier) MG/KG** | **Sample Location of Maximum Detected Concentration** | **Noncarcinogenic Residential Soil RSL HQ=1** | **Carcinogenic Residential Soil RSL ELCR = 1E-06** | **Hazard Index[a]** | **Cancer Risk[b]** | **Target Organ** |
|---|---|---|---|---|---|---|---|---|
| Aroclor-1260 | 11 / 17 | 9.4E-01 | CBD-S07-SS01P-1012 | N/A | 2.4E-01 | N/A | 4E-06 | N/A |
| Arsenic | 17 / 17 | 3.5E+00 | CBD-S07-SS07-1012, CBD-S07-SS27-000H | 3.5E+01 | 6.8E-01 | 0.1 | 5E-06 | Cardiovascular, Dermal |
| Chromium (hexavalent) | 1 / 1 | 3.0E-01 J | CBD-S07-SS01P-1012 | 2.3E+02 | 3.0E-01 | 0.001 | 1E-06 | None Reported, Respiratory |
| Cobalt | 17 / 17 | 2.8E+00 | CBD-S07-SS21P-000H | 2.3E+01 | 4.2E+02 | 0.1 | 7E-09 | Thyroid, Respiratory |
| Iron | 17 / 17 | 1.5E+04 | CBD-S07-SS07-1012 | 5.5E+04 | N/A | 0.3 | N/A | Gastrointestinal |
| Thallium | 15 / 17 | 2.4E-01 J | CBD-S07-SS21P-000H | 7.8E-01 | N/A | 0.3 | N/A | Dermal |
| Vanadium | 17 / 17 | 1.2E+02 | CBD-S07-SS27-000H | 3.9E+02 | N/A | 0.3 | N/A | Hair |
| **Cumulative Hazard Index[c]** | | | | | | **1** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Cardiovascular HI = | 0.3 |
| Total Dermal HI = | 0.4 |
| Total Respiratory HI = | 0.1 |
| Total Thyroid HI = | 0.1 |
| Total Gastrointestinal HI = | 0.3 |
| Total Hair HI = | 0.3 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (2-8 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 78-93-3 | 2-Butanone | 1.1E-03 J | 4.1E-03 J | MG/KG | CBD-S07-SB09-0608 | 4/19 | 0.0004 - 0.00075 | 4.1E-03 | N/A | 2.7E+03 N | 1.2E-01 | SSL | NO | BSL |
|  | 591-78-6 | 2-Hexanone | 6.9E-04 J | 6.9E-04 J | MG/KG | CBD-S07-SB15-0204 | 1/19 | 0.0004 - 0.00075 | 6.9E-04 | N/A | 2.0E+01 N | 8.8E-04 | SSL | NO | BSL |
|  | 67-64-1 | Acetone | 2.4E-02 J | 8.8E-02 J | MG/KG | CBD-S07-SB09-0608 | 4/19 | 0.004 - 0.0075 | 8.8E-02 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
|  | 71-43-2 | Benzene | 2.0E-04 J | 1.7E-01 J | MG/KG | CBD-S07-SB01-0608 | 4/19 | 0.0004 - 0.00075 | 1.7E-01 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
|  | 74-83-9 | Bromomethane | 3.9E-04 J | 1.2E-03 J | MG/KG | CBD-S07-SB15-0204 | 3/19 | 0.0004 - 0.00075 | 1.2E-03 | N/A | 6.8E-01 N | 1.9E-04 | SSL | NO | BSL |
|  | 75-15-0 | Carbon disulfide | 2.5E-04 J | 2.5E-04 J | MG/KG | CBD-S07-SB19-0204 | 1/19 | 0.0004 - 0.00075 | 2.5E-04 | N/A | 7.7E+01 N | 2.4E-02 | SSL | NO | BSL |
|  | 110-82-7 | Cyclohexane | 1.3E-04 J | 5.7E-01 J | MG/KG | CBD-S07-SB01-0608 | 3/19 | 0.0004 - 0.00075 | 5.7E-01 | N/A | 1.2E+02 SAT | 1.3E+00 | SSL | NO | BSL |
|  | 100-41-4 | Ethylbenzene | 1.8E-02 J | 5.2E-01 | MG/KG | CBD-S07-SB03-0608 | 3/19 | 0.0004 - 0.00075 | 5.2E-01 | N/A | 5.8E+00 C | 1.7E-03 | SSL | NO | BSL |
|  | 98-82-8 | Isopropylbenzene | 1.6E-01 J | 4.1E-01 | MG/KG | CBD-S07-SB03-0608 | 3/19 | 0.0002 - 0.00037 | 4.1E-01 | N/A | 1.9E+02 N | 7.4E-02 | SSL | NO | BSL |
|  | m&pXYLENE | m- and p-Xylene | 7.3E-02 J | 2.5E+00 | MG/KG | CBD-S07-SB03-0608 | 3/19 | 0.0004 - 0.00075 | 2.5E+00 | N/A | 5.8E+01 N | 1.9E-02 | SSL | NO | BSL |
|  | 79-20-9 | Methyl acetate | 9.5E-03 | 2.0E-02 J | MG/KG | CBD-S07-SB01-0608 | 2/19 | 0.0004 - 0.00075 | 2.0E-02 | N/A | 7.8E+03 N | 4.1E-01 | SSL | NO | BSL |
|  | 108-87-2 | Methylcyclohexane | 1.5E-04 J | 1.2E+00 | MG/KG | CBD-S07-SB02-0507 | 6/19 | 0.0004 - 0.00075 | 1.2E+00 | N/A | 6.1E+01 N | N/A |  | NO | BSL |
|  | 95-47-6 | o-Xylene | 4.1E-02 J | 6.6E-01 | MG/KG | CBD-S07-SB03-0608 | 3/19 | 0.0002 - 0.00037 | 6.6E-01 | N/A | 6.5E+01 N | 1.9E-02 | SSL | NO | BSL |
|  | 108-88-3 | Toluene | 4.3E-03 | 4.0E-02 | MG/KG | CBD-S07-SB03-0608 | 2/19 | 0.0004 - 0.00075 | 4.0E-02 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
|  | 11096-82-5 | Aroclor-1260 | 4.6E-03 J | 8.5E-02 | MG/KG | CBD-S07-SB01-0608 | 4/27 | 0.0063 - 0.023 | 8.5E-02 | N/A | 2.4E-01 C | 5.5E-03 | SSL | NO | BSL |
|  | **7429-90-5** | **Aluminum** | **1.6E+03** | **1.0E+04** | **MG/KG** | **CBD-S07-SB07-0608, CBD-S07-SB08-0608** | **27/27** | **N/A** | **1.0E+04** | **1.6E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
|  | 7440-36-0 | Antimony | 6.0E-02 J | 2.1E-01 | MG/KG | CBD-S07-SB08-0608 | 22/27 | 0.13 - 0.19 | 2.1E-01 | 5.5E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
|  | **7440-38-2** | **Arsenic** | **1.0E+00** | **5.5E+00 J** | **MG/KG** | **CBD-S07-SB09-0608, CBD-S07-SB25-0508** | **26/27** | **N/A** | **5.5E+00** | **9.8E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
|  | 7440-39-3 | Barium | 6.5E+00 | 5.1E+01 | MG/KG | CBD-S07-SB27-0508 | 27/27 | N/A | 5.1E+01 | 5.7E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
|  | 7440-41-7 | Beryllium | 1.3E-01 | 1.3E+00 | MG/KG | CBD-S07-SB21-0508 | 27/27 | N/A | 1.3E+00 | 1.2E+00 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
|  | 7440-43-9 | Cadmium | 7.2E-03 J | 7.1E-01 | MG/KG | CBD-S07-SB01P-0608 | 24/27 | 0.13 - 0.19 | 7.1E-01 | 8.1E-01 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
|  | 7440-70-2 | Calcium | 1.2E+02 | 5.3E+05 | MG/KG | CBD-S07-SB26-0508 | 27/27 | N/A | 5.3E+05 | 1.4E+03 | N/A | N/A |  | NO | NUT |
|  | **18540-29-9** | **Chromium (hexavalent)** | **3.1E-01 J** | **3.1E-01 J** | **MG/KG** | **CBD-S07-SB01P-0608** | **1/1** | **N/A** | **3.1E-01** | **4.9E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |
|  | 7440-47-3 | Chromium | 2.4E+00 | 4.1E+01 | MG/KG | CBD-S07-SB09-0608 | 27/27 | N/A | 4.1E+01 | 5.8E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
|  | **7440-48-4** | **Cobalt** | **3.5E-01** | **5.2E+00** | **MG/KG** | **CBD-S07-SB01P-0608** | **27/27** | **N/A** | **5.2E+00** | **5.9E+00** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
|  | 7440-50-8 | Copper | 1.2E+00 | 2.5E+01 J | MG/KG | CBD-S07-SB23-0508 | 27/27 | N/A | 2.5E+01 | 7.9E+00 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
|  | 57-12-5 | Cyanide | 4.0E-02 J | 6.5E-02 J | MG/KG | CBD-S07-SB09-0608 | 3/19 | 0.049 - 0.072 | 6.5E-02 | N/A | 2.3E+00 N | 1.5E-03 | SSL | NO | BSL |
|  | **7439-89-6** | **Iron** | **3.3E+03** | **2.3E+04** | **MG/KG** | **CBD-S07-SB21-0508** | **27/27** | **N/A** | **2.3E+04** | **3.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
|  | 7439-92-1 | Lead | 2.0E+00 | 2.1E+01 | MG/KG | CBD-S07-SB23-0508 | 27/27 | N/A | 2.1E+01 | 1.2E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
|  | 7439-95-4 | Magnesium | 1.6E+02 | 6.4E+05 | MG/KG | CBD-S07-SB25-0508 | 27/27 | N/A | 6.4E+05 | 3.4E+03 | N/A | N/A |  | NO | NUT |
|  | **7439-96-5** | **Manganese** | **7.5E+00** | **2.5E+02** | **MG/KG** | **CBD-S07-SB09-0608** | **27/27** | **N/A** | **2.5E+02** | **2.3E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
|  | 7439-97-6 | Mercury | 6.7E-03 J | 2.8E-02 J | MG/KG | CBD-S07-SB08-0608 | 9/27 | 0.13 - 0.19 | 2.8E-02 | 4.0E-02 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
|  | 7440-02-0 | Nickel | 6.6E-01 | 2.0E+01 K | MG/KG | CBD-S07-SB01-0608 | 27/27 | N/A | 2.0E+01 | 1.3E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
|  | 7440-09-7 | Potassium | 2.0E+02 | 4.0E+05 | MG/KG | CBD-S07-SB24-0508 | 27/27 | N/A | 4.0E+05 | 1.6E+03 | N/A | N/A |  | NO | NUT |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (2-8 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7782-49-2 | Selenium | 1.3E-01 | 1.7E+00 | MG/KG | CBD-S07-SB27-0508 | 17/27 | N/A | 1.7E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 1.5E-02 J | 1.6E-01 J | MG/KG | CBD-S07-SB23-0508 | 18/27 | 0.01 - 0.19 | 1.6E-01 | 2.3E-01 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.4E+01 J+ | 6.6E+03 | MG/KG | CBD-S07-SB24-0508 | 22/27 | 7.2 - 25 | 6.6E+03 | 1.4E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **2.7E-02 J** | **5.8E-01** | **MG/KG** | **CBD-S07-SB21-0508** | **27/27** | **N/A** | **5.8E-01** | **4.1E-01** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 1.3E+00 | 2.1E+01 | MG/KG | CBD-S07-SB14-0204, CBD-S07-SB21-0508 | 27/27 | N/A | 2.1E+01 | 3.6E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 3.7E+00 | 1.9E+02 | MG/KG | CBD-S07-SB01P-0608 | 16/27 | N/A | 1.9E+02 | 6.4E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for n-hexane used as surrogate for methylcyclohexane.
RSL value for chromium(III) used for chromium since one soil sample was also analyzed for chromium (hexavalentl).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
K, J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable
SAT = soil saturation concentration less than residential soil RSL, therefor soil saturation concentration used as screening level.

**Table 2.2a. Step 2 Subsurface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (MG/KG) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 27 / 27 | 1.0E+04 | CBD-S07-SB07-0608, CBD-S07-SB08-0608 | 7.70E+04 | N/A | 0.1 | N/A | Neurological |
| **Arsenic** | **26 / 27** | **5.5E+00 J** | **CBD-S07-SB09-0608, CBD-S07-SB25-0508** | **3.50E+01** | **6.80E-01** | **0.2** | **8E-06** | **Cardiovascular, Dermal** |
| Chromium (hexavalent) | 1 / 1 | 3.1E-01 J | CBD-S07-SB01P-0608 | 2.30E+02 | 3.00E-01 | 0.001 | 1E-06 | None Reported, Respiratory |
| Cobalt | 27 / 27 | 5.2E+00 | CBD-S07-SB01P-0608 | 2.30E+01 | N/A | 0.2 | N/A | Thyroid, Respiratory |
| Iron | 27 / 27 | 2.3E+04 | CBD-S07-SB21-0508 | 5.50E+04 | N/A | 0.4 | N/A | Gastrointestinal |
| Manganese | 27 / 27 | 2.5E+02 | CBD-S07-SB09-0608 | 1.80E+03 | N/A | 0.1 | N/A | Nervous |
| **Thallium** | **27 / 27** | **5.8E-01** | **CBD-S07-SB21-0508** | **7.80E-01** | **N/A** | **0.7** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **2** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **9E-06** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.3 |
| Total Cardiovascular HI = | 0.2 |
| Total Dermal HI = | 0.9 |
| Total Respiratory HI = | 0.2 |
| Total Thyroid HI = | 0.2 |
| Total Gastrointestinal HI = | 0.4 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern

ELCR = Excess Lifetime Cancer Risk

HI = Hazard Index

HQ = Hazard Quotient

MG/KG = milligrams per kilogram

MDE = Maryland Department of the Environment

N/A = Not available/not applicable

RSL = Regional Screening Levels, November 2019

USEPA = US Environmental Protection Agency

**Table 2.2b. Step 3 Subsurface Soil Screening - Risk Ratio, 95% UCL, Site 7**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-06 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 27 / 27 | 3.2E+00 | 95% KM (t) UCL | 1 | 3.5E+01 | 6.8E-01 | 0.09 | 5E-06 | Cardiovascular, Dermal |
| Thallium | 26 / 27 | 2.2E-01 | 95% Adjusted Gamma UCL | 1, 3 | 7.8E-01 | N/A | 0.3 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **0.4** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **5E-06** | |
| | | | | | | | | Total Dermal HI = | 0.4 |

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.
Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 3 COPCs bas MDE = Maryland Department of the Environment

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. November, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).
(5) Recommended 95% UCL exceeds maximum detected concentration.

**Site 7 Subsurface Soil**

## UCL Statistics for Data Sets with Non-Detects

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.11/7/2019 7:38:30 PM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Thallium (MG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 27 | Number of Distinct Observations | 21 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.027 | Mean | 0.177 |
| Maximum | 0.58 | Median | 0.14 |
| SD | 0.124 | Std. Error of Mean | 0.0238 |
| Coefficient of Variation | 0.698 | Skewness | 1.918 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.808 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.211 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Data Not Normal at 5% Significance Level |

**Data Not Normal at 5% Significance Level**

#### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.218 | 95% Adjusted-CLT UCL (Chen-1995) | 0.226 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.219 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.561 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.753 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.128 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.17 | Detected data appear Gamma Distributed at 5% Significance Level |

**Detected data appear Gamma Distributed at 5% Significance Level**

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 2.708 | k star (bias corrected MLE) | 2.432 |
| Theta hat (MLE) | 0.0655 | Theta star (bias corrected MLE) | 0.0729 |
| nu hat (MLE) | 146.2 | nu star (bias corrected) | 131.3 |
| MLE Mean (bias corrected) | 0.177 | MLE Sd (bias corrected) | 0.114 |
| | | Approximate Chi Square Value (0.05) | 105.8 |
| Adjusted Level of Significance | 0.0401 | Adjusted Chi Square Value | 104.4 |

#### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50) | 0.22 | 95% Adjusted Gamma UCL (use when n<50) | 0.223 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.969 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.923 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.12 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.167 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -3.612 | Mean of logged Data | -1.925 |
| Maximum of Logged Data | -0.545 | SD of logged Data | 0.644 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.234 | 90% Chebyshev (MVUE) UCL | 0.248 |
| 95% Chebyshev (MVUE) UCL | 0.28 | 97.5% Chebyshev (MVUE) UCL | 0.325 |
| 99% Chebyshev (MVUE) UCL | 0.412 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.217 | 95% Jackknife UCL | 0.218 |
| 95% Standard Bootstrap UCL | 0.215 | 95% Bootstrap-t UCL | 0.242 |
| 95% Hall's Bootstrap UCL | 0.255 | 95% Percentile Bootstrap UCL | 0.217 |
| 95% BCA Bootstrap UCL | 0.228 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.249 | 95% Chebyshev(Mean, Sd) UCL | 0.281 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.326 | 99% Chebyshev(Mean, Sd) UCL | 0.414 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Adjusted Gamma UCL | 0.223 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Site 7 Subsurface Soil**

## UCL Statistics for Data Sets with Non-Detects

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.111/7/2019 10:20:02 AM |
| From File | UCLInput_b.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Arsenic (MG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 27 | Number of Distinct Observations | 25 |
| Number of Detects | 26 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 24 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 1 | Minimum Non-Detect | 0.31 |
| Maximum Detect | 5.5 | Maximum Non-Detect | 0.31 |
| Variance Detects | 1.658 | Percent Non-Detects | 3.704% |
| Mean Detects | 2.896 | SD Detects | 1.288 |
| Median Detects | 2.85 | CV Detects | 0.445 |
| Skewness Detects | 0.427 | Kurtosis Detects | -0.546 |
| Mean of Logged Detects | 0.959 | SD of Logged Detects | 0.483 |

#### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.957 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.92 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.0902 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.17 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

#### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 2.8 | KM Standard Error of Mean | 0.261 |
| KM SD | 1.332 | 95% KM (BCA) UCL | 3.189 |
| 95% KM (t) UCL | 3.246 | 95% KM (Percentile Bootstrap) UCL | 3.219 |
| 95% KM (z) UCL | 3.23 | 95% KM Bootstrap t UCL | 3.275 |
| 90% KM Chebyshev UCL | 3.585 | 95% KM Chebyshev UCL | 3.94 |
| 97.5% KM Chebyshev UCL | 4.433 | 99% KM Chebyshev UCL | 5.401 |

#### Gamma GOF Tests on Detected Observations Only

| | | |
|---|---|---|
| A-D Test Statistic | 0.208 | **Anderson-Darling GOF Test** |
| 5% A-D Critical Value | 0.746 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.082 | **Kolmogorov-Smirnov GOF** |
| 5% K-S Critical Value | 0.172 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

#### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.945 | k star (bias corrected MLE) | 4.4 |
| Theta hat (MLE) | 0.586 | Theta star (bias corrected MLE) | 0.658 |
| nu hat (MLE) | 257.1 | nu star (bias corrected) | 228.8 |
| Mean (detects) | 2.896 | | |

## Site 7 Subsurface Soil

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.552 | Mean | 2.809 |
| Maximum | 5.5 | Median | 2.8 |
| SD | 1.341 | CV | 0.477 |
| k hat (MLE) | 3.958 | k star (bias corrected MLE) | 3.543 |
| Theta hat (MLE) | 0.71 | Theta star (bias corrected MLE) | 0.793 |
| nu hat (MLE) | 213.7 | nu star (bias corrected) | 191.3 |
| Adjusted Level of Significance (β) | 0.0401 | | |
| Approximate Chi Square Value (191.33, α) | 160.3 | Adjusted Chi Square Value (191.33, β) | 158.5 |
| 95% Gamma Approximate UCL (use when n>=50) | 3.353 | 95% Gamma Adjusted UCL (use when n<50) | 3.391 |

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 2.8 | SD (KM) | 1.332 |
| Variance (KM) | 1.774 | SE of Mean (KM) | 0.261 |
| k hat (KM) | 4.421 | k star (KM) | 3.955 |
| nu hat (KM) | 238.7 | nu star (KM) | 213.6 |
| theta hat (KM) | 0.633 | theta star (KM) | 0.708 |
| 80% gamma percentile (KM) | 3.866 | 90% gamma percentile (KM) | 4.688 |
| 95% gamma percentile (KM) | 5.445 | 99% gamma percentile (KM) | 7.062 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (213.56, α) | 180.7 | Adjusted Chi Square Value (213.56, β) | 178.8 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 3.309 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3.345 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.961 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.92 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.113 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.17 | Detected Data appear Lognormal at 5% Significance Level |

**Detected Data appear Lognormal at 5% Significance Level**

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 2.818 | Mean in Log Scale | 0.914 |
| SD in Original Scale | 1.327 | SD in Log Scale | 0.527 |
| 95% t UCL (assumes normality of ROS data) | 3.253 | 95% Percentile Bootstrap UCL | 3.237 |
| 95% BCA Bootstrap UCL | 3.258 | 95% Bootstrap t UCL | 3.29 |
| 95% H-UCL (Log ROS) | 3.523 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | 0.88 | KM Geo Mean | 2.411 |
| KM SD (logged) | 0.615 | 95% Critical H Value (KM-Log) | 2.076 |
| KM Standard Error of Mean (logged) | 0.121 | 95% H-UCL (KM -Log) | 3.74 |
| KM SD (logged) | 0.615 | 95% Critical H Value (KM-Log) | 2.076 |
| KM Standard Error of Mean (logged) | 0.121 | | |

Site 7 Subsurface Soil

### DL/2 Statistics

| DL/2 Normal | | DL/2 Log-Transformed | |
|---|---|---|---|
| Mean in Original Scale | 2.795 | Mean in Log Scale | 0.854 |
| SD in Original Scale | 1.368 | SD in Log Scale | 0.721 |
| 95% t UCL (Assumes normality) | 3.244 | 95% H-Stat UCL | 4.147 |

**DL/2 is not a recommended method, provided for comparisons and historical reasons**

### Nonparametric Distribution Free UCL Statistics

**Detected Data appear Normal Distributed at 5% Significance Level**

### Suggested UCL to Use

95% KM (t) UCL 3.246

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

# Appendix F.5
# Site 9 Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0 - 0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Surface Soil | 78-93-3 | 2-Butanone | 4.0E-03 J | 8.1E-03 J | MG/KG | CBD-S09-SS01-1012, CBD-S09-SS04-1012 | 4/4 | 0.00047 - 0.00066 | 8.1E-03 | N/A | 2.7E+03 N | 1.2E-01 | SSL | NO | BSL |
| | 591-78-6 | 2-Hexanone | 7.4E-03 L | 7.4E-03 L | MG/KG | CBD-S09-SS01-1012 | 1/4 | 0.00047 - 0.00066 | 7.4E-03 | N/A | 2.0E+01 N | 8.8E-04 | SSL | NO | BSL |
| | 67-64-1 | Acetone | 3.5E-02 | 6.7E-02 | MG/KG | CBD-S09-SS04-1012 | 4/4 | N/A | 6.7E-02 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 71-43-2 | Benzene | 2.1E-04 J | 4.3E-03 | MG/KG | CBD-S09-SS04-1012 | 2/4 | 0.00047 - 0.00066 | 4.3E-03 | N/A | 1.2E+00 C | 2.3E-04 | SSL | NO | BSL |
| | 75-15-0 | Carbon disulfide | 1.1E-03 J | 8.4E-03 J | MG/KG | CBD-S09-SS03-1012 | 2/4 | 0.00047 - 0.00066 | 8.4E-03 | N/A | 7.7E+01 N | 2.4E-02 | SSL | NO | BSL |
| | 110-82-7 | Cyclohexane | 3.4E-03 J | 3.4E-03 J | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00047 - 0.00066 | 3.4E-03 | N/A | 1.2E+02 SAT | 1.3E+00 | SSL | NO | BSL |
| | 100-41-4 | Ethylbenzene | 1.7E-03 | 1.7E-03 | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00047 - 0.00066 | 1.7E-03 | N/A | 5.8E+00 C | 1.7E-03 | SSL | NO | BSL |
| | 98-82-8 | Isopropylbenzene | 1.1E-03 J | 1.1E-03 J | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00023 - 0.00033 | 1.1E-03 | N/A | 1.9E+02 N | 7.4E-02 | SSL | NO | BSL |
| | m&pXYLENE | m- and p-Xylene | 4.3E-03 | 4.3E-03 | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00047 - 0.00066 | 4.3E-03 | N/A | 5.8E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 108-87-2 | Methylcyclohexane | 6.5E-03 J | 6.5E-03 J | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00047 - 0.00066 | 6.5E-03 | N/A | 6.1E+01 N | N/A | | NO | BSL |
| | 95-47-6 | o-Xylene | 2.9E-03 | 2.9E-03 | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00023 - 0.00033 | 2.9E-03 | N/A | 6.5E+01 N | 1.9E-02 | SSL | NO | BSL |
| | 100-42-5 | Styrene | 1.8E-03 | 1.8E-03 | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00023 - 0.00033 | 1.8E-03 | N/A | 6.0E+02 N | 1.3E-01 | SSL | NO | BSL |
| | 108-88-3 | Toluene | 8.6E-03 | 8.6E-03 | MG/KG | CBD-S09-SS04-1012 | 1/4 | 0.00047 - 0.00066 | 8.6E-03 | N/A | 4.9E+02 N | 7.6E-02 | SSL | NO | BSL |
| | 83-32-9 | Acenaphthene | 6.0E-04 J | 6.0E-04 J | MG/KG | CBD-S09-SS08-000H | 1/10 | 0.0011 - 0.045 | 6.0E-04 | N/A | 3.6E+02 N | 5.5E-01 | SSL | NO | BSL |
| | 208-96-8 | Acenaphthylene | 1.1E-03 J | 3.6E-03 J | MG/KG | CBD-S09-SS07-000H | 3/10 | 0.0011 - 0.045 | 3.6E-03 | N/A | 3.6E+02 N | N/A | | NO | BSL |
| | 120-12-7 | Anthracene | 2.0E-03 J | 1.2E-02 J | MG/KG | CBD-S09-SS04-1012 | 4/10 | 0.0035 - 0.18 | 1.2E-02 | N/A | 1.8E+03 N | 5.8E+00 | SSL | NO | BSL |
| | 56-55-3 | Benzo(a)anthracene | 1.0E-02 J | 1.5E-01 J | MG/KG | CBD-S09-SS04-1012 | 4/10 | 0.0035 - 0.18 | 1.5E-01 | N/A | 1.1E+00 C | 1.1E-02 | SSL | NO | BSL |
| | 50-32-8 | Benzo(a)pyrene | 1.8E-03 J | 4.6E-02 J | MG/KG | CBD-S09-SS04-1012 | 7/10 | 0.014 - 0.18 | 4.6E-02 | N/A | 1.1E-01 C | 2.9E-02 | SSL | NO | BSL |
| | 205-99-2 | Benzo(b)fluoranthene | 1.6E-02 J | 3.7E-01 J | MG/KG | CBD-S09-SS04-1012 | 4/10 | 0.0071 - 0.28 | 3.7E-01 | N/A | 1.1E+00 C | 3.0E-01 | SSL | NO | BSL |
| | 191-24-2 | Benzo(g,h,i)perylene | 1.4E-02 J | 9.1E-02 J | MG/KG | CBD-S09-SS04-1012 | 5/10 | 0.0035 - 0.280 | 9.1E-02 | N/A | 1.8E+02 N | N/A | | NO | BSL |
| | 207-08-9 | Benzo(k)fluoranthene | 9.1E-02 J | 9.1E-02 J | MG/KG | CBD-S09-SS04-1012 | 1/10 | 0.0071 - 0.18 | 9.1E-02 | N/A | 1.1E+01 C | 2.9E+00 | SSL | NO | BSL |
| | 117-81-7 | bis(2-Ethylhexyl)phthalate | 1.2E-02 J | 9.1E-02 J | MG/KG | CBD-S09-SS04-1012 | 3/10 | 0.036 - 0.804 | 9.1E-02 | N/A | 3.9E+01 C | 1.3E+00 | SSL | NO | BSL |
| | 218-01-9 | Chrysene | 1.2E-02 | 1.7E-01 J | MG/KG | CBD-S09-SS04-1012 | 2/10 | 0.0036 - 0.18 | 1.7E-01 | N/A | 1.1E+02 C | 9.0E+00 | SSL | NO | BSL |
| | 53-70-3 | Dibenz(a,h)anthracene | 3.1E-03 J | 3.1E-03 J | MG/KG | CBD-S09-SS08-000H | 1/10 | 0.0071 - 0.28 | 3.1E-03 | N/A | 1.1E-01 C | 9.6E-02 | SSL | NO | BSL |
| | 206-44-0 | Fluoranthene | 3.6E-03 J | 2.1E-01 | MG/KG | CBD-S09-SS04-1012 | 5/10 | 0.0035 - 0.18 | 2.1E-01 | N/A | 2.4E+02 N | 8.9E+00 | SSL | NO | BSL |
| | 193-39-5 | Indeno(1,2,3-cd)pyrene | 1.6E-02 J | 8.8E-02 J | MG/KG | CBD-S09-SS04-1012 | 4/10 | 0.0071 - 0.28 | 8.8E-02 | N/A | 1.1E+00 C | 9.8E-01 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 2.1E-03 J | 1.3E-01 | MG/KG | CBD-S09-SS04-1012 | 6/10 | 0.0035 - 0.280 | 1.3E-01 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | 129-00-0 | Pyrene | 5.7E-03 J | 3.2E-01 J | MG/KG | CBD-S09-SS04-1012 | 8/10 | 0.0071 - 0.28 | 3.2E-01 | N/A | 1.8E+02 N | 1.3E+00 | SSL | NO | BSL |
| | **7429-90-5** | **Aluminum** | **2.6E+03** | **8.1E+03** | **MG/KG** | **CBD-S09-SS06-000H** | **10/10** | **N/A** | **8.1E+03** | **1.3E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 9.8E-02 J | 8.8E-01 | MG/KG | CBD-S09-SS03-1012 | 5/10 | 0.14 - 0.17 | 8.8E-01 | 4.2E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **6.2E-01** | **3.0E+00** | **MG/KG** | **CBD-S09-SS08-000H** | **10/10** | **N/A** | **3.0E+00** | **6.4E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 8.9E+00 | 6.0E+01 J | MG/KG | CBD-S09-SS06-000H | 10/10 | N/A | 6.0E+01 | 5.8E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.7E-01 J | 5.0E-01 J | MG/KG | CBD-S09-SS06-000H | 8/10 | 0.27 - 0.35 | 5.0E-01 | 8.1E-01 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 3.0E-02 J | 3.4E-01 | MG/KG | CBD-S09-SS06-000H | 9/10 | 0.14 - 0.17 | 3.4E-01 | 1.7E+00 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 9.0E+02 | 7.9E+03 | MG/KG | CBD-S09-SS04-1012 | 10/10 | N/A | 7.9E+03 | 9.4E+03 | N/A | N/A | | NO | NUT |
| | **18540-29-9** | **Chromium (hexavalent)** | **1.5E-01 J** | **1.1E+00** | **MG/KG** | **CBD-S09-SS04-1012** | **4/4** | **N/A** | **1.1E+00** | **4.0E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0 - 0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7440-47-3 | Chromium | 7.8E+00 | 2.0E+01 | MG/KG | CBD-S09-SS06-000H, CBD-S09-SS08-000H | 10/10 | N/A | 2.0E+01 | 3.1E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **6.4E-01** | **6.1E+00** | **MG/KG** | **CBD-S09-SS06-000H** | **10/10** | **N/A** | **6.1E+00** | **1.2E+01** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.8E+00 | 1.6E+01 | MG/KG | CBD-S09-SS08-000H | 10/10 | N/A | 1.6E+01 | 2.7E+01 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **3.2E+03** | **1.6E+04** | **MG/KG** | **CBD-S09-SS08-000H** | **10/10** | **N/A** | **1.6E+04** | **4.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 1.9E+00 | 3.7E+01 | MG/KG | CBD-S09-SS05-000H | 10/10 | N/A | 3.7E+01 | 5.0E+01 | 4.0E+02 L* | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 6.1E+02 | 3.0E+03 | MG/KG | CBD-S09-SS06-000H | 10/10 | N/A | 3.0E+03 | 3.8E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **1.5E+01 J** | **2.3E+02** | **MG/KG** | **CBD-S09-SS06-000H** | **10/10** | **N/A** | **2.3E+02** | **2.0E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7439-97-6 | Mercury | 1.2E-02 J | 1.4E-01 J | MG/KG | CBD-S09-SS06-000H | 5/10 | 0.14 - 0.17 | 1.4E-01 | 1.9E-01 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 1.1E+00 J | 2.3E+01 | MG/KG | CBD-S09-SS08-000H | 10/10 | N/A | 2.3E+01 | 1.2E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 2.3E+02 | 1.5E+03 | MG/KG | CBD-S09-SS08-000H | 10/10 | N/A | 1.5E+03 | 1.5E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 2.5E-01 | 1.1E+00 | MG/KG | CBD-S09-SS06-000H | 9/10 | N/A | 1.1E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 4.1E-02 J | 3.9E+00 J | MG/KG | CBD-S09-SS01P-1012 | 8/10 | 0.14 - 0.17 | 3.9E+00 | 1.4E+00 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 1.8E+01 J+ | 1.4E+02 | MG/KG | CBD-S09-SS05-000H | 6/10 | 25 - 25 | 1.4E+02 | 3.1E+02 | N/A | N/A | | NO | NUT |
| | **7440-28-0** | **Thallium** | **7.7E-02 J** | **1.5E-01** | **MG/KG** | **CBD-S09-SS01-1012, CBD-S09-SS02-1012, CBD-S09-SS04-1012** | **6/10** | **0.14 - 0.17** | **1.5E-01** | **1.3E+00** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 4.7E+00 | 2.4E+01 | MG/KG | CBD-S09-SS06-000H | 10/10 | N/A | 2.4E+01 | 3.0E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 6.1E+00 | 5.1E+01 | MG/KG | CBD-S09-SS06-000H | 9/10 | N/A | 5.1E+01 | 7.9E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of $10^{-6}$ for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for xylenes used for m- and p-xylene.
RSL value for n-hexane used as surrogate for methylcyclohexane.
RSL value for acenaphthene used as surrogate for aenaphthylene.
RSL value for pyrene used as surrogate for benzo(g,h,i)perylene.
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium(III) used for chromium since four soil samples were also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
L = Biased Low
C = Carcinogenic
N = Noncarcinogenic
L* = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable
SAT = soil saturation concentration less than residential soil RSL, therefor soil saturation concentration used as screening level.

**Table 2.1a. Step 2 Surface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) MG/KG | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-6 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 10 / 10 | 8.1E+03 | CBD-S09-SS06-000H | 7.7E+04 | N/A | 0.1 | N/A | Neurological |
| Arsenic | 10 / 10 | 3.0E+00 | CBD-S09-SS08-000H | 3.5E+01 | 6.8E-01 | 0.09 | 4E-06 | Cardiovascular, Dermal |
| Chromium (hexavalent) | 4 / 4 | 1.1E+00 | CBD-S09-SS04-1012 | 2.3E+02 | 3.0E-01 | 0.005 | 4E-06 | None Reported, Respiratory |
| Cobalt | 10 / 10 | 6.1E+00 | CBD-S09-SS06-000H | 2.3E+01 | 4.2E+02 | 0.3 | 1E-08 | Thyroid, Respiratory |
| Iron | 10 / 10 | 1.6E+04 | CBD-S09-SS08-000H | 5.5E+04 | N/A | 0.3 | N/A | Gastrointestinal |
| Manganese | 10 / 10 | 2.3E+02 | CBD-S09-SS06-000H | 1.8E+03 | N/A | 0.1 | N/A | Nervous |
| Thallium | 6 / 10 | 1.5E-01 | CBD-S09-SS01-1012, CBD-S09-SS02-1012, CBD-S09-SS04-1012 | 7.8E-01 | N/A | 0.2 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | **1** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **8E-06** | |

Total Neurological/Nervous HI = 0.2
Total Cardiovascular HI = 0.09
Total Dermal HI = 0.3
Total Respiratory HI = 0.3
Total Thyroid HI = 0.3
Total Gastrointestinal HI = 0.3

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 15 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 78-93-3 | 2-Butanone | 2.1E-03 J | 1.1E-02 J | MG/KG | CBD-S09-SB01-1315 | 2/4 | 0.00077 - 0.00089 | 1.1E-02 | N/A | 2.7E+03 N | 1.2E-01 | SSL | NO | BSL |
| | 67-64-1 | Acetone | 1.4E-02 J | 1.4E-01 | MG/KG | CBD-S09-SB01-1315 | 2/4 | 0.0077 - 0.0089 | 1.4E-01 | N/A | 6.1E+03 N | 2.9E-01 | SSL | NO | BSL |
| | 75-15-0 | Carbon disulfide | 1.3E-02 J | 1.3E-02 J | MG/KG | CBD-S09-SB01-1315 | 1/4 | N/A | 1.3E-02 | N/A | 7.7E+01 N | 2.4E-02 | SSL | NO | BSL |
| | 127-18-4 | Tetrachloroethene | 1.3E-03 J | 1.3E-03 J | MG/KG | CBD-S09-SB02-1315 | 1/4 | 0.00077 - 0.00089 | 1.3E-03 | N/A | 8.1E+00 N | 1.8E-03 | SSL | NO | BSL |
| | 534-52-1 | 4,6-Dinitro-2-methylphenol | 3.5E-02 J | 3.5E-02 J | MG/KG | CBD-S09-SB03-1315 | 1/10 | 0.029 - 2.39 | 3.5E-02 | N/A | 5.1E-01 N | 2.6E-04 | SSL | NO | BSL |
| | 117-81-7 | bis(2-Ethylhexyl)phthalate | 1.1E-02 J | 1.4E-02 J | MG/KG | CBD-S09-SB01-1315 | 3/10 | 0.239 - 1.22 | 1.4E-02 | N/A | 3.9E+01 C | 1.3E+00 | SSL | NO | BSL |
| | 85-01-8 | Phenanthrene | 6.0E-03 J | 6.0E-03 J | MG/KG | CBD-S09-SB08-0810 | 1/10 | 0.0029 - 0.011 | 6.0E-03 | N/A | 1.8E+03 N | N/A | | NO | BSL |
| | **7429-90-5** | **Aluminum** | **3.1E+03** | **1.5E+04** | **MG/KG** | **CBD-S09-SB08-0810** | **10/10** | **N/A** | **1.5E+04** | **1.6E+04** | **7.7E+03 N** | **3.0E+03** | **SSL** | **YES** | **ASL** |
| | 7440-36-0 | Antimony | 9.7E-02 J | 3.0E-01 | MG/KG | CBD-S09-SB02-1315 | 2/10 | 0.17 - 0.2 | 3.0E-01 | 5.5E-02 | 3.1E+00 N | 3.5E-02 | SSL | NO | BSL |
| | **7440-38-2** | **Arsenic** | **9.3E-01** | **5.8E+00 J** | **MG/KG** | **CBD-S09-SB10-0810** | **10/10** | **N/A** | **5.8E+00** | **9.8E+00** | **6.8E-01 C** | **1.5E-03** | **SSL** | **YES** | **ASL** |
| | 7440-39-3 | Barium | 4.9E+00 | 5.3E+01 J | MG/KG | CBD-S09-SB10P-0810 | 10/10 | N/A | 5.3E+01 | 5.7E+01 | 1.5E+03 N | 1.6E+01 | SSL | NO | BSL |
| | 7440-41-7 | Beryllium | 1.8E-01 | 1.4E+00 | MG/KG | CBD-S09-SB03-1315 | 9/10 | 0.36 - 0.36 | 1.4E+00 | 1.2E+00 | 1.6E+01 N | 1.9E+00 | SSL | NO | BSL |
| | 7440-43-9 | Cadmium | 1.4E-01 J | 1.5E+00 | MG/KG | CBD-S09-SB01-1315 | 8/10 | 0.17 - 0.2 | 1.5E+00 | 8.1E-01 | 7.1E+00 N | 6.9E-02 | SSL | NO | BSL |
| | 7440-70-2 | Calcium | 1.0E+03 | 3.5E+03 | MG/KG | CBD-S09-SB01-1315 | 10/10 | N/A | 3.5E+03 | 1.4E+03 | N/A | N/A | | NO | NUT |
| | **18540-29-9** | **Chromium (hexavalent)** | **2.9E-01 J** | **9.8E-01** | **MG/KG** | **CBD-S09-SB03-1315** | **3/4** | **0.31 - 0.31** | **9.8E-01** | **4.9E-01** | **3.0E-01 C** | **6.7E-04** | **SSL** | **YES** | **ASL** |
| | 7440-47-3 | Chromium | 1.6E+01 | 2.8E+01 | MG/KG | CBD-S09-SB01-1315, CBD-S09-SB04-1315 | 10/10 | N/A | 2.8E+01 | 5.8E+01 | 1.2E+04 N | 4.0E+06 | SSL | NO | BSL |
| | **7440-48-4** | **Cobalt** | **4.9E-01** | **4.4E+01** | **MG/KG** | **CBD-S09-SB02-1315** | **10/10** | **N/A** | **4.4E+01** | **5.9E+00** | **2.3E+00 N** | **2.7E-02** | **SSL** | **YES** | **ASL** |
| | 7440-50-8 | Copper | 1.7E+00 | 4.6E+00 | MG/KG | CBD-S09-SB03-1315 | 10/10 | N/A | 4.6E+00 | 7.9E+00 | 3.1E+02 N | 2.8E+00 | SSL | NO | BSL |
| | **7439-89-6** | **Iron** | **4.3E+03** | **1.8E+04** | **MG/KG** | **CBD-S09-SB05-0810** | **10/10** | **N/A** | **1.8E+04** | **3.0E+04** | **5.5E+03 N** | **3.5E+01** | **SSL** | **YES** | **ASL** |
| | 7439-92-1 | Lead | 2.0E+00 | 9.2E+00 J | MG/KG | CBD-S09-SB10P-0810 | 10/10 | N/A | 9.2E+00 | 1.2E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |
| | 7439-95-4 | Magnesium | 1.1E+03 | 3.5E+03 | MG/KG | CBD-S09-SB01-1315 | 10/10 | N/A | 3.5E+03 | 3.4E+03 | N/A | N/A | | NO | NUT |
| | **7439-96-5** | **Manganese** | **2.0E+00** | **2.6E+02** | **MG/KG** | **CBD-S09-SB02-1315** | **10/10** | **N/A** | **2.6E+02** | **2.3E+02** | **1.8E+02 N** | **2.8E+00** | **SSL** | **YES** | **ASL** |
| | 7439-97-6 | Mercury | 6.5E-03 J | 1.5E-02 J | MG/KG | CBD-S09-SB02-1315 | 3/10 | 0.017 - 0.2 | 1.5E-02 | 4.0E-02 | 2.3E+00 N | 3.3E-03 | SSL | NO | BSL |
| | 7440-02-0 | Nickel | 1.1E+00 | 1.2E+01 | MG/KG | CBD-S09-SB08-0810 | 10/10 | N/A | 1.2E+01 | 1.3E+01 | 1.5E+02 N | 2.6E+00 | SSL | NO | BSL |
| | 7440-09-7 | Potassium | 6.1E+02 | 1.9E+03 | MG/KG | CBD-S09-SB01-1315 | 10/10 | N/A | 1.9E+03 | 1.6E+03 | N/A | N/A | | NO | NUT |
| | 7782-49-2 | Selenium | 4.0E-01 J | 2.3E+00 J | MG/KG | CBD-S09-SB10P-0810 | 7/10 | N/A | 2.3E+00 | 2.1E+00 | 3.9E+01 N | 5.2E-02 | SSL | NO | BSL |
| | 7440-22-4 | Silver | 5.5E-02 | 1.6E-01 J | MG/KG | CBD-S09-SB09-0810 | 5/10 | 0.17 - 0.2 | 1.6E-01 | 2.3E-01 | 3.9E+01 N | 8.0E-02 | SSL | NO | BSL |
| | 7440-23-5 | Sodium | 6.7E+01 J+ | 1.2E+02 | MG/KG | CBD-S09-SB02-1315, CBD-S09-SB08-0810 | 7/10 | N/A | 1.2E+02 | 1.4E+02 | N/A | N/A | | NO | NUT |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 15 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **7440-28-0** | **Thallium** | **7.9E-02 J** | **3.4E-01 J** | **MG/KG** | **CBD-S09-SB05-0810** | **10/10** | **N/A** | **3.4E-01** | **4.1E-01** | **7.8E-02 N** | **1.4E-03** | **SSL** | **YES** | **ASL** |
| | 7440-62-2 | Vanadium | 6.6E+00 | 1.5E+01 | MG/KG | CBD-S09-SB04-1315 | 10/10 | N/A | 1.5E+01 | 3.6E+01 | 3.9E+01 N | 8.6E+00 | SSL | NO | BSL |
| | 7440-66-6 | Zinc | 1.4E+01 | 1.5E+02 | MG/KG | CBD-S09-SB03-1315 | 10/10 | N/A | 1.5E+02 | 6.4E+01 | 2.3E+03 N | 3.7E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).

[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
Residential Soil RSLs (based on cancer risk of 10-6 for carcinogens and hazard quotient of 0.1 for noncarcinogens).
RSL value for anthracene used as surrogate for phenanthrene.
RSL value for chromium(III) used for chromium since four soil samples were also analyzed for chromium (hexavalent).
RSL value for mercuric chloride (and other mercury salts) used for mercury.

[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
J+ = Biased High
C = Carcinogenic
N = Noncarcinogenic
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater risk-based Soil Screening Level from November 2019 RSL Table. If risk-based SSL not available, used MCL-based SSL.
N/A = Not available/not applicable

**Table 2.2a. Step 2 Subsurface Soil Screening - Risk Ratio, Maximum Detected Concentration, Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 1 COPC | Detection Frequency | Maximum Detected Concentration (Qualifier) (MG/KG) | Sample Location of Maximum Detected Concentration | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-6 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 10 / 10 | 1.5E+04 | CBD-S09-SB08-0810 | 7.70E+04 | N/A | 0.2 | N/A | Neurological |
| **Arsenic** | **10 / 10** | **5.8E+00 J** | **CBD-S09-SB10-0810** | **3.50E+01** | **6.80E-01** | **0.2** | **9E-06** | **Cardiovascular, Dermal** |
| ***Chromium (hexavalent)*** | ***3 / 4*** | ***9.8E-01*** | ***CBD-S09-SB03-1315*** | ***2.30E+02*** | ***3.00E-01*** | ***0.004*** | ***3E-06*** | ***None Reported, Respiratory*** |
| ***Cobalt*** | ***10 / 10*** | ***4.4E+01*** | ***CBD-S09-SB02-1315*** | ***2.3E+01*** | ***4.20E+02*** | ***2*** | ***1E-07*** | ***Thyroid, Respiratory*** |
| Iron | 10 / 10 | 1.8E+04 | CBD-S09-SB05-0810 | 5.50E+04 | N/A | 0.3 | N/A | Gastrointestinal |
| Manganese | 10 / 10 | 2.6E+02 | CBD-S09-SB02-1315 | 1.80E+03 | N/A | 0.1 | N/A | Nervous |
| **Thallium** | **10 / 10** | **3.4E-01 J** | **CBD-S09-SB05-0810** | **7.80E-01** | **N/A** | **0.4** | **N/A** | **Dermal** |
| **Cumulative Hazard Index[c]** | | | | | | **3** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Neurological/Nervous HI = | 0.3 |
| Total Cardiovascular HI = | 0.2 |
| Total Dermal HI = | 0.6 |
| Total Respiratory HI = | 2 |
| Total Gastrointestinal HI = | 0.3 |
| Total Thyroid HI = | 2 |

**Notes:**

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.
Constituent selected as a MDE Step 2 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.
Constituents selected as Step 2 COPCs based on Navy criteria are indicated by bold text.
Constituents selected as Step 2 COPCs based on USEPA criteria are indicated by italic text.
Constituents selected as Step 2 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

**Table 2.2b. Step 3 Subsurface Soil Screening - Risk Ratio, 95% UCL, Site 9**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

| Step 2 COPC | Detection Frequency | 95% UCL (MG/KG) | | 95% UCL Rationale | Noncarcinogenic Residential Soil RSL HQ=1 | Carcinogenic Residential Soil RSL ELCR = 1E-6 | Hazard Index[a] | Cancer Risk[b] | Target Organ |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 10 / 10 | 4.2E+00 | 95% Student's-t UCL | 1 | 3.50E+01 | 6.80E-01 | 0.1 | 6E-06 | Cardiovascular, Dermal |
| **Chromium (hexavalent)** | **3 / 4** | **9.8E-01** | **Maximum** | **5** | **2.30E+02** | **3.00E-01** | **0.004** | **3E-06** | **None Reported, Respiratory** |
| **Cobalt** | **10 / 10** | **2.5E+01** | **95% Chebyshev(Mean, Sd) UCL** | **1** | **2.30E+01** | **4.20E+02** | **1** | **6E-08** | **Thyroid, Respiratory** |
| Thallium | 10 / 10 | 2.9E-01 | 95% Student's-t UCL | 1. 3 | 7.80E-01 | N/A | 0.4 | N/A | Dermal |
| **Cumulative Hazard Index[c]** | | | | | | | **2** | | |
| **Cumulative Cancer Risk[d]** | | | | | | | | **1E-05** | |

| | |
|---|---|
| Total Cardiovascular HI = | 0.1 |
| Total Dermal HI = | 0.4 |
| Total Thyroid HI = | 1 |
| Total Respiratory HI = | 1 |

[a] Hazard Index equals maximum detected concentration divided by the noncarcinogenic RSL divided by the acceptable hazard level of 1.

[b] Cancer Risk equals maximum detected concentration divided by the carcinogenic RSL divided by the acceptable risk level of 1E-06

[c] Cumulative Hazard Index equals sum of hazard indices for each constituent.

[d] Cumulative Cancer Risk equals sum of cancer risks for each constituent.

Constituent selected as Navy Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 0.5 or Cumulative Cancer Risk greater than 5E-05.

Constituent selected as USEPA Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or Cumulative Cancer Risk greater than 1E-04.

Constituent selected as a MDE Step 3 COPC if it contributes to an overall Hazard Index by target organ greater than 1 or a Cumulative Cancer Risk greater than 1E-05.

Constituents selected as Step 3 COPCs based on Navy criteria are indicated by bold text.

Constituents selected as Step 3 COPCs based on USEPA criteria are indicated by italic text.

Constituents selected as Step 3 COPCs based on MDE criteria are indicated by shading.

COPC = Chemical of Potential Concern
ELCR = Excess Lifetime Cancer Risk
HI = Hazard Index
HQ = Hazard Quotient
MG/KG = milligrams per kilogram
UCL = Upper Confidence Limit
MDE = Maryland Department of the Environment
N/A = Not available/not applicable
RSL = Regional Screening Levels, November 2019
USEPA = US Environmental Protection Agency

ProUCL, Version 5.1.002 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. October, 2016. Prepared by Lockheed Martin Environmental Services).

UCL Rationale:

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Anderson-Darling and/or Kolmogorov-Smirnov Tests indicate data are gamma distributed.
(4) Distribution tests are inconclusive (data are not normal, log-normal, or gamma-distributed).

## Table 2.2c. Comparison of Concentrations of COPCs to Background Concentrations - Site 9

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (8 - 15 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Exceeds Background? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface So | **18540-29-9** | **Chromium (hexavalent)** | **2.9E-01 J** | **9.8E-01** | **MG/KG** | **CBD-S09-SB03-1315** | **3/4** | **0.31 - 0.31** | **9.8E-01** | **4.9E-01** | **YES** |
|  | **7440-48-4** | **Cobalt** | **4.9E-01** | **4.4E+01** | **MG/KG** | **CBD-S09-SB02-1315** | **10/10** | **N/A** | **4.4E+01** | **5.9E+00** | **YES** |

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background value is the surface soil background threshold value (BTV).

bgs = below ground surface
COPC = Chemical of Potential Concern
MG/KG = milligrams per kilogram

Site 9 Subsurface Soil

## UCL Statistics for Data Sets with Non-Detects

| User Selected Options | |
|---|---|
| Date/Time of Computation | ProUCL 5.11/8/2019 8:09:07 AM |
| From File | ProUCL input.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Cobalt (MG/KG)

#### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 10 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.49 | Mean | 6.875 |
| Maximum | 44 | Median | 3.1 |
| SD | 13.13 | Std. Error of Mean | 4.153 |
| Coefficient of Variation | 1.91 | Skewness | 3.084 |

#### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.475 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.436 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Normal at 5% Significance Level |

Data Not Normal at 5% Significance Level

#### Assuming Normal Distribution

| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
|---|---|---|---|
| 95% Student's-t UCL | 14.49 | 95% Adjusted-CLT UCL (Chen-1995) | 18.03 |
| | | 95% Modified-t UCL (Johnson-1978) | 15.16 |

#### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 1.126 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.759 | Data Not Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.326 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.277 | Data Not Gamma Distributed at 5% Significance Level |

Data Not Gamma Distributed at 5% Significance Level

#### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 0.719 | k star (bias corrected MLE) | 0.57 |
| Theta hat (MLE) | 9.564 | Theta star (bias corrected MLE) | 12.06 |
| nu hat (MLE) | 14.38 | nu star (bias corrected) | 11.4 |
| MLE Mean (bias corrected) | 6.875 | MLE Sd (bias corrected) | 9.107 |
| | | Approximate Chi Square Value (0.05) | 4.833 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 4.115 |

#### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 16.21 | 95% Adjusted Gamma UCL (use when n<50) | 19.04 |

Site 9 Subsurface Soil

### Lognormal GOF Test

| | | | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.899 | **Shapiro Wilk Lognormal GOF Test** | |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level | |
| Lilliefors Test Statistic | 0.228 | **Lilliefors Lognormal GOF Test** | |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level | |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.713 | Mean of logged Data | 1.09 |
| Maximum of Logged Data | 3.784 | SD of logged Data | 1.208 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 25.71 | 90% Chebyshev (MVUE) UCL | 12.24 |
| 95% Chebyshev (MVUE) UCL | 15.28 | 97.5% Chebyshev (MVUE) UCL | 19.49 |
| 99% Chebyshev (MVUE) UCL | 27.77 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 13.71 | 95% Jackknife UCL | 14.49 |
| 95% Standard Bootstrap UCL | 13.23 | 95% Bootstrap-t UCL | 58.79 |
| 95% Hall's Bootstrap UCL | 53.58 | 95% Percentile Bootstrap UCL | 15.12 |
| 95% BCA Bootstrap UCL | 18.93 | | |
| 90% Chebyshev(Mean, Sd) UCL | 19.33 | 95% Chebyshev(Mean, Sd) UCL | 24.98 |
| 97.5% Chebyshev(Mean, Sd) UCL | 32.81 | 99% Chebyshev(Mean, Sd) UCL | 48.19 |

### Suggested UCL to Use

| | |
|---|---|
| 95% Chebyshev (Mean, Sd) UCL | 24.98 |

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Chromium (hexavalent) (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 4 | Number of Distinct Observations | 4 |
| Number of Detects | 3 | Number of Non-Detects | 1 |
| Number of Distinct Detects | 3 | Number of Distinct Non-Detects | 1 |
| Minimum Detect | 0.29 | Minimum Non-Detect | 0.31 |
| Maximum Detect | 0.98 | Maximum Non-Detect | 0.31 |
| Variance Detects | 0.141 | Percent Non-Detects | 25% |
| Mean Detects | 0.72 | SD Detects | 0.375 |
| Median Detects | 0.89 | CV Detects | 0.521 |
| Skewness Detects | -1.621 | Kurtosis Detects | N/A |
| Mean of Logged Detects | -0.458 | SD of Logged Detects | 0.677 |

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

### Normal GOF Test on Detects Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.846 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.341 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Normal at 5% Significance Level |

Detected Data appear Normal at 5% Significance Level

### Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

| | | | |
|---|---|---|---|
| KM Mean | 0.613 | KM Standard Error of Mean | 0.198 |
| KM SD | 0.324 | 95% KM (BCA) UCL | N/A |
| 95% KM (t) UCL | 1.08 | 95% KM (Percentile Bootstrap) UCL | N/A |
| 95% KM (z) UCL | 0.939 | 95% KM Bootstrap t UCL | N/A |
| 90% KM Chebyshev UCL | 1.208 | 95% KM Chebyshev UCL | 1.478 |
| 97.5% KM Chebyshev UCL | 1.852 | 99% KM Chebyshev UCL | 2.587 |

### Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

### Gamma Statistics on Detected Data Only

| | | | |
|---|---|---|---|
| k hat (MLE) | 4.014 | k star (bias corrected MLE) | N/A |
| Theta hat (MLE) | 0.179 | Theta star (bias corrected MLE) | N/A |
| nu hat (MLE) | 24.08 | nu star (bias corrected) | N/A |
| Mean (detects) | 0.72 | | |

### Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

| | | | |
|---|---|---|---|
| Minimum | 0.29 | Mean | 0.624 |
| Maximum | 0.98 | Median | 0.613 |
| SD | 0.362 | CV | 0.58 |
| k hat (MLE) | 3.607 | k star (bias corrected MLE) | 1.068 |
| Theta hat (MLE) | 0.173 | Theta star (bias corrected MLE) | 0.584 |
| nu hat (MLE) | 28.86 | nu star (bias corrected) | 8.547 |
| Adjusted Level of Significance (β) | 0.00498 | | |
| Approximate Chi Square Value (8.55, α) | 3.056 | Adjusted Chi Square Value (8.55, β) | N/A |
| 95% Gamma Approximate UCL (use when n>=50) | 1.745 | 95% Gamma Adjusted UCL (use when n<50) | N/A |

## Site 9 Subsurface Soil

### Estimates of Gamma Parameters using KM Estimates

| | | | |
|---|---|---|---|
| Mean (KM) | 0.613 | SD (KM) | 0.324 |
| Variance (KM) | 0.105 | SE of Mean (KM) | 0.198 |
| k hat (KM) | 3.572 | k star (KM) | 1.06 |
| nu hat (KM) | 28.58 | nu star (KM) | 8.478 |
| theta hat (KM) | 0.171 | theta star (KM) | 0.578 |
| 80% gamma percentile (KM) | 0.981 | 90% gamma percentile (KM) | 1.39 |
| 95% gamma percentile (KM) | 1.798 | 99% gamma percentile (KM) | 2.74 |

### Gamma Kaplan-Meier (KM) Statistics

| | | | |
|---|---|---|---|
| Approximate Chi Square Value (8.48, α) | 3.015 | Adjusted Chi Square Value (8.48, β) | 1.532 |
| 95% Gamma Approximate KM-UCL (use when n>=50) | 1.722 | 95% Gamma Adjusted KM-UCL (use when n<50) | 3.39 |

### Lognormal GOF Test on Detected Observations Only

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.809 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.767 | Detected Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.36 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.425 | Detected Data appear Lognormal at 5% Significance Level |

Detected Data appear Lognormal at 5% Significance Level

### Lognormal ROS Statistics Using Imputed Non-Detects

| | | | |
|---|---|---|---|
| Mean in Original Scale | 0.617 | Mean in Log Scale | -0.637 |
| SD in Original Scale | 0.369 | SD in Log Scale | 0.659 |
| 95% t UCL (assumes normality of ROS data) | 1.051 | 95% Percentile Bootstrap UCL | N/A |
| 95% BCA Bootstrap UCL | N/A | 95% Bootstrap t UCL | N/A |
| 95% H-UCL (Log ROS) | 3.707 | | |

### Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| KM Mean (logged) | -0.653 | KM Geo Mean | 0.52 |
| KM SD (logged) | 0.586 | 95% Critical H Value (KM-Log) | 4.126 |
| KM Standard Error of Mean (logged) | 0.359 | 95% H-UCL (KM -Log) | 2.494 |
| KM SD (logged) | 0.586 | 95% Critical H Value (KM-Log) | 4.126 |
| KM Standard Error of Mean (logged) | 0.359 | | |

### DL/2 Statistics

| | | | |
|---|---|---|---|
| **DL/2 Normal** | | **DL/2 Log-Transformed** | |
| Mean in Original Scale | 0.579 | Mean in Log Scale | -0.81 |
| SD in Original Scale | 0.417 | SD in Log Scale | 0.894 |
| 95% t UCL (Assumes normality) | 1.069 | 95% H-Stat UCL | 14.72 |

DL/2 is not a recommended method, provided for comparisons and historical reasons

### Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

### Suggested UCL to Use

| | |
|---|---|
| 95% KM (t) UCL | 1.08 |

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

## Site 9 Subsurface Soil

## UCL Statistics for Uncensored Full Data Sets

| | |
|---|---|
| User Selected Options | |
| Date/Time of Computation | ProUCL 5.111/7/2019 10:19:02 AM |
| From File | UCLInput_c.xls |
| Full Precision | OFF |
| Confidence Coefficient | 95% |
| Number of Bootstrap Operations | 2000 |

### Arsenic (MG/KG)

**General Statistics**

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 9 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.93 | Mean | 3.283 |
| Maximum | 5.8 | Median | 3.25 |
| SD | 1.583 | Std. Error of Mean | 0.501 |
| Coefficient of Variation | 0.482 | Skewness | -0.159 |

**Normal GOF Test**

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.948 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.16 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

**Assuming Normal Distribution**

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 4.201 | 95% Adjusted-CLT UCL (Chen-1995) | 4.08 |
| | | 95% Modified-t UCL (Johnson-1978) | 4.196 |

**Gamma GOF Test**

| | | |
|---|---|---|
| A-D Test Statistic | 0.485 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.73 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.227 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.268 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

**Gamma Statistics**

| | | | |
|---|---|---|---|
| k hat (MLE) | 3.64 | k star (bias corrected MLE) | 2.615 |
| Theta hat (MLE) | 0.902 | Theta star (bias corrected MLE) | 1.256 |
| nu hat (MLE) | 72.8 | nu star (bias corrected) | 52.29 |
| MLE Mean (bias corrected) | 3.283 | MLE Sd (bias corrected) | 2.03 |
| | | Approximate Chi Square Value (0.05) | 36.68 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 34.42 |

**Assuming Gamma Distribution**

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 4.68 | 95% Adjusted Gamma UCL (use when n<50) | 4.987 |

Site 9 Subsurface Soil

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.875 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.255 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Lognormal at 5% Significance Level |

Data appear Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -0.0726 | Mean of logged Data | 1.045 |
| Maximum of Logged Data | 1.758 | SD of logged Data | 0.618 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 5.641 | 90% Chebyshev (MVUE) UCL | 5.395 |
| 95% Chebyshev (MVUE) UCL | 6.312 | 97.5% Chebyshev (MVUE) UCL | 7.586 |
| 99% Chebyshev (MVUE) UCL | 10.09 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 4.106 | 95% Jackknife UCL | 4.201 |
| 95% Standard Bootstrap UCL | 4.074 | 95% Bootstrap-t UCL | 4.172 |
| 95% Hall's Bootstrap UCL | 4.105 | 95% Percentile Bootstrap UCL | 4.026 |
| 95% BCA Bootstrap UCL | 4 | | |
| 90% Chebyshev(Mean, Sd) UCL | 4.785 | 95% Chebyshev(Mean, Sd) UCL | 5.465 |
| 97.5% Chebyshev(Mean, Sd) UCL | 6.409 | 99% Chebyshev(Mean, Sd) UCL | 8.264 |

### Suggested UCL to Use

95% Student's-t UCL 4.201

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

Thallium (MG/KG)

### General Statistics

| | | | |
|---|---|---|---|
| Total Number of Observations | 10 | Number of Distinct Observations | 7 |
| | | Number of Missing Observations | 0 |
| Minimum | 0.079 | Mean | 0.241 |
| Maximum | 0.34 | Median | 0.24 |
| SD | 0.0769 | Std. Error of Mean | 0.0243 |
| Coefficient of Variation | 0.319 | Skewness | -0.824 |

Site 9 Subsurface Soil

### Normal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.921 | **Shapiro Wilk GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data appear Normal at 5% Significance Level |
| Lilliefors Test Statistic | 0.197 | **Lilliefors GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data appear Normal at 5% Significance Level |

Data appear Normal at 5% Significance Level

### Assuming Normal Distribution

| | | | |
|---|---|---|---|
| **95% Normal UCL** | | **95% UCLs (Adjusted for Skewness)** | |
| 95% Student's-t UCL | 0.285 | 95% Adjusted-CLT UCL (Chen-1995) | 0.274 |
| | | 95% Modified-t UCL (Johnson-1978) | 0.284 |

### Gamma GOF Test

| | | |
|---|---|---|
| A-D Test Statistic | 0.607 | **Anderson-Darling Gamma GOF Test** |
| 5% A-D Critical Value | 0.727 | Detected data appear Gamma Distributed at 5% Significance Level |
| K-S Test Statistic | 0.25 | **Kolmogorov-Smirnov Gamma GOF Test** |
| 5% K-S Critical Value | 0.267 | Detected data appear Gamma Distributed at 5% Significance Level |

Detected data appear Gamma Distributed at 5% Significance Level

### Gamma Statistics

| | | | |
|---|---|---|---|
| k hat (MLE) | 7.88 | k star (bias corrected MLE) | 5.583 |
| Theta hat (MLE) | 0.0306 | Theta star (bias corrected MLE) | 0.0432 |
| nu hat (MLE) | 157.6 | nu star (bias corrected) | 111.7 |
| MLE Mean (bias corrected) | 0.241 | MLE Sd (bias corrected) | 0.102 |
| | | Approximate Chi Square Value (0.05) | 88.26 |
| Adjusted Level of Significance | 0.0267 | Adjusted Chi Square Value | 84.65 |

### Assuming Gamma Distribution

| | | | |
|---|---|---|---|
| 95% Approximate Gamma UCL (use when n>=50)) | 0.305 | 95% Adjusted Gamma UCL (use when n<50) | 0.318 |

### Lognormal GOF Test

| | | |
|---|---|---|
| Shapiro Wilk Test Statistic | 0.796 | **Shapiro Wilk Lognormal GOF Test** |
| 5% Shapiro Wilk Critical Value | 0.842 | Data Not Lognormal at 5% Significance Level |
| Lilliefors Test Statistic | 0.286 | **Lilliefors Lognormal GOF Test** |
| 5% Lilliefors Critical Value | 0.262 | Data Not Lognormal at 5% Significance Level |

Data Not Lognormal at 5% Significance Level

### Lognormal Statistics

| | | | |
|---|---|---|---|
| Minimum of Logged Data | -2.538 | Mean of logged Data | -1.488 |
| Maximum of Logged Data | -1.079 | SD of logged Data | 0.42 |

### Assuming Lognormal Distribution

| | | | |
|---|---|---|---|
| 95% H-UCL | 0.332 | 90% Chebyshev (MVUE) UCL | 0.343 |
| 95% Chebyshev (MVUE) UCL | 0.388 | 97.5% Chebyshev (MVUE) UCL | 0.45 |
| 99% Chebyshev (MVUE) UCL | 0.572 | | |

### Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

### Nonparametric Distribution Free UCLs

| | | | |
|---|---|---|---|
| 95% CLT UCL | 0.281 | 95% Jackknife UCL | 0.285 |
| 95% Standard Bootstrap UCL | 0.28 | 95% Bootstrap-t UCL | 0.281 |
| 95% Hall's Bootstrap UCL | 0.276 | 95% Percentile Bootstrap UCL | 0.279 |
| 95% BCA Bootstrap UCL | 0.273 | | |
| 90% Chebyshev(Mean, Sd) UCL | 0.314 | 95% Chebyshev(Mean, Sd) UCL | 0.347 |
| 97.5% Chebyshev(Mean, Sd) UCL | 0.393 | 99% Chebyshev(Mean, Sd) UCL | 0.483 |

### Suggested UCL to Use

95% Student's-t UCL 0.285

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**

# Appendix F.6

# AOC D Human Health Risk Screening Tables

**Table 2.1. Occurrence, Distribution and Selection of Chemicals of Potential Concern - AOC D**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil (0-0.5 foot bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Surface Soil** | **7439-92-1** | **Lead** | **1.0E+02** | **3.0E+03** | **MG/KG** | **CBD-AOD-SS02-1012** | **14/14** | **N/A** | **3.0E+03** | **5.0E+01** | **4.0E+02 L** | **1.4E+01** | **SSL** | **YES** | **ASL** |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Navy Research Laboratory background threshold value for surface soil (95 percent upper tolerance limit).
[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater MCL-based Soil Screening Level from November 2019 RSL Table.
N/A = Not available/not applicable
AOC = Area of Concern

## Table 2.1a. IEUBK- AOC D Surface Soil, Child Resident

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

```
        LEAD MODEL FOR WINDOWS Version 1.1

  ==================================================================================
  Model Version: 1.1 Build11
  User Name: Jacobs
  Date: 01/09/2019
  Site Name: Naval Research Laboratory - Chesapeake Bay Detachment
  Operable Unit: Site 4
  Run Mode: Site Risk Assessment
  --------------------------------------------------------------------------------

# Soil/Dust Data
Average lead surface soil concentration
# Maternal Data
value from OLEM Directive 9285.6-56
# GSD, Cutoff and Age Type
12 - 72 months
  ==================================================================================

  ****** Air ******

  Indoor Air Pb Concentration: 30.000 percent of outdoor.
  Other Air Parameters:

  Age      Time      Ventilation      Lung       Outdoor Air
         Outdoors       Rate       Absorption     Pb Conc
         (hours)     (m³/day)         (%)       (µg Pb/m³)
  ---------------------------------------------------------------------
  .5-1    1.000        2.000        32.000        0.100
  1-2     2.000        3.000        32.000        0.100
  2-3     3.000        5.000        32.000        0.100
  3-4     4.000        5.000        32.000        0.100
  4-5     4.000        5.000        32.000        0.100
  5-6     4.000        7.000        32.000        0.100
  6-7     4.000        7.000        32.000        0.100

  ****** Diet ******

  Age     Diet Intake(µg/day)
  -----------------------------------
  .5-1    2.260
  1-2     1.960
  2-3     2.130
  3-4     2.040
  4-5     1.950
  5-6     2.050
  6-7     2.220
```

## Table 2.1a. IEUBK- AOC D Surface Soil, Child Resident

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

****** Drinking Water ******

Water Consumption:

| Age | Water (L/day) |
|---|---|
| .5-1 | 0.200 |
| 1-2 | 0.500 |
| 2-3 | 0.520 |
| 3-4 | 0.530 |
| 4-5 | 0.550 |
| 5-6 | 0.580 |
| 6-7 | 0.590 |

Drinking Water Concentration: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 924.200 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

| Age | Time Outdoors (hours) | Ventilation Rate ($m^3$/day) | Lung Absorption (%) | Outdoor Air Pb Conc (µg Pb/$m^3$) |
|---|---|---|---|---|
| .5-1 | 1.000 | 2.000 | 32.000 | 0.100 |
| 1-2 | 2.000 | 3.000 | 32.000 | 0.100 |
| 2-3 | 3.000 | 5.000 | 32.000 | 0.100 |
| 3-4 | 4.000 | 5.000 | 32.000 | 0.100 |
| 4-5 | 4.000 | 5.000 | 32.000 | 0.100 |
| 5-6 | 4.000 | 7.000 | 32.000 | 0.100 |
| 6-7 | 4.000 | 7.000 | 32.000 | 0.100 |

## Table 2.1a. IEUBK- AOC D Surface Soil, Child Resident

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

```
****** Diet ******

Age     Diet Intake(µg/day)
-----------------------------------
.5-1      2.260
1-2       1.960
2-3       2.130
3-4       2.040
4-5       1.950
5-6       2.050
6-7       2.220

****** Drinking Water ******

Water Consumption:
Age     Water (L/day)
-----------------------------------
.5-1      0.200
1-2       0.500
2-3       0.520
3-4       0.530
4-5       0.550
5-6       0.580
6-7       0.590

Drinking Water Concentration: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 924.200 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age         Soil (µg Pb/g)      House Dust (µg Pb/g)
--------------------------------------------------------
.5-1           1306.000            924.200
1-2            1306.000            924.200
2-3            1306.000            924.200
3-4            1306.000            924.200
4-5            1306.000            924.200
5-6            1306.000            924.200
6-7            1306.000            924.200
```

**Table 2.1a. IEUBK-  AOC D Surface Soil, Child Resident**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

```
****** Alternate Intake ******

Age     Alternate (µg Pb/day)
----------------------------------
.5-1    0.000
1-2     0.000
2-3     0.000
3-4     0.000
4-5     0.000
5-6     0.000
6-7     0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 0.600 µg Pb/dL

*****************************************
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
*****************************************

Year       Air            Diet          Alternate     Water
        (µg/day)        (µg/day)        (µg/day)     (µg/day)
-----------------------------------------------------------------------------
.5-1      0.021           0.866          0.000        0.307
1-2       0.034           0.719          0.000        0.733
2-3       0.062           0.810          0.000        0.791
3-4       0.067           0.802          0.000        0.834
4-5       0.067           0.826          0.000        0.932
5-6       0.093           0.894          0.000        1.011
6-7       0.093           0.983          0.000        1.045

 Year    Soil+Dust         Total          Blood
        (µg/day)        (µg/day)        (µg/dL)
--------------------------------------------------------------
.5-1     21.418          22.612           11.8
1-2      32.551          34.037           13.7
2-3      33.773          35.436           12.9
3-4      34.907          36.610           12.5
4-5      27.847          29.671           10.4
5-6      25.796          27.794            8.8
6-7      24.753          26.874            7.7
```

**Table 2.1b. Calculations of Blood Lead Concentrations (PbBs) and Risk in Nonresidential Areas**

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee, Version date 6/14/2017

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Exposure Medium: Surface Soil, AOC D
Receptor: Industrial Worker

| Variable | Description of Variable | Units | GSDi and PbBo from Analysis of NHANES 2009-2014 | GSDi and PbBo from Analysis of NHANES 2007-2010 | GSDi and PbBo from Analysis of NHANES 2004-2007 | GSDi and PbBo from Analysis of NHANES III (Phases 1&2) |
|---|---|---|---|---|---|---|
| PbS | Soil lead concentration | μg/g or ppm | 1306 | 1306 | 1306 | 1306 |
| $R_{fetal/maternal}$ | Fetal/maternal PbB ratio | -- | 0.9 | 0.9 | 0.9 | 0.9 |
| BKSF | Biokinetic Slope Factor | μg/dL per μg/day | 0.4 | 0.4 | 0.4 | 0.4 |
| $GSD_i$ | Geometric standard deviation PbB | -- | 1.8 | 1.7 | 1.8 | 2.1 |
| $PbB_0$ | Baseline PbB | μg/dL | 0.6 | 0.7 | 1.0 | 1.5 |
| $IR_S$ | Soil ingestion rate (including soil-derived indoor dust) | g/day | 0.050 | 0.050 | 0.050 | 0.050 |
| $IR_{S+D}$ | Total ingestion rate of outdoor soil and indoor dust | g/day | -- | -- | -- | -- |
| $W_S$ | Weighting factor; fraction of $IR_{S+D}$ ingested as outdoor soil | -- | -- | -- | -- | -- |
| $K_{SD}$ | Mass fraction of soil in dust | -- | -- | -- | -- | -- |
| $AF_{S,\ D}$ | Absorption fraction (same for soil and dust) | -- | 0.12 | 0.12 | 0.12 | 0.12 |
| $EF_{S,\ D}$ | Exposure frequency (same for soil and dust) | days/yr | 219 | 219 | 219 | 219 |
| $AT_{S,\ D}$ | Averaging time (same for soil and dust) | days/yr | 365 | 365 | 365 | 365 |
| $PbB_{adult}$ | PbB of adult worker, geometric mean | μg/dL | 2.5 | 2.6 | 2.9 | 3.4 |
| $PbB_{fetal,\ 0.95}$ | 95th percentile PbB among fetuses of adult workers | μg/dL | 5.9 | 5.6 | 6.8 | 10.3 |
| $PbB_t$ | Target PbB level of concern (e.g., 2-8 ug/dL) | μg/dL | **10** | **10** | **10** | **10** |
| **$P(PbB_{fetal} > PbB_t)$** | **Probability that fetal PbB exceeds target PbB, assuming lognormal distribution** | **%** | **0.5%** | **0.3%** | **1.1%** | **5.4%** |

**Table 2.2. Occurrence, Distribution and Selection of Chemicals of Potential Concern - AOC D**

*Base-wide Expanded Site Inspection Report Naval Research Laboratory – Chesapeake Bay Detachment*

Scenario Timeframe: Future
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil (1.5 - 2 feet bgs)

| Exposure Point | CAS Number | Chemical | Minimum [1] Concentration Qualifier | Maximum [1] Concentration Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration [2] Used for Screening | Background [3] Value | Screening [4] Toxicity Value | Potential ARAR/TBC Value | Potential ARAR/TBC Source | Step 1 COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subsurface Soil | 7439-92-1 | Lead | 7.8E+00 | 1.6E+02 J | MG/KG | CBD-AOD-SB12-1H02 | 10/10 | N/A | 1.6E+02 | 1.2E+01 | 4.0E+02 L | 1.4E+01 | SSL | NO | BSL |

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Navy Research Laboratory background threshold value for subsurface soil (95 percent upper tolerance limit).
[4] USEPA. November, 2019. Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs).
[5] Rationale Codes

| | |
|---|---|
| Selection Reason: | Above Screening Levels (ASL) |
| Deletion Reason: | No Toxicity Information (NTX) |
| | Essential Nutrient (NUT) |
| | Below Screening Level (BSL) |

bgs = below ground surface
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
L = Lead screening level from November 2019 RSL Table.
MG/KG = Milligrams per kilogram
SSL = Protection of groundwater MCL-based Soil Screening Level from November 2019 RSL Table.
N/A = Not available/not applicable
AOC = Area of Concern

**Table Lead.2a**
**RAGS D IEUBK LEAD WORKSHEET**
**Child (Age 12 – 72 Months)**
Expanded Site Investigation Report – AOC D
Naval Research Laboratory - Chesapeake Bay Detachment, Chesapeake Beach, Maryland

## 1. Lead Screening Questions

| Medium | Lead Concentration Used in Model Run | | Basis for Lead Concentration Used For Model Run | Lead Screening Concentration | | Basis for Lead Screening Level |
|---|---|---|---|---|---|---|
| | Value | Units | | Value | Units | |
| Surface Soil | 1306 | mg/kg | Average Detected Value in Soil | 400 | mg/kg | Recommended Soil Screening Level |
| Water | 4 | µg/L | Default Model Value | 15 | µg/L | Recommended Drinking Water Action Level |

## 2. Lead Model Questions

| Question | Response for Residential Lead Model |
|---|---|
| What lead model (version and date was used)? | Lead Model for Windows, Version 1.1 Build 11 (February, 2010) |
| Where are the input values located in the risk assessment report? | Located in IEUBKwin OUTPUT (Attached as Table Lead.1b and Figure Lead 1) |
| What range of media concentrations were used for the model? | 100 – 3000 mg/kg (surface soil) |
| What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics? | Arithmetic Mean Concentration; Data are located in Appendix D. |
| Was soil sample taken from top 2 cm? If not, why? | Yes |
| Was soil sample sieved? What size screen was used? If not sieved, provide rationale. | No – Samples were collected for multiple analyses. |
| What was the point of exposure/location? | AOC D |
| Where are the output values located in the risk assessment report? | IEUBKwin OUTPUT (Attached as Table Lead.2b and Figure Lead.2) |
| Was the model run using default values only? | No – Assumed site-specific arithmetic mean concentration of lead in subsurface soil and groundwater, and maternal blood lead concentration of 0.6 µg Pb/dL. |
| Was the default soil bioavailability used? | Yes -- Default is 30% |
| Was the default soil ingestion rate used? | Yes -- Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day |
| If non-default values were used, where is the rationale for the values located in the risk assessment report? | Section 5. |

## 3. Final Result

| Medium | Result | Comment/PRG [1] |
|---|---|---|
| Subsurface soil and groundwater | 1306 mg/kg lead in subsurface soil results in 62.8 % of children above a blood lead level of 10 µg/dL. Geometric mean blood lead = 11.7 µg/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 µg/dL blood lead. | PRG not calculated. |

**1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see [www.epa.gov/superfund/programs/lead](www.epa.gov/superfund/programs/lead)**

## Table Lead.3a
## RAGS D ADULT LEAD WORKSHEET
## Calculations of Blood Lead Concentrations – Industrial Worker
Expanded Site Investigation Report – AOC D
Naval Research Laboratory - Chesapeake Bay Detachment, Chesapeake Beach, Maryland

**1. Lead Screening Questions**

|  | Lead Concentration used in Model Run |  | Basis for Lead Concentration Used For Model Run | Lead Screening Concentration |  |  |
|---|---|---|---|---|---|---|
| Medium | Value | Units |  | Value | Units | Basis for Lead Screening Level |
| Surface Soil | 1306 | mg/kg | Average Detected Value | 400 | mg/kg | Recommended Soil Screening Level |

**2. Lead Model Questions**

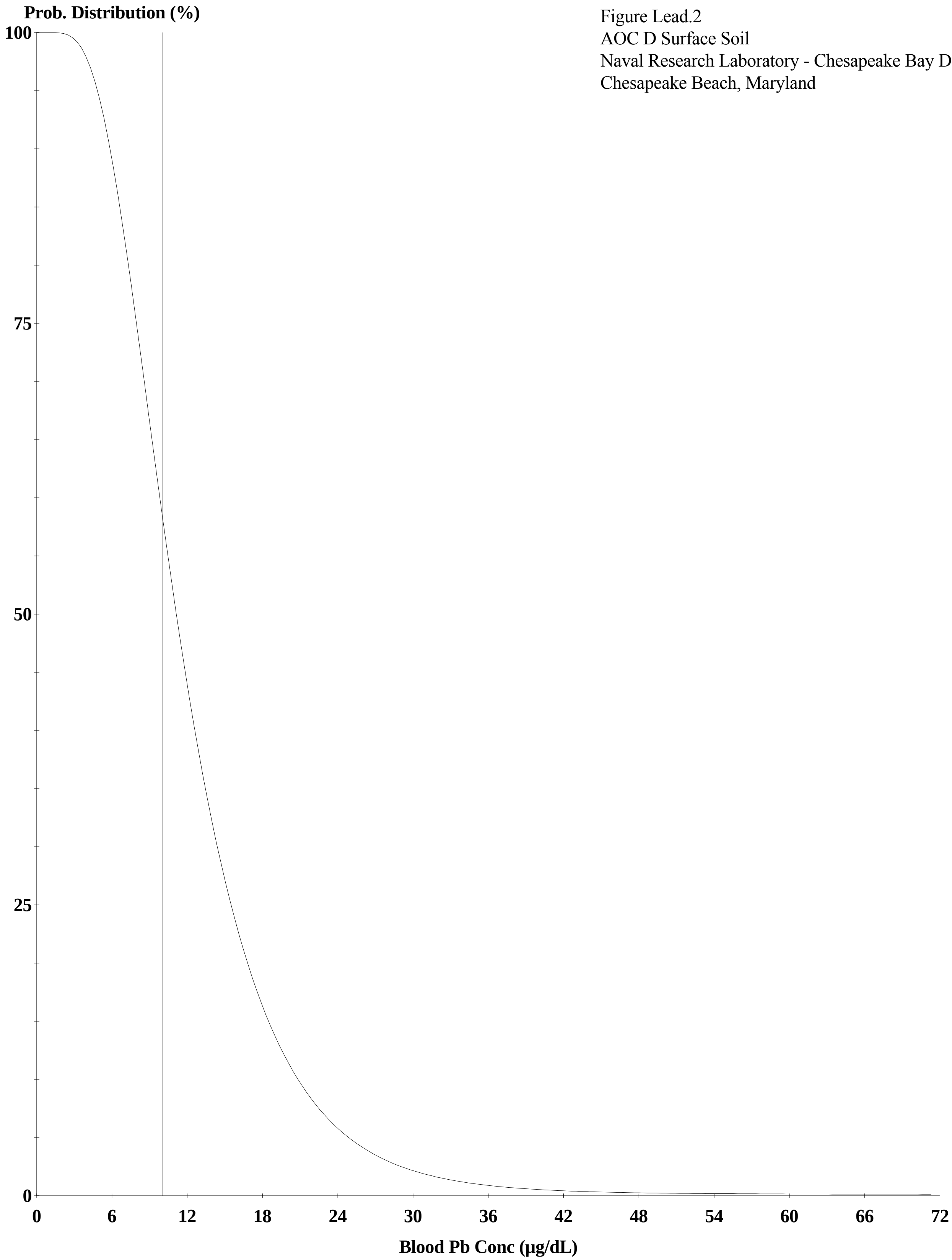
| Question | Response |
|---|---|
| What lead model was used? Provide reference and version | USEPA Adult Lead Model, Version dated 6/14/2017 |
| If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected. | N/A |
| Where are the input values located in the risk assessment report? | Table Lead.3b |
| What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics? | Mean surface soil concentration; See Appendix D. |
| What was the point of exposure and location? | AOC D |
| Where are the output values located in the risk assessment report? | Attached as Table Lead.3b |
| What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix. | Default values were used (1.7 through 2.1). |
| What baseline blood lead concentration ($PbB_0$) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix. | Default values from ALM were used (0.6 through 1.5 ug/dL). |
| Was the default exposure frequency (EF; 219 days/year) used? | Yes |
| Was the default BKSF used (0.4 ug/dL per ug/day) used? | Yes |
| Was the default absorption fraction (AF; 0.12) used? | Yes |
| Was the default soil ingestion rate (IR; 50 mg/day) used? | Yes |
| If non-default values were used for any of the parameters listed above, where is the rationale for the values located in the risk assessment report? | Default values were used. |

**3. Final Result**

| Medium | Result | Comment/RBRG [1] |
|---|---|---|
| Soil | 1305 mg/kg lead soil results in geometric mean blood lead levels ranging from 2.5 to 3.4 ug/dL for women of child-bearing age in homogeneous and heterogeneous populations. The 95th percentile fetal blood lead concentrations range from 5.6 to 10.3 ug/dL. The probabilities that the fetal blood lead levels exceed 10 ug/dL range from 0.5 % to 5.4%. The upper end of the range slightly exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead. | PRG not calculated. |

**1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see [www.epa.gov/superfund/programs/lead](www.epa.gov/superfund/programs/lead)**

Figure Lead.2
AOC D Surface Soil
Naval Research Laboratory - Chesapeake Bay Detachment,
Chesapeake Beach, Maryland



**Cutoff = 10.000 µg/dl**
**Geo Mean = 11.664**
**GSD = 1.600**
**% Above = 62.836**

**Age Range = User Designated: Ages 12 - 72 months**

**Run Mode = Site Risk Assessment**
**Comment = mat blood**

# Appendix G
# Ecological Risk Screening Tables

TABLE 1

## Ecological Surface Soil Screening Values

*Expanded Site Investigation Report*

***NRL-CBD, Chesapeake Beach, Maryland***

| Chemical | Screening Value and Source | |
|---|---|---|
| **Inorganics (MG/KG)** | | |
| Aluminum | NSV | -- |
| Antimony | 5.0 | USEPA 2005 |
| Arsenic | 7 | USEPA 2005 |
| Barium | 110 | USEPA 2005 |
| Beryllium | 2.5 | USEPA 2005 |
| Cadmium | 32.0 | USEPA 2005 |
| Calcium | NSV | -- |
| Chromium (hexavalent) | 0.4 | Efroymson et al. 1997a |
| Chromium | 10.0 | USEPA 1995 |
| Cobalt | 13.0 | USEPA 2005 |
| Copper | 70.0 | USEPA 2007 |
| Cyanide | 1.0 | MHSPE 2000 |
| Iron | NSV | -- |
| Lead | 120 | USEPA 2005 |
| Magnesium | NSV | -- |
| Manganese | 220 | USEPA 2007 |
| Mercury | 0.05 | USEPA 2007 |
| Nickel | 38 | USEPA 2007 |
| Potassium | NSV | -- |
| Selenium | 0.52 | USEPA 2007 |
| Silver | 560 | USEPA 2006 |
| Sodium | NSV | -- |
| Thallium | 0.05 | USEPA 1995 |
| Vanadium | 60 | USEPA 1995 |
| Zinc | 120 | USEPA 2007 |
| **Polychlorinated Biphenyls (UG/KG)** [1] | | |
| Aroclor-1016 | 160 | LANL, 2017 |
| Aroclor-1221 | 160 | LANL, 2017 |
| Aroclor-1232 | 160 | LANL, 2017 |
| Aroclor-1242 | 160 | LANL, 2017 |
| Aroclor-1248 | 160 | LANL, 2017 |
| Aroclor-1254 | 160 | LANL, 2017 |
| Aroclor-1260 | 160 | LANL, 2017 |
| Aroclor-1262 | 160 | LANL, 2017 |
| Aroclor-1268 | 160 | LANL, 2017 |
| **Pesticides (UG/KG)** | | |
| 4,4'-DDD | 100 | USEPA 1995 |
| 4,4'-DDE | 100 | USEPA 1995 |
| 4,4'-DDT | 100 | USEPA 1995 |
| Aldrin | 100 | USEPA 1995 |
| alpha-BHC | NSV | -- |
| alpha-Chlordane | 2.2 | LANL, 2017 |
| beta-BHC | NSV | -- |
| delta-BHC | NSV | -- |
| Dieldrin | 100 | USEPA 1995 |
| Endosulfan I | NSV | -- |

NSV - No Screening Value

[1] - Stated criteria compared to mean site-specific soil pH

TABLE 1

**Ecological Surface Soil Screening Values**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Chemical | Screening Value and Source | |
|---|---|---|
| Endosulfan II | NSV | -- |
| Endosulfan sulfate | NSV | -- |
| Endrin | 100 | USEPA 1995 |
| Endrin aldehyde | NSV | -- |
| Endrin ketone | NSV | -- |
| gamma-BHC (Lindane) | 100 | USEPA 1995 |
| Heptachlor | 400 | LANL, 2017 |
| Heptachlor epoxide | 100 | USEPA 1995 |
| Methoxychlor | 100 | USEPA 1995 |
| Toxaphene | NSV | -- |
| **Semivolatile Organic Compounds (UG/KG)** | | |
| 1,1-Biphenyl | 60,000 | Efroymson et al. 1997b |
| 1,2,4,5-Tetrachlorobenzene | NSV | -- |
| 2,2'-Oxybis(1-chloropropane) | NSV | -- |
| 2,3,4,6-Tetrachlorophenol | NSV | -- |
| 2,4,5-Trichlorophenol | 100 | USEPA 1995 |
| 2,4,6-Trichlorophenol | 100 | USEPA 1995 |
| 2,4-Dichlorophenol | 100 | USEPA 1995 |
| 2,4-Dimethylphenol | 100 | USEPA 1995 |
| 2,4-Dinitrophenol | 100 | USEPA 1995 |
| 2,4-Dinitrotoluene | NSV | -- |
| 2,6-Dinitrotoluene | NSV | -- |
| 2-Chloronaphthalene | NSV | -- |
| 2-Chlorophenol | 100 | USEPA 1995 |
| 2-Methylnaphthalene | NSV | See LMW PAHs |
| 2-Methylphenol | 100 | USEPA 1995 |
| 2-Nitroaniline | NSV | -- |
| 2-Nitrophenol | NSV | -- |
| 3,3'-Dichlorobenzidine | NSV | -- |
| 3-Nitroaniline | NSV | -- |
| 4,6-Dinitro-2-methylphenol | NSV | -- |
| 4-Bromophenyl-phenylether | NSV | -- |
| 4-Chloro-3-methylphenol | NSV | -- |
| 4-Chloroaniline | NSV | -- |
| 4-Chlorophenyl-phenylether | NSV | -- |
| 4-Methylphenol | 100 | USEPA 1995 |
| 4-Nitroaniline | NSV | -- |
| 4-Nitrophenol | 100 | USEPA 1995 |
| Acenaphthene | NSV | See LMW PAHs |
| Acenaphthylene | NSV | See LMW PAHs |
| Acetophenone | NSV | -- |
| Anthracene | NSV | See LMW PAHs |
| Atrazine | NSV | -- |
| Benzaldehyde | NSV | -- |
| Benzo(a)anthracene | NSV | See HMW PAHs |
| Benzo(a)pyrene | NSV | See HMW PAHs |
| Benzo(b)fluoranthene | NSV | See HMW PAHs |

NSV - No Screening Value

1 - Stated criteria compared to mean site-specific soil pH

TABLE 1

**Ecological Surface Soil Screening Values**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Chemical | Screening Value and Source | |
|---|---|---|
| Benzo(g,h,i)perylene | NSV | See HMW PAHs |
| Benzo(k)fluoranthene | NSV | See HMW PAHs |
| bis(2-Chloroethoxy)methane | NSV | -- |
| bis(2-Chloroethyl)ether | NSV | -- |
| bis(2-Ethylhexyl)phthalate | NSV | -- |
| Butylbenzylphthalate | NSV | -- |
| Caprolactam | NSV | -- |
| Carbazole | NSV | -- |
| Chrysene | NSV | See HMW PAHs |
| Dibenz(a,h)anthracene | NSV | See HMW PAHs |
| Dibenzofuran | NSV | -- |
| Diethylphthalate | 100,000 | Efroymson et al. 1997b |
| Dimethyl phthalate | 200,000 | Efroymson et al. 1997a |
| Di-n-butylphthalate | 200,000 | Efroymson et al. 1997b |
| Di-n-octylphthalate | NSV | -- |
| Fluoranthene | NSV | See HMW PAHs |
| Fluorene | NSV | See LMW PAHs |
| Hexachlorobenzene | 1,000,000 | Efroymson et al. 1997a |
| Hexachlorobutadiene | NSV | -- |
| Hexachlorocyclopentadiene | 10,000 | Efroymson et al. 1997b |
| Hexachloroethane | NSV | -- |
| Indeno(1,2,3-cd)pyrene | NSV | See HMW PAHs |
| Isophorone | NSV | -- |
| Naphthalene | NSV | See LMW PAHs |
| Nitrobenzene | 40,000 | Efroymson et al. 1997b |
| n-Nitroso-di-n-propylamine | NSV | -- |
| n-Nitrosodiphenylamine | 20,000 | Efroymson et al. 1997a |
| Low Molecular Weight PAHs1 | 29,000 | USEPA 2007 |
| High Molecular Weight PAHs2 | 1,100 | USEPA 2007 |
| Pentachlorophenol | 5,000 | USEPA 2007 |
| Phenanthrene | NSV | See LMW PAHs |
| Phenol | 100 | USEPA 1995 |
| Pyrene | NSV | See HMW PAHs |
| **Volatile Organic Compounds (UG/KG)** | | |
| 1,1,1-Trichloroethane | 300 | USEPA 1995 |
| 1,1,2,2-Tetrachloroethane | 300 | USEPA 1995 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-11 | NSV | -- |
| 1,1,2-Trichloroethane | 300 | USEPA 1995 |
| 1,1-Dichloroethane | 300 | USEPA 1995 |
| 1,1-Dichloroethene | NSV | -- |
| 1,2,3-Trichlorobenzene | NSV | -- |
| 1,2,4-Trichlorobenzene | 100 | USEPA 1995 |
| 1,2-Dibromo-3-chloropropane | NSV | -- |
| 1,2-Dibromoethane | 5,000 | USEPA 1995 |
| 1,2-Dichlorobenzene | 100 | USEPA 1995 |
| 1,2-Dichloroethane | 870,000 | USEPA 1995 |
| 1,2-Dichloropropane | 300 | USEPA 1995 |

NSV - No Screening Value

1 - Stated criteria compared to mean site-specific soil pH

TABLE 1

**Ecological Surface Soil Screening Values**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Chemical | Screening Value and Source | |
|---|---|---|
| 1,3-Dichlorobenzene | NSV | -- |
| 1,4-Dichlorobenzene | 100 | USEPA 1995 |
| 2-Butanone | NSV | -- |
| 2-Hexanone | 12,600 | USEPA 2003 |
| 4-Methyl-2-pentanone | 100,000 | USEPA 1995 |
| Acetone | NSV | -- |
| Benzene | 100 | USEPA 1995 |
| Bromochloromethane | NSV | -- |
| Bromodichloromethane | NSV | -- |
| Bromoform | 1,147,000 | USEPA 1995 |
| Bromomethane | NSV | -- |
| Carbon disulfide | 94.1 | USEPA 2003 |
| Carbon tetrachloride | 300 | USEPA 1995 |
| Chlorobenzene | 100 | USEPA 1995 |
| Chloroethane | NSV | -- |
| Chloroform | 300 | USEPA 1995 |
| Chloromethane | NSV | -- |
| cis-1,2-Dichloroethene | 300 | USEPA 1995 |
| cis-1,3-Dichloropropene | 300 | USEPA 1995 |
| Cyclohexane | NSV | -- |
| Dibromochloromethane | NSV | -- |
| Dichlorodifluoromethane (Freon-12) | NSV | -- |
| Ethylbenzene | 100 | USEPA 1995 |
| Isopropylbenzene | NSV | -- |
| m- and p-Xylene | 100 | USEPA 1995 |
| Methyl acetate | NSV | -- |
| Methylcyclohexane | NSV | -- |
| Methylene chloride | 300 | USEPA 1995 |
| Methyl-tert-butyl ether (MTBE) | NSV | -- |
| o-Xylene | 100 | USEPA 1995 |
| Styrene | 100 | USEPA 1995 |

NSV - No Screening Value

1 - Stated criteria compared to mean site-specific soil pH

TABLE 1

**Ecological Surface Soil Screening Values**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Chemical | Screening Value and Source | |
|---|---|---|
| Tetrachloroethene | 300 | USEPA 1995 |
| Toluene | 100 | USEPA 1995 |
| Total Cresols | NSV | -- |
| trans-1,2-Dichloroethene | 300 | USEPA 1995 |
| trans-1,3-Dichloropropene | 300 | USEPA 1995 |
| Trichloroethene | 300 | USEPA 1995 |
| Trichlorofluoromethane (Freon-11) | 16,400 | USEPA 2003 |
| Vinyl chloride | 300 | USEPA 1995 |

Notes

HMW PAHs - High molecular weight PAHs

LMW PAHs - Low molecular weight PAHs

1 - Aroclor-1254 was used as a surrogate for all aroclors

NSV - No Screening Value

1 - Stated criteria compared to mean site-specific soil pH

TABLE 2

**Surface Soil Data Used in the ERA**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| **Site** | **Sample ID** | **Depth (feet)** | **Date Collected** |
|---|---|---|---|
| AOD | CBD-AOD-DP05 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP07 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP10 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP11* | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP12* | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP13 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP13* | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP18 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP19 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP21 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-DP25 | 0-0.5 | 4/11/2018 |
|  | CBD-AOD-SO01 | 0-0.5 | 10/15/2012 |
|  | CBD-AOD-SO01* | 0-0.5 | 10/15/2012 |
|  | CBD-AOD-SO02 | 0-0.5 | 10/15/2012 |
|  | CBD-AOD-SO03 | 0-0.5 | 10/15/2012 |
|  | CBD-AOD-SO04 | 0-0.5 | 10/15/2012 |
| Site 3 | CBD-S03-DP01 | 0-0.5 | 10/17/2012 |
|  | CBD-S03-DP02 | 0-0.5 | 10/17/2012 |
|  | CBD-S03-DP03 | 0-0.5 | 10/17/2012 |
|  | CBD-S03-DP04 | 0-0.5 | 10/17/2012 |
|  | CBD-S03-DP05 | 0-0.5 | 10/17/2012 |
|  | CBD-S03-DP06 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP07 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP08 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP09 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP10 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP11* | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP12 | 0-0.5 | 4/4/2018 |
|  | CBD-S03-DP13 | 0-0.5 | 4/3/2018 |
|  | CBD-S03-DP14 | 0-0.5 | 4/4/2018 |
|  | CBD-S03-DP15 | 0-0.5 | 4/3/2018 |
| Site 4 | CBD-S04-DP01* | 0-0.5 | 10/18/2012 |
|  | CBD-S04-DP02 | 0-0.5 | 10/18/2012 |
|  | CBD-S04-DP03 | 0-0.5 | 10/18/2012 |
|  | CBD-S04-DP04 | 0-0.5 | 10/18/2012 |
|  | CBD-S04-DP05 | 0-0.5 | 10/18/2012 |
|  | CBD-S04-SO06 | 0-0.5 | 10/18/2012 |
|  | CBD-S04-DP07 | 0-0.5 | 4/5/2018 |
|  | CBD-S04-DP08 | 0-0.5 | 4/5/2018 |
|  | CBD-S04-DP09 | 0-0.5 | 4/4/2018 |
|  | CBD-S04-DP10 | 0-0.5 | 4/4/2018 |
|  | CBD-S04-DP11 | 0-0.5 | 4/5/2018 |

TABLE 2

**Surface Soil Data Used in the ERA**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Site | Sample ID | Depth (feet) | Date Collected |
|---|---|---|---|
| | CBD-S04-DP12 | 0-0.5 | 4/5/2018 |
| | CBD-S04-DP13* | 0-0.5 | 4/5/2018 |
| | CBD-S04-DP14 | 0-0.5 | 4/5/2018 |
| | CBD-S04-DP15 | 0-0.5 | 4/5/2018 |
| | CBD-S04-DP16 | 0-0.5 | 4/5/2018 |
| Site 5 | CBD-S05-DP01* | 0-0.5 | 10/18/2012 |
| | CBD-S05-DP02 | 0-0.5 | 10/19/2012 |
| | CBD-S05-DP03 | 0-0.5 | 10/18/2012 |
| | CBD-S05-DP04 | 0-0.5 | 10/19/2012 |
| | CBD-S05-DP05 | 0-0.5 | 10/19/2012 |
| | CBD-S05-SO06 | 0-0.5 | 10/19/2012 |
| | CBD-S05-DP07 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP08 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP09 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP10 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP11 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP12 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP13* | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP14 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP15 | 0-0.5 | 4/5/2018 |
| | CBD-S05-DP16 | 0-0.5 | 4/5/2018 |
| | CBD-S05-SS17 | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS18* | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS19 | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS20 | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS21 | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS22 | 0-0.5 | 4/6/2018 |
| | CBD-S05-SS23 | 0-0.5 | 4/6/2018 |
| Site 7 | CBD-S07-DP01* | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP02 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP03 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP04 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP05 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP06 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP07 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP08 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP09 | 0-0.5 | 10/22/2012 |
| | CBD-S07-DP20 | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP21* | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP22 | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP23 | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP24 | 0-0.5 | 4/3/2018 |

TABLE 2

**Surface Soil Data Used in the ERA**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Site | Sample ID | Depth (feet) | Date Collected |
|---|---|---|---|
| | CBD-S07-DP25 | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP26 | 0-0.5 | 4/3/2018 |
| | CBD-S07-DP27 | 0-0.5 | 4/4/2018 |
| Site 9 | CBD-S09-DP01* | 0-0.5 | 10/12/2012 |
| | CBD-S09-DP02 | 0-0.5 | 10/12/2012 |
| | CBD-S09-DP03 | 0-0.5 | 10/12/2012 |
| | CBD-S09-DP04 | 0-0.5 | 10/12/2012 |
| | CBD-S09-DP05 | 0-0.5 | 4/4/2018 |
| | CBD-S09-DP06* | 0-0.5 | 4/4/2018 |
| | CBD-S09-DP07 | 0-0.5 | 4/4/2018 |
| | CBD-S09-DP08 | 0-0.5 | 4/4/2018 |
| | CBD-S09-DP09 | 0-0.5 | 4/4/2018 |
| | CBD-S09-DP10 | 0-0.5 | 4/4/2018 |

Notes

* analytes with field duplicates.

TABLE 3

**Hazard Quotients for Analytes in Surface Soil at Site 3**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background[3]** | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOA (UG/KG)** | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 / 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2,2-Tetrachloroethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 1,1,2-Trichloroethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethane | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 300 | 0.001 | 0.000 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 1,2,3-Trichlorobenzene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 1,2,4-Trichlorobenzene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.00 | -- | No | HQ(s) less than one |
| 1,2-Dibromo-3-chloropropane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 1,2-Dibromoethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 5000 | 0.0001 | 0.0001 | -- | No | HQ(s) less than one |
| 1,2-Dichlorobenzene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.00 | -- | No | HQ(s) less than one |
| 1,2-Dichloroethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 870000 | 0.000001 | 0.000000 | -- | No | HQ(s) less than one |
| 1,2-Dichloropropane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,3-Dichlorobenzene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 1,4-Dichlorobenzene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| 2-Butanone | 0.55 | 1.7 | -- | -- | 0.85 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| 2-Hexanone | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 12600 | 0.00004 | 0.00002 | -- | No | HQ(s) less than one |
| 4-Methyl-2-pentanone | -- | -- | 0.44 | 3 | 1.72 | Average | 2 5 | 100000 | 0.00003 | 0.00002 | -- | No | HQ(s) less than one |
| Acetone | -- | -- | 65 | 65 | 65 | Average | 1 5 | NSV | -- | -- | -- | No | Uncertainty |
| Benzene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.00 | -- | No | HQ(s) less than one |
| Bromochloromethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Bromodichloromethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | HQ(s) less than one |
| Bromoform | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 1147000 | 0.0000002 | 0.0000001 | -- | No | HQ(s) less than one |
| Bromomethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Carbon disulfide | 0.4 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 5 | 94.1 | 0.01 | 0.00 | -- | No | HQ(s) less than one |
| Carbon tetrachloride | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 300 | 0.001 | 0.000 | -- | No | HQ(s) less than one |
| Chlorobenzene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| Chloroethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Chloroform | -- | -- | 0.14 | 0.14 | 0.14 | Average | 1 5 | 300 | 0.0005 | 0.0005 | -- | No | HQ(s) less than one |
| Chloromethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| cis-1,2-Dichloroethene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| cis-1,3-Dichloropropene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Cyclohexane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Dibromochloromethane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Dichlorodifluoromethane (Freon-12) | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Ethylbenzene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.003 | -- | No | HQ(s) less than one |
| Isopropylbenzene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| m- and p-Xylene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.003 | -- | No | HQ(s) less than one |
| Methyl acetate | 1.3 | 2.6 | -- | -- | 1.3 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Methylcyclohexane | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| Methylene chloride | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Methyl-tert-butyl ether (MTBE) | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | NSV | -- | -- | -- | No | Not detected |
| o-Xylene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| Styrene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| Tetrachloroethene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Toluene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 100 | 0.01 | 0.003 | -- | No | HQ(s) less than one |
| trans-1,2-Dichloroethene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 5 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| trans-1,3-Dichloropropene | 0.42 | 0.55 | -- | -- | 0.275 | 1/2 Max MDL | 0 5 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |

TABLE 3

**Hazard Quotients for Analytes in Surface Soil at Site 3**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trichloroethene | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 | 5 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Trichlorofluoromethane (Freon-11) | -- | -- | 0.28 | 0.28 | 0.28 | Average | 1 | 5 | 16400 | 0.00002 | 0.00002 | -- | No | HQ(s) less than one |
| Vinyl chloride | 0.21 | 0.28 | -- | -- | 0.14 | 1/2 Max MDL | 0 | 5 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| **SVOA (UG/KG)** | | | | | | | | | | | | | | |
| 1,1-Biphenyl | 18 | 640 | -- | -- | 320 | 1/2 Max MDL | 0 | 10 | 60000 | 0.0 | 0.01 | -- | No | Not detected |
| 1,2,4,5-Tetrachlorobenzene | 1.8 | 1.8 | -- | -- | 0.9 | 1/2 Max MDL | 0 | 5 | NSV | -- | -- | -- | No | Not detected |
| 2,2'-Oxybis(1-chloropropane) | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 2,3,4,6-Tetrachlorophenol | 3.6 | 3.7 | -- | -- | 1.85 | 1/2 Max MDL | 0 | 5 | NSV | -- | -- | -- | No | Not detected |
| 2,4,5-Trichlorophenol | 18 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2,4,6-Trichlorophenol | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2,4-Dichlorophenol | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2,4-Dimethylphenol | 36 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2,4-Dinitrophenol | 180 | 2150 | -- | -- | 1075 | 1/2 Max MDL | 0 | 10 | 100 | 22 | 11 | -- | No | Not detected |
| 2,4-Dinitrotoluene | 18 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 2,6-Dinitrotoluene | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Chloronaphthalene | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Chlorophenol | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2-Methylnaphthalene | 1.8 | 3 | -- | -- | 1.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| 2-Methylphenol | 7.2 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| 2-Nitroaniline | 18 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Nitrophenol | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 3,3'-Dichlorobenzidine | 155 | 370 | -- | -- | 185 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 3-Nitroaniline | 36 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4,6-Dinitro-2-methylphenol | 18 | 2150 | -- | -- | 1075 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Bromophenyl-phenylether | 1.8 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloro-3-methylphenol | 7.2 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloroaniline | 18 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chlorophenyl-phenylether | 1.8 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Methylphenol | 3.6 | 3.7 | -- | -- | 1.85 | 1/2 Max MDL | 0 | 5 | 100 | 0.04 | 0.02 | -- | No | HQ(s) less than one |
| 4-Nitroaniline | 36 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Nitrophenol | 36 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | 100 | 4.3 | 2.2 | -- | No | Not detected |
| Acenaphthene | -- | -- | 0.76 | 1.5 | 1.023333333 | Average | 3 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acenaphthylene | -- | -- | 0.69 | 12 | 4.83 | Average | 3 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acetophenone | 18 | 210 | -- | -- | 105 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Anthracene | -- | -- | 2.6 | 13 | 7.8 | Average | 2 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Atrazine | 18 | 640 | -- | -- | 320 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Benzo(a)anthracene | -- | -- | 15 | 29 | 22 | Average | 2 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(a)pyrene | -- | -- | 2.9 | 48 | 26.58333333 | Average | 6 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(b)fluoranthene | -- | -- | 15 | 97 | 56.62 | 95% KM (t) UCL | 3 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(g,h,i)perylene | -- | -- | 9.1 | 42 | 23.36666667 | Average | 3 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(k)fluoranthene | -- | -- | 13 | 30 | 21.5 | Average | 2 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| bis(2-Chloroethoxy)methane | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Chloroethyl)ether | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Ethylhexyl)phthalate | 8.5 | 853 | -- | -- | 426.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Butylbenzylphthalate | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Caprolactam | 18 | 5400 | -- | -- | 2700 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Carbazole | 36 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Chrysene | -- | -- | 24 | 47 | 35.5 | Average | 2 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Dibenz(a,h)anthracene | -- | -- | 3.7 | 10 | 6.16 | Average | 5 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |

TABLE 3

**Hazard Quotients for Analytes in Surface Soil at Site 3**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background$^{3}$** | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dibenzofuran | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Diethylphthalate | 5.9 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100000 | 0.00 | 0.00 | -- | No | HQ(s) less than one |
| Dimethyl phthalate | 3.6 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | 200000 | 0.00 | 0.00 | -- | No | HQ(s) less than one |
| Di-n-butylphthalate | 18 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 200000 | 0.001 | 0.001 | -- | No | HQ(s) less than one |
| Di-n-octylphthalate | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Fluoranthene | -- | -- | 29 | 52 | 40.5 | Average | 2 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Fluorene | -- | -- | 1.1 | 2.1 | 1.466666667 | Average | 3 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Hexachlorobenzene | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 1000000 | 0.0002 | 0.0001 | -- | No | HQ(s) less than one |
| Hexachlorobutadiene | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Hexachlorocyclopentadiene | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 10000 | 0.0 | 0.0 | -- | No | Not detected |
| Hexachloroethane | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Indeno(1,2,3-cd)pyrene | -- | -- | 10 | 51 | 30 | Average | 4 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Isophorone | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| Naphthalene | 1.8 | 3 | -- | -- | 1.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| n-Nitroso-di-n-propylamine | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | NSV | -- | -- | -- | No | Not detected |
| n-Nitrosodiphenylamine | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 20000 | 0.0 | 0.0 | -- | No | Not detected |
| Nitrobenzene | 1.8 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 40000 | 0.01 | 0.00 | -- | No | HQ(s) less than one |
| Pentachlorophenol | 36 | 430 | -- | -- | 215 | 1/2 Max MDL | 0 | 10 | 5000 | 0 | 0 | -- | No | Not detected |
| Phenanthrene | -- | -- | 6.6 | 21 | 13.65 | Average | 4 | 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Phenol | 3.6 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 10 | 100 | 2.2 | 1.1 | -- | No | Not detected |
| Pyrene | -- | -- | 3.4 | 68 | 30.06 | Average | 5 | 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Total cresols | 155 | 215 | -- | -- | 107.5 | 1/2 Max MDL | 0 | 5 | NSV | -- | -- | -- | No | Not detected |
| Low Molecular Weight PAHs$^{1}$ | -- | -- | 0.69 | 40.91 | 18.29 | 95% KM (t) UCL⍰ | -- | -- | 29000 | 0.001 | 0.001 | -- | No | HQ(s) less than one |
| High Molecular Weight PAHs$^{2}$ | -- | -- | 0 | 447 | 181.10 | 95% KM (t) UCL⍰ | -- | -- | 1,100 | 0.41 | 0.16 | -- | No | HQ(s) less than one |
| **PEST/PCB (UG/KG)** | | | | | | | | 0 | | | | | | |
| 4,4'-DDD | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| 4,4'-DDE | -- | -- | 2.73 | 13.5 | 5.602 | 95% KM (t) UCL | 3 | 9 | 100 | 0.1 | 0.1 | -- | No | HQ(s) less than one |
| 4,4'-DDT | 0.26 | 0.599 | -- | -- | 0.2995 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Aldrin | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| alpha-BHC | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| alpha-Chlordane | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 2.2 | 0.14 | 0.07 | -- | No | HQ(s) less than one |
| Aroclor-1016 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1221 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1232 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1242 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1248 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1254 | 6.6 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 10 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1260 | -- | -- | 41 | 5500 | 3248 | 95% Adjusted Gamma UCL | 10 | 10 | 160 | 34 | 20 | -- | Yes | HQ(s) greater than one |
| Aroclor-1262 | 14 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 5 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| Aroclor-1268 | 14 | 290 | -- | -- | 145 | 1/2 Max MDL | 0 | 5 | 160 | 1.8 | 0.9 | -- | No | Not detected |
| beta-BHC | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| delta-BHC | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| Dieldrin | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Endosulfan I | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan II | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan sulfate | 0.26 | 0.599 | -- | -- | 0.2995 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| Endrin | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Endrin aldehyde | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| Endrin ketone | 0.26 | 0.599 | -- | -- | 0.2995 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |

TABLE 3

**Hazard Quotients for Analytes in Surface Soil at Site 3**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| gamma-BHC (Lindane) | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Heptachlor | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 400 | 0.00 | 0.00 | -- | No | HQ(s) less than one |
| Heptachlor epoxide | 0.13 | 0.299 | -- | -- | 0.1495 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Methoxychlor | 0.26 | 0.599 | -- | -- | 0.2995 | 1/2 Max MDL | 0 | 8 | 100 | 0.0 | 0.0 | -- | No | Not detected |
| Toxaphene | 13 | 29.9 | -- | -- | 14.95 | 1/2 Max MDL | 0 | 8 | NSV | -- | -- | -- | No | Not detected |
| **METAL (MG/KG)** | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 4500 | 7900 | 6160 | Average | 10 | 10 | NSV | -- | -- | 9340 | No | Consistent with background |
| Antimony | -- | -- | 0.076 | 0.9 | 0.2476 | Average | 10 | 10 | 5 | 0.18 | 0.05 | -- | No | HQ(s) less than one |
| Arsenic | -- | -- | 1.2 | 14 | 3.68 | Average | 10 | 10 | 6.8 | 2.06 | 0.54 | 6.24 | No | EPC-based HQ less than one |
| Barium | -- | -- | 9.8 | 44 | 31.28 | Average | 10 | 10 | 110 | 0.40 | 0.28 | 105 | No | HQ(s) less than one |
| Beryllium | -- | -- | 0.24 | 0.64 | 0.41 | Average | 10 | 10 | 2.5 | 0.26 | 0.16 | 1.04 | No | HQ(s) less than one |
| Cadmium | -- | -- | 0.055 | 1.7 | 0.3366 | Average | 10 | 10 | 32 | 0.05 | 0.01 | 1.09 | No | HQ(s) less than one |
| Calcium | -- | -- | 180 | 780000 | 78757.6 | Average | 10 | 10 | NSV | -- | -- | 3560 | No | Macronutrient |
| Chromium (hexavalent) | -- | -- | 0.15 | 0.15 | 0.15 | Average | 1 | 1 | 0.4 | 0.38 | 0.38 | -- | No | HQ(s) less than one |
| Chromium | -- | -- | 6.2 | 16 | 12.31 | 95% Student's-t UCL | 10 | 10 | 10 | 2 | 1 | 27.3 | No | Consistent with background |
| Cobalt | -- | -- | 1.4 | 3.9 | 2.51 | Average | 10 | 10 | 13 | 0.30 | 0.19 | 5.41 | No | HQ(s) less than one |
| Copper | -- | -- | 1.9 | 16 | 5.46 | Average | 10 | 10 | 70 | 0.23 | 0.08 | 43.6 | No | HQ(s) less than one |
| Cyanide | -- | -- | 0.043 | 0.043 | 0.043 | Average | 1 | 5 | 1 | 0.04 | 0.04 | -- | No | HQ(s) less than one |
| Iron | -- | -- | 5600 | 10000 | 8270 | Average | 10 | 10 | NSV | -- | -- | 17300 | No | Consistent with background |
| Lead | -- | -- | 2.9 | 95 | 18.63 | Average | 10 | 10 | 120 | 0.79 | 0.16 | 95.8 | No | HQ(s) less than one |
| Magnesium | -- | -- | 480 | 797000 | 80359.3 | Average | 10 | 10 | NSV | -- | -- | 1830 | No | Macronutrient |
| Manganese | -- | -- | 20 | 160 | 96.4 | Average | 10 | 10 | 220 | 0.73 | 0.44 | 208 | No | HQ(s) less than one |
| Mercury | -- | -- | 0.0078 | 0.012 | 0.010075 | Average | 4 | 10 | 0.05 | 0.24 | 0.20 | 0.99 | No | HQ(s) less than one |
| Nickel | -- | -- | 2.3 | 10 | 6.68 | Average | 10 | 10 | 38 | 0.26 | 0.18 | 15.1 | No | HQ(s) less than one |
| Potassium | -- | -- | 250 | 577000 | 58075.5 | Average | 10 | 10 | NSV | -- | -- | 986 | No | Macronutrient |
| Selenium | -- | -- | 0.25 | 1.3 | 0.916 | 95% KM (t) UCL | 9 | 10 | 0.52 | 2.5 | 1.8 | 2.76 | No | Consistent with background |
| Silver | -- | -- | 0.024 | 0.16 | 0.074333333 | Average | 9 | 10 | 560 | 0.0003 | 0.0001 | 8.7 | No | HQ(s) less than one |
| Sodium | -- | -- | 14.1 | 379000 | 94809.125 | Average | 4 | 10 | NSV | -- | -- | -- | No | Macronutrient |
| Thallium | -- | -- | 0.08 | 0.24 | 0.207 | 95% Student's-t UCL | 10 | 10 | 0.05 | 5 | 4 | 0.441 | No | Consistent with background |
| Vanadium | -- | -- | 8.2 | 18 | 14.56 | 95% Student's-t UCL | 10 | 10 | 60 | 0 | 0 | 26.1 | No | Consistent with background |
| Zinc | -- | -- | 29 | 70 | 42.875 | Average | 8 | 10 | 120 | 0.58 | 0.36 | 142 | No | HQ(s) less than one |

**Notes**

COC - Contaminant of concern

EPC - Exposure point concentration

ESV - Ecological screening value

FOD - Frequency of detection

HQ - Hazard quotient

MDL - Method detection limit

NSV - No screening value

1 - Low Molecular Weight PAHs were assumed to include 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

2 - High Molecular Weight PAHs were assumed to include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

TABLE 4

**Hazard Quotients for Analytes in Surface Soil at Site 4**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOA (UG/KG)** | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2,2-Tetrachloroethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,1,2-Trichloroethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethane | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2,3-Trichlorobenzene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2,4-Trichlorobenzene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 100 | 0.01 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dibromo-3-chloropropane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2-Dibromoethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 5000 | 0.0001 | 0.00006 | -- | No | HQ(s) less than one |
| 1,2-Dichlorobenzene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 100 | 0.006 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dichloroethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 870000 | 7E-07 | 3E-07 | -- | No | HQ(s) less than one |
| 1,2-Dichloropropane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,3-Dichlorobenzene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,4-Dichlorobenzene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| 2-Butanone | 0.42 | 3.80 | -- | -- | 1.9 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2-Hexanone | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 12600 | 5E-05 | 2E-05 | -- | No | HQ(s) less than one |
| 4-Methyl-2-pentanone | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 100000 | 6E-06 | 3E-06 | -- | No | HQ(s) less than one |
| Acetone | -- | -- | 22 | 100 | 61.66667 | Average | 6 / 6 | NSV | -- | -- | -- | No | Uncertainty |
| Benzene | -- | -- | 0.18 | 0.18 | 0.18 | Maximum | 1 / 6 | 100 | 0.002 | 0.002 | -- | No | HQ(s) less than one |
| Bromochloromethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Bromodichloromethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | HQ(s) less than one |
| Bromoform | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 1147000 | 3E-07 | 1E-07 | -- | No | HQ(s) less than one |
| Bromomethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Carbon disulfide | 0.33 | 0.63 | -- | -- | 0.315 | 1/2 Max MDL | 0 / 6 | 94.1 | 0.007 | 0.003 | -- | No | HQ(s) less than one |
| Carbon tetrachloride | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Chlorobenzene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| Chloroethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Chloroform | 0.17 | 0.26 | -- | -- | 0.13 | 1/2 Max MDL | 0 / 6 | 300 | 0.0009 | 0.0004 | -- | No | HQ(s) less than one |
| Chloromethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| cis-1,2-Dichloroethene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| cis-1,3-Dichloropropene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Cyclohexane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Dibromochloromethane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Dichlorodifluoromethane (Freon-12) | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Ethylbenzene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 100 | 0.01 | 0.003 | -- | No | HQ(s) less than one |
| Isopropylbenzene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| m- and p-Xylene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 100 | 0.0057 | 0.00285 | -- | No | HQ(s) less than one |
| Methyl acetate | 1.30 | 6.30 | -- | -- | 3.15 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Methylcyclohexane | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Methylene chloride | 0.43 | 3.70 | -- | -- | 1.85 | 1/2 Max MDL | 0 / 6 | 300 | 0.01 | 0.006 | -- | No | HQ(s) less than one |
| Methyl-tert-butyl ether (MTBE) | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| o-Xylene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 100 | 0.0029 | 0.00145 | -- | No | HQ(s) less than one |
| Styrene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.001 | -- | No | HQ(s) less than one |
| Tetrachloroethene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Toluene | -- | -- | 0.2 | 0.2 | 0.2 | Maximum | 1 / 6 | 100 | 0.002 | 0.002 | -- | No | HQ(s) less than one |
| trans-1,2-Dichloroethene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| trans-1,3-Dichloropropene | 0.42 | 0.57 | -- | -- | 0.285 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |

TABLE 4

**Hazard Quotients for Analytes in Surface Soil at Site 4**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trichloroethene | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Trichlorofluoromethane (Freon-11) | -- | -- | 0.26 | 0.26 | 0.26 | Maximum | 1 / 6 | 16400 | 2E-05 | 2E-05 | -- | No | HQ(s) less than one |
| Vinyl chloride | 0.21 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| **SVOA (UG/KG)** | | | | | | | 0 | | | | | | |
| 1,1-Biphenyl | -- | -- | 13 | 13 | 13 | Maximum | 1 / 11 | 60000 | 0.0002 | 0.0002 | -- | No | HQ(s) less than one |
| 1,2,4,5-Tetrachlorobenzene | 1.80 | 1.90 | -- | -- | 0.95 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2,2'-Oxybis(1-chloropropane) | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 2,3,4,6-Tetrachlorophenol | 3.50 | 3.80 | -- | -- | 1.9 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2,4,5-Trichlorophenol | 18.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2,4,6-Trichlorophenol | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2,4-Dichlorophenol | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2,4-Dimethylphenol | 35.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2,4-Dinitrophenol | 180.00 | 2470.00 | -- | -- | 1235 | 1/2 Max MDL | 0 / 11 | 100 | 25 | 12 | -- | No | Not detected |
| 2,4-Dinitrotoluene | 18.00 | 494.00 | -- | -- | 247 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 2,6-Dinitrotoluene | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 2-Chloronaphthalene | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 2-Chlorophenol | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2-Methylnaphthalene | -- | -- | 32 | 32 | 32 | Maximum | 1 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| 2-Methylphenol | 7.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| 2-Nitroaniline | 18.00 | 494.00 | -- | -- | 247 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 2-Nitrophenol | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 3,3'-Dichlorobenzidine | 141.00 | 380.00 | -- | -- | 190 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 3-Nitroaniline | 35.00 | 490.00 | -- | -- | 245 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4,6-Dinitro-2-methylphenol | -- | -- | 23 | 23 | 23 | Maximum | 1 / 11 | NSV | -- | -- | -- | No | Uncertainty |
| 4-Bromophenyl-phenylether | 1.80 | 494.00 | -- | -- | 247 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloro-3-methylphenol | 7.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloroaniline | 18.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4-Chlorophenyl-phenylether | 1.80 | 494.00 | -- | -- | 247 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4-Methylphenol | 3.50 | 3.80 | -- | -- | 1.9 | 1/2 Max MDL | 0 / 6 | 100 | 0.04 | 0.02 | -- | No | HQ(s) less than one |
| 4-Nitroaniline | 35.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| 4-Nitrophenol | 35.00 | 490.00 | -- | -- | 245 | 1/2 Max MDL | 0 / 11 | 100 | 5 | 2 | -- | No | Not detected |
| Acenaphthene | -- | -- | 0.58 | 310 | 54.505 | Average | 6 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acenaphthylene | -- | -- | 0.56 | 4.5 | 2.232 | Average | 5 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acetophenone | 18.00 | 250.00 | -- | -- | 125 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Anthracene | -- | -- | 1.6 | 580 | 89.7 | Average | 7 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Atrazine | 18.00 | 740.00 | -- | -- | 370 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Benzaldehyde | 420.00 | 740.00 | -- | -- | 370 | 1/2 Max MDL | 0 / 5 | NSV | -- | -- | -- | No | Not detected |
| Benzo(a)anthracene | -- | -- | 1.9 | 3100 | 430.7625 | Average | 8 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(a)pyrene | -- | -- | 8 | 3500 | 553.7143 | Average | 7 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(b)fluoranthene | -- | -- | 15 | 3900 | 639.2857 | Average | 7 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(g,h,i)perylene | -- | -- | 1.2 | 800 | 131.4375 | Average | 8 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(k)fluoranthene | -- | -- | 5.3 | 730 | 135.3286 | Average | 7 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| bis(2-Chloroethoxy)methane | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Chloroethyl)ether | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Ethylhexyl)phthalate | 5.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Butylbenzylphthalate | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Caprolactam | 18.00 | 6200.00 | -- | -- | 3100 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Carbazole | -- | -- | 380 | 380 | 380 | Maximum | 1 / 11 | NSV | -- | -- | -- | No | Uncertainty |
| Chrysene | -- | -- | 1.5 | 2600 | 372.0625 | Average | 8 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |

TABLE 4

**Hazard Quotients for Analytes in Surface Soil at Site 4**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dibenz(a,h)anthracene | -- | -- | 3.8 | 230 | 47.53333 | Average | 6 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Dibenzofuran | -- | -- | 2.2 | 170 | 58.36667 | Average | 3 / 11 | NSV | -- | -- | -- | No | Uncertainty |
| Diethylphthalate | 3.10 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100000 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Dimethyl phthalate | -- | -- | 2.3 | 2.3 | 2.3 | Maximum | 1 / 11 | 200000 | 1E-05 | 1E-05 | -- | No | HQ(s) less than one |
| Di-n-butylphthalate | 18.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 200000 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Di-n-octylphthalate | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Fluoranthene | -- | -- | 1.2 | 4800 | 592.9222 | Average | 9 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Fluorene | -- | -- | 3.2 | 210 | 55.125 | Average | 4 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Hexachlorobenzene | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 1000000 | 0.0002 | 0.0001 | -- | No | HQ(s) less than one |
| Hexachlorobutadiene | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Hexachlorocyclopentadiene | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 10000 | 0.02 | 0.01 | -- | No | Not detected |
| Hexachloroethane | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Indeno(1,2,3-cd)pyrene | -- | -- | 6.7 | 830 | 158.8143 | Average | 7 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Isophorone | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| Naphthalene | -- | -- | 1.1 | 84 | 29.1 | Average | 3 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| n-Nitroso-di-n-propylamine | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | NSV | -- | -- | -- | No | Not detected |
| n-Nitrosodiphenylamine | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 20000 | 0.01 | 0.006 | -- | No | EPC-based HQ less than one |
| Nitrobenzene | 1.80 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 40000 | 0.006 | 0.003 | -- | No | HQ(s) less than one |
| Pentachlorophenol | 35.00 | 494.00 | -- | -- | 247 | 1/2 Max MDL | 0 / 11 | 5000 | 0.1 | 0.05 | -- | No | Not detected |
| Phenanthrene | -- | -- | 1.2 | 3500 | 413.3667 | Average | 9 / 11 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Phenol | 3.50 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 11 | 100 | 2 | 1 | -- | No | Not detected |
| Pyrene | -- | -- | 2.3 | 4500 | 622.6625 | Average | 8 / 11 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Total cresols | 141.00 | 247.00 | -- | -- | 123.5 | 1/2 Max MDL | 0 / 5 | NSV | -- | -- | -- | No | Not detected |
| Low Molecular Weight PAHs[1] | -- | -- | 1.2 | 4719.4 | 558.5 | Average | -- / -- | 29000 | 0.2 | 0.02 | -- | No | HQ(s) less than one |
| High Molecular Weight PAHs[2] | -- | -- | 1.2 | 24990 | 3165.2 | Average | -- / -- | 1,100 | 23 | 3 | -- | No | See text for discussion |
| **PEST/PCB (UG/KG)** | | | | | | | 0 | | | | -- | | |
| 4,4'-DDD | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| 4,4'-DDE | -- | -- | 0.188 | 0.519 | 0.3535 | Average | 2 / 10 | 100 | 0.005 | 0.004 | -- | No | HQ(s) less than one |
| 4,4'-DDT | 0.26 | 0.47 | -- | -- | 0.2355 | 1/2 Max MDL | 0 / 10 | 100 | 0.005 | 0.002 | -- | No | Not detected |
| Aldrin | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| alpha-BHC | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| alpha-Chlordane | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 2.2 | 0.1 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1016 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1221 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1232 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1242 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1248 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1254 | 6.50 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 11 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1260 | -- | -- | 7.2 | 260 | 77.05 | Average | 4 / 11 | 160 | 2 | 0.5 | -- | No | EPC-based HQ less than one |
| Aroclor-1262 | 14.00 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 6 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Aroclor-1268 | 14.00 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 6 | 160 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| beta-BHC | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| delta-BHC | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Dieldrin | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| Endosulfan I | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan II | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan sulfate | 0.26 | 0.47 | -- | -- | 0.2355 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Endrin | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| Endrin aldehyde | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |

TABLE 4

**Hazard Quotients for Analytes in Surface Soil at Site 4**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Endrin ketone | 0.26 | 0.47 | -- | -- | 0.2355 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| gamma-BHC (Lindane) | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| Heptachlor | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 400 | 0.001 | 0.0003 | -- | No | HQ(s) less than one |
| Heptachlor epoxide | 0.13 | 0.24 | -- | -- | 0.118 | 1/2 Max MDL | 0 / 10 | 100 | 0.002 | 0.001 | -- | No | Not detected |
| Methoxychlor | 0.26 | 0.47 | -- | -- | 0.2355 | 1/2 Max MDL | 0 / 10 | 100 | 0.005 | 0.002 | -- | No | Not detected |
| Toxaphene | 13.00 | 23.60 | -- | -- | 11.8 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| **METAL (MG/KG)** | | | | | | | | | | | | | |
| Aluminum | -- | -- | 4400 | 21000 | 9172.727 | Average | 11 / 11 | NSV | -- | -- | 16800 | No | Only one detection exceeds background |
| Antimony | -- | -- | 0.084 | 2.1 | 0.538 | Average | 8 / 11 | 5 | 0.4 | 0.1 | -- | No | HQ(s) less than one |
| Arsenic | -- | -- | 2.2 | 8.3 | 4.509091 | Average | 11 / 11 | 6.8 | 1 | 0.7 | 9.95 | No | EPC-based HQ less than one |
| Barium | -- | -- | 6.3 | 85 | 29.84545 | Average | 11 / 11 | 110 | 0.8 | 0.3 | 67 | No | HQ(s) less than one |
| Beryllium | -- | -- | 0.23 | 0.8 | 0.448182 | Average | 11 / 11 | 2.5 | 0.3 | 0.2 | 0.759 | No | HQ(s) less than one |
| Cadmium | -- | -- | 0.044 | 0.32 | 0.155714 | Average | 7 / 11 | 32 | 0.01 | 0.005 | 1.57 | No | HQ(s) less than one |
| Calcium | -- | -- | 210 | 893 | 483.8182 | Average | 11 / 11 | NSV | -- | -- | 3030 | No | Consistent with background |
| Chromium (hexavalent) | -- | -- | 0.05 | 0.35 | 0.155 | Average | 4 / 4 | 0.4 | 0.9 | 0.4 | -- | No | HQ(s) less than one |
| Chromium | -- | -- | 7.8 | 32 | 14.65455 | Average | 11 / 11 | 10 | 3 | 1 | 42 | No | Consistent with background |
| Cobalt | -- | -- | 0.55 | 4 | 1.98 | Average | 11 / 11 | 13 | 0.3 | 0.2 | 4.8 | No | HQ(s) less than one |
| Copper | -- | -- | 2.8 | 46 | 9.845455 | Average | 11 / 11 | 70 | 0.7 | 0.1 | 21.3 | No | HQ(s) less than one |
| Cyanide | -- | -- | 0.026 | 0.026 | 0.026 | Maximum | 1 / 6 | 1 | 0.03 | 0.03 | -- | No | HQ(s) less than one |
| Iron | -- | -- | 7600 | 37000 | 14854.55 | Average | 11 / 11 | NSV | -- | -- | 71300 | No | Consistent with background |
| Lead | -- | -- | 3.2 | 160 | 30.47273 | Average | 11 / 11 | 120 | 1 | 0.3 | 61.8 | No | EPC-based HQ less than one |
| Magnesium | -- | -- | 490 | 1670 | 897.2727 | Average | 11 / 11 | NSV | -- | -- | 1210 | No | Macronutrient |
| Manganese | -- | -- | 6.4 | 120 | 52.49091 | Average | 11 / 11 | 220 | 0.5 | 0.2 | 331 | No | HQ(s) less than one |
| Mercury | -- | -- | 0.0064 | 0.18 | 0.064067 | Average | 6 / 11 | 0.05 | 4 | 1 | 0.11 | No | Low magnitude of exceedance |
| Nickel | -- | -- | 0.99 | 11 | 4.399091 | Average | 11 / 11 | 38 | 0.3 | 0.1 | 10.1 | No | HQ(s) less than one |
| Potassium | -- | -- | 350 | 1180 | 609.3636 | Average | 11 / 11 | NSV | -- | -- | 1280 | No | Consistent with background |
| Selenium | -- | -- | 0.22 | 1.3 | 0.701818 | Average | 11 / 11 | 0.52 | 3 | 1 | 2.41 | No | Consistent with background |
| Silver | -- | -- | 0.033 | 1.6 | 0.41325 | Average | 8 / 11 | 560 | 0.003 | 0.0007 | 0.143 | No | HQ(s) less than one |
| Sodium | -- | -- | 18.9 | 18.9 | 18.9 | Maximum | 1 / 11 | NSV | -- | -- | -- | No | Macronutrient |
| Thallium | -- | -- | 0.065 | 0.27 | 0.152182 | Average | 11 / 11 | 0.05 | 5 | 3 | 0.328 | No | Consistent with background |
| Vanadium | -- | -- | 14 | 32 | 20.36364 | Average | 11 / 11 | 60 | 0.5 | 0.3 | 42.8 | No | Consistent with background |
| Zinc | -- | -- | 15 | 170 | 49.28571 | Average | 7 / 11 | 120 | 1 | 0.4 | 65.6 | No | EPC-based HQ less than one |

**Notes**

COC - Contaminant of concern

EPC - Exposure point concentration

ESV - Ecological screening value

FOD - Frequency of detection

HQ - Hazard quotient

MDL - Method detection limit

TABLE 5

**Hazard Quotients for Analytes in Surface Soil at Site 5**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background [3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOA (UG/KG)** | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2,2-Tetrachloroethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2-Trichloro-1,2,2-trifluoroeth | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,1,2-Trichloroethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethane | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2,3-Trichlorobenzene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2,4-Trichlorobenzene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 100 | 0.007 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dibromo-3-chloropropane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,2-Dibromoethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 5000 | 0.0001 | 0.00007 | -- | No | HQ(s) less than one |
| 1,2-Dichlorobenzene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 100 | 0.007 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dichloroethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 870000 | 8E-07 | 4E-07 | -- | No | HQ(s) less than one |
| 1,2-Dichloropropane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,3-Dichlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 1,4-Dichlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.002 | -- | No | HQ(s) less than one |
| 2-Butanone | 2.90 | 9.90 | -- | -- | 4.95 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2-Hexanone | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 12600 | 5E-05 | 3E-05 | -- | No | HQ(s) less than one |
| 4-Methyl-2-pentanone | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 100000 | 7E-06 | 3E-06 | -- | No | HQ(s) less than one |
| Acetone | -- | -- | 98 | 400 | 178 | Average | 6 / 6 | NSV | -- | -- | -- | No | Uncertainty |
| Benzene | -- | -- | 0.32 | 0.32 | 0.32 | Average | 1 / 6 | 100 | 0.003 | 0.003 | -- | No | HQ(s) less than one |
| Bromochloromethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Bromodichloromethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Bromoform | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 1147000 | 3E-07 | 1E-07 | -- | No | HQ(s) less than one |
| Bromomethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Carbon disulfide | 0.38 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 6 | 94.1 | 0.007 | 0.004 | -- | No | HQ(s) less than one |
| Carbon tetrachloride | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Chlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.002 | -- | No | HQ(s) less than one |
| Chloroethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Chloroform | 0.14 | 0.32 | -- | -- | 0.16 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Chloromethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| cis-1,2-Dichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| cis-1,3-Dichloropropene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Cyclohexane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Dibromochloromethane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Dichlorodifluoromethane (Freon- | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Ethylbenzene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 100 | 0.0067 | 0.00335 | -- | No | HQ(s) less than one |
| Isopropylbenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| m- and p-Xylene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 100 | 0.0067 | 0.00335 | -- | No | HQ(s) less than one |
| Methyl acetate | -- | -- | 31 | 31 | 31 | Average | 1 / 5 | NSV | -- | -- | -- | No | Uncertainty |
| Methylcyclohexane | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Methylene chloride | 0.47 | 1.40 | -- | -- | 0.7 | 1/2 Max MDL | 0 / 6 | 300 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| Methyl-tert-butyl ether (MTBE) | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| o-Xylene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 100 | 0.0033 | 0.00165 | -- | No | HQ(s) less than one |
| Styrene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 100 | 0.003 | 0.002 | -- | No | HQ(s) less than one |

TABLE 5

**Hazard Quotients for Analytes in Surface Soil at Site 5**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background $^{3}$ | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tetrachloroethene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Toluene | -- | -- | 0.24 | 1.8 | 0.881667 | Average | 6 / 6 | 100 | 0.02 | 0.009 | -- | No | HQ(s) less than one |
| trans-1,2-Dichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| trans-1,3-Dichloropropene | 0.47 | 0.67 | -- | -- | 0.335 | 1/2 Max MDL | 0 / 6 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Trichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.001 | -- | No | HQ(s) less than one |
| Trichlorofluoromethane (Freon-1 | -- | -- | 0.26 | 0.26 | 0.26 | Average | 1 / 6 | 16400 | 2E-05 | 2E-05 | -- | No | HQ(s) less than one |
| Vinyl chloride | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 6 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| **SVOA (UG/KG)** | | | | | | | 0 | | | | | | |
| 1,1-Biphenyl | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | 60000 | 0.02 | 0.008 | -- | No | HQ(s) less than one |
| 1,2,4,5-Tetrachlorobenzene | 1.80 | 100.00 | -- | -- | 50 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2,2'-Oxybis(1-chloropropane) | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 2,3,4,6-Tetrachlorophenol | 3.50 | 200.00 | -- | -- | 100 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| 2,4,5-Trichlorophenol | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | 100 | 10 | 5 | -- | No | Not detected |
| 2,4,6-Trichlorophenol | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 100 | 3 | 2 | -- | No | Not detected |
| 2,4-Dichlorophenol | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 100 | 3 | 2 | -- | No | Not detected |
| 2,4-Dimethylphenol | 35.00 | 2000.00 | -- | -- | 1000 | 1/2 Max MDL | 0 / 18 | 100 | 20 | 10 | -- | No | Not detected |
| 2,4-Dinitrophenol | 180.00 | 10000.00 | -- | -- | 5000 | 1/2 Max MDL | 0 / 18 | 100 | 100 | 50 | -- | No | Not detected |
| 2,4-Dinitrotoluene | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 2,6-Dinitrotoluene | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 2-Chloronaphthalene | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 2-Chlorophenol | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 100 | 3 | 2 | -- | No | Not detected |
| 2-Methylnaphthalene | -- | -- | 13 | 330 | 134 | Average | 3 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| 2-Methylphenol | 6.90 | 400.00 | -- | -- | 200 | 1/2 Max MDL | 0 / 18 | 100 | 4 | 2 | -- | No | Not detected |
| 2-Nitroaniline | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 2-Nitrophenol | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 3,3'-Dichlorobenzidine | 127.00 | 20000.00 | -- | -- | 10000 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 3-Nitroaniline | 35.00 | 2000.00 | -- | -- | 1000 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4,6-Dinitro-2-methylphenol | 18.00 | 3080.00 | -- | -- | 1540 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Bromophenyl-phenylether | 1.80 | 615.00 | -- | -- | 307.5 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloro-3-methylphenol | 6.90 | 400.00 | -- | -- | 200 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloroaniline | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Chlorophenyl-phenylether | 1.80 | 615.00 | -- | -- | 307.5 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Methylphenol | 3.50 | 200.00 | -- | -- | 100 | 1/2 Max MDL | 0 / 6 | 100 | 2 | 1 | -- | No | Not detected |
| 4-Nitroaniline | 35.00 | 2000.00 | -- | -- | 1000 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| 4-Nitrophenol | 35.00 | 2000.00 | -- | -- | 1000 | 1/2 Max MDL | 0 / 18 | 100 | 20 | 10 | -- | No | Not detected |
| Acenaphthene | -- | -- | 0.95 | 2600 | 1615 | 99% KM (Chebyshev) UCL | 11 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| Acenaphthylene | -- | -- | 0.83 | 15 | 4.293636 | Average | 11 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| Acetophenone | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Anthracene | -- | -- | 3.2 | 6400 | 3984 | 99% KM (Chebyshev) UCL | 12 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| Atrazine | 18.00 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Benzaldehyde | 380.00 | 920.00 | -- | -- | 460 | 1/2 Max MDL | 0 / 12 | NSV | -- | -- | -- | No | Not detected |
| Benzo(a)anthracene | -- | -- | 2.8 | 30000 | 18411 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Benzo(a)pyrene | -- | -- | 10 | 3700 | 1369 | M-UCL (use when k<=1 and 1 | 15 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Benzo(b)fluoranthene | -- | -- | 4.5 | 32000 | 19656 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Benzo(g,h,i)perylene | -- | -- | 2.4 | 13000 | 8003 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |

TABLE 5

**Hazard Quotients for Analytes in Surface Soil at Site 5**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background [3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(k)fluoranthene | -- | -- | 2.4 | 11000 | 6783 | 99% KM (Chebyshev) UCL | 15 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| bis(2-Chloroethoxy)methane | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Chloroethyl)ether | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Ethylhexyl)phthalate | 6.60 | 1000.00 | -- | -- | 500 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Butylbenzylphthalate | -- | -- | 61 | 61 | 61 | Average | 1 / 18 | NSV | -- | -- | -- | No | Uncertainty |
| Caprolactam | 17.00 | 7700.00 | -- | -- | 3850 | 1/2 Max MDL | 0 / 19 | NSV | -- | -- | -- | No | Not detected |
| Carbazole | -- | -- | 64 | 3100 | 1582 | Average | 2 / 19 | NSV | -- | -- | -- | No | Uncertainty |
| Chrysene | -- | -- | 4.9 | 26000 | 15978 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Dibenz(a,h)anthracene | -- | -- | 4.6 | 420 | 79.40769 | Average | 13 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Dibenzofuran | -- | -- | 39 | 1200 | 619.5 | Average | 2 / 18 | NSV | -- | -- | -- | No | Uncertainty |
| Diethylphthalate | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 100000 | 0.003 | 0.002 | -- | No | HQ(s) less than one |
| Dimethyl phthalate | -- | -- | 2.6 | 2.6 | 2.6 | Average | 1 / 18 | 200000 | 0.00001 | 0.00001 | -- | No | HQ(s) less than one |
| Di-n-butylphthalate | -- | -- | 129 | 129 | 129 | Average | 1 / 18 | 200000 | 0.0006 | 0.0006 | -- | No | HQ(s) less than one |
| Di-n-octylphthalate | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Fluoranthene | -- | -- | 1 | 45000 | 27615 | 99% KM (Chebyshev) UCL | 17 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Fluorene | -- | -- | 1.7 | 2100 | 876.6 | 97.5% KM (Chebyshev) UCL | 12 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| Hexachlorobenzene | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 1000000 | 0.0003 | 0.0002 | -- | No | HQ(s) less than one |
| Hexachlorobutadiene | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Hexachlorocyclopentadiene | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 10000 | 0.03 | 0.02 | -- | No | HQ(s) less than one |
| Hexachloroethane | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| Indeno(1,2,3-cd)pyrene | -- | -- | 4.9 | 13000 | 8072 | 99% KM (Chebyshev) UCL | 14 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Isophorone | -- | -- | 195 | 195 | 195 | Average | 1 / 18 | NSV | -- | -- | -- | No | Low frequency of detection |
| Naphthalene | -- | -- | 27 | 1500 | 709.7 | M-UCL (use when k<=1 and 1! | 3 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| n-Nitroso-di-n-propylamine | 3.50 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | NSV | -- | -- | -- | No | Not detected |
| n-Nitrosodiphenylamine | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 20000 | 0.02 | 0.008 | -- | No | HQ(s) less than one |
| Nitrobenzene | 1.80 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 18 | 40000 | 0.008 | 0.004 | -- | No | HQ(s) less than one |
| Pentachlorophenol | 35.00 | 2000.00 | -- | -- | 1000 | 1/2 Max MDL | 0 / 18 | 5000 | 0.4 | 0.2 | -- | No | HQ(s) less than one |
| Phenanthrene | -- | -- | 3.5 | 27000 | 16641 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total LMW PAHs |
| Phenol | 3.40 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 19 | 100 | 3 | 2 | -- | No | Not detected |
| Pyrene | -- | -- | 7.3 | 48000 | 29449 | 99% KM (Chebyshev) UCL | 16 / 18 | NSV | -- | -- | -- | No | See total HMW PAHs |
| Total cresols | 127.00 | 308.00 | -- | -- | 154 | 1/2 Max MDL | 0 / 12 | NSV | -- | -- | -- | No | Not detected |
| Low Molecular Weight PAHs[1] | -- | -- | 3.5 | 39930 | 24614 | 99% KM (Chebyshev) UCL | -- / -- | 29000 | 1 | 0.8 | -- | No | EPC-based HQ less than one |
| High Molecular Weight PAHs[2] | -- | -- | 1 | 222120 | 136429 | 99% KM (Chebyshev) UCL | -- / -- | 1,100 | 202 | 124 | -- | Yes | See text for discussion |
| **PEST/PCB (UG/KG)** | | | | | | | | | | | | | |
| 4,4'-DDD | -- | -- | 0.691 | 5.15 | 1.47 | 95% KM (t) UCL | 4 / 17 | 100 | 0.05 | 0.01 | -- | No | HQ(s) less than one |
| 4,4'-DDE | -- | -- | 0.431 | 153 | 82.47 | M-UCL (use when k<=1 and 1! | 7 / 17 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 4,4'-DDT | -- | -- | 1.47 | 181 | 46.88 | 95% KM (t) UCL | 4 / 17 | 100 | 2 | 0.5 | -- | No | EPC-based HQ less than one |
| Aldrin | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 100 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| alpha-BHC | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| alpha-Chlordane | -- | -- | 0.27 | 0.616 | 0.443 | Average | 2 / 17 | 2.2 | 0.3 | 0.2 | -- | No | HQ(s) less than one |
| Aroclor-1016 | 6.20 | 23.00 | -- | -- | 11.5 | 1/2 Max MDL | 0 / 18 | 160 | 0.1 | 0.07 | -- | No | HQ(s) less than one |
| Aroclor-1221 | 6.20 | 23.00 | -- | -- | 11.5 | 1/2 Max MDL | 0 / 18 | 160 | 0.1 | 0.07 | -- | No | HQ(s) less than one |
| Aroclor-1232 | 6.20 | 23.00 | -- | -- | 11.5 | 1/2 Max MDL | 0 / 18 | 160 | 0.1 | 0.07 | -- | No | HQ(s) less than one |
| Aroclor-1242 | 6.20 | 23.00 | -- | -- | 11.5 | 1/2 Max MDL | 0 / 18 | 160 | 0.1 | 0.07 | -- | No | HQ(s) less than one |

TABLE 5

**Hazard Quotients for Analytes in Surface Soil at Site 5**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aroclor-1248 | 6.20 | 23.00 | -- | -- | 11.5 | 1/2 Max MDL | 0 / 18 | 160 | 0.1 | 0.07 | -- | No | HQ(s) less than one |
| Aroclor-1254 | -- | -- | 9.1 | 46 | 29.03333 | Average | 3 / 18 | 160 | 0.3 | 0.2 | -- | No | HQ(s) less than one |
| Aroclor-1260 | -- | -- | 5.6 | 80 | 32.7 | Average | 4 / 18 | 160 | 0.5 | 0.2 | -- | No | HQ(s) less than one |
| Aroclor-1262 | 14.00 | 19.00 | -- | -- | 9.5 | 1/2 Max MDL | 0 / 6 | 160 | 0.1 | 0.06 | -- | No | HQ(s) less than one |
| Aroclor-1268 | 14.00 | 19.00 | -- | -- | 9.5 | 1/2 Max MDL | 0 / 6 | 160 | 0.1 | 0.06 | -- | No | HQ(s) less than one |
| beta-BHC | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| delta-BHC | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| Dieldrin | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 100 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| Endosulfan I | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan II | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| Endosulfan sulfate | 0.24 | 0.93 | -- | -- | 0.464 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| Endrin | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 100 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| Endrin aldehyde | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| Endrin ketone | 0.24 | 0.93 | -- | -- | 0.464 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| gamma-BHC (Lindane) | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 100 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| Heptachlor | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 400 | 0.001 | 0.001 | -- | No | HQ(s) less than one |
| Heptachlor epoxide | 0.12 | 0.46 | -- | -- | 0.232 | 1/2 Max MDL | 0 / 17 | 100 | 0.005 | 0.002 | -- | No | HQ(s) less than one |
| Methoxychlor | 0.24 | 0.93 | -- | -- | 0.464 | 1/2 Max MDL | 0 / 17 | 100 | 0.009 | 0.005 | -- | No | HQ(s) less than one |
| Toxaphene | 12.10 | 46.40 | -- | -- | 23.2 | 1/2 Max MDL | 0 / 17 | NSV | -- | -- | -- | No | Not detected |
| **METAL (MG/KG)** | | | | | | | | | | | | | |
| Aluminum | -- | -- | 2300 | 15000 | 7166.667 | Average | 18 / 18 | NSV | -- | -- | 16800 | No | Consistent with background |
| Antimony | -- | -- | 0.056 | 2.4 | 0.627455 | Average | 11 / 18 | 5 | 0.5 | 0.1 | -- | No | HQ(s) less than one |
| Arsenic | -- | -- | 0.91 | 6 | 3.407778 | Average | 18 / 18 | 6.8 | 0.9 | 0.5 | 9.95 | No | Consistent with background |
| Barium | -- | -- | 6 | 76 | 27.56667 | Average | 18 / 18 | 110 | 0.7 | 0.3 | 67 | No | HQ(s) less than one |
| Beryllium | -- | -- | 0.15 | 1.4 | 0.424706 | Average | 17 / 18 | 2.5 | 0.6 | 0.2 | 0.759 | No | HQ(s) less than one |
| Cadmium | -- | -- | 0.033 | 1.2 | 0.323933 | Average | 15 / 18 | 32 | 0.04 | 0.01 | 1.57 | No | Consistent with background |
| Calcium | -- | -- | 25 | 6300 | 1739.511 | Average | 18 / 18 | NSV | -- | -- | 3030 | No | Macronutrient |
| Chromium (hexavalent) | 0.21 | 0.21 | -- | -- | 0.105 | 1/2 Max MDL | 0 / 1 | 0.4 | 0.5 | 0.3 | -- | No | HQ(s) less than one |
| Chromium | -- | -- | 4.4 | 24 | 21.03 | 5% Chebyshev (Mean, Sd) UC | 18 / 18 | 10 | 2 | 2 | 42 | No | Consistent with background |
| Cobalt | -- | -- | 0.7 | 6.9 | 2.346111 | Average | 18 / 18 | 13 | 0.5 | 0.2 | 4.8 | No | HQ(s) less than one |
| Copper | -- | -- | 1.7 | 230 | 33.95556 | Average | 18 / 18 | 70 | 3 | 0.5 | 21.3 | No | EPC-based HQ less than one |
| Cyanide | -- | -- | 0.032 | 0.065 | 0.0569 | KM Student's t | 4 / 6 | 1 | 0.07 | 0.06 | -- | No | HQ(s) less than one |
| Iron | -- | -- | 2600 | 28000 | 12676.47 | Average | 17 / 18 | NSV | -- | -- | 71300 | No | Consistent with background |
| Lead | -- | -- | 2.9 | 270 | 37.92222 | Average | 18 / 18 | 120 | 2 | 0.3 | 61.8 | No | EPC-based HQ less than one |
| Magnesium | -- | -- | 220 | 2350 | 996.0556 | Average | 18 / 18 | NSV | -- | -- | 1210 | No | Macronutrient |
| Manganese | -- | -- | 13 | 290 | 85.38889 | Average | 18 / 18 | 220 | 1 | 0.4 | 331 | No | Consistent with background |
| Mercury | -- | -- | 0.0066 | 0.35 | 0.134 | 95% KM (t) UCL | 7 / 18 | 0.05 | 7 | 2.7 | 0.11 | No | EPC-based HQ has low magnitude of |
| Nickel | -- | -- | 1.4 | 26 | 7.233333 | Average | 18 / 18 | 38 | 0.7 | 0.2 | 10.1 | No | HQ(s) less than one |
| Potassium | -- | -- | 180 | 1620 | 712.3333 | Average | 18 / 18 | NSV | -- | -- | 1280 | No | Macronutrient |
| Selenium | -- | -- | 0.1 | 1.5 | 0.81 | 95% KM (t) UCL | 16 / 18 | 0.52 | 3 | 2 | 2.41 | No | Consistent with background |
| Silver | -- | -- | 0.076 | 1 | 0.315278 | Average | 18 / 18 | 560 | 0.002 | 0.001 | 0.143 | No | HQ(s) less than one |
| Sodium | -- | -- | 13.1 | 41.2 | 23.2 | Average | 8 / 18 | NSV | -- | -- | -- | No | Macronutrient |
| Thallium | -- | -- | 0.045 | 0.18 | 0.141 | 95% KM (t) UCL | 15 / 18 | 0.05 | 4 | 3 | 0.328 | No | Consistent with background |
| Vanadium | -- | -- | 6 | 380 | 54.32 | 95% H-UCL | 18 / 18 | 60 | 6 | 0.9 | 42.8 | No | EPC-based HQ less than one |
| Zinc | -- | -- | 5.9 | 280 | 55.55385 | Average | 13 / 18 | 120 | 2 | 0.5 | 65.6 | No | EPC-based HQ less than one |

TABLE 5

**Hazard Quotients for Analytes in Surface Soil at Site 5**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background [3]** | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Notes**

COC - Contaminant of concern

EPC - Exposure point concentration

ESV - Ecological screening value

FOD - Frequency of detection

TABLE 6

**Hazard Quotients for Analytes in Surface Soil at Site 7**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background$^1$ | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOA (UG/KG)** | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| 1,1,2,2-Tetrachloroethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| 1,1,2-Trichloroethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| 1,1-Dichloroethane | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.001 | -- | No | Not detected |
| 1,1-Dichloroethene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| 1,2,3-Trichlorobenzene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| 1,2,4-Trichlorobenzene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 100 | 0.007 | 0.004 | -- | No | Not detected |
| 1,2-Dibromo-3-chloropropane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| 1,2-Dibromoethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 5000 | 0.0001 | 0.00007 | -- | No | Not detected |
| 1,2-Dichlorobenzene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 100 | 0.007 | 0.004 | -- | No | Not detected |
| 1,2-Dichloroethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 870000 | 8.05E-07 | 4.02E-07 | -- | No | Not detected |
| 1,2-Dichloropropane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| 1,3-Dichlorobenzene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| 1,4-Dichlorobenzene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 100 | 0.004 | 0.002 | -- | No | Not detected |
| 2-Butanone | -- | -- | 1 | 8.7 | 4.4 | Average | 9 / 9 | NSV | -- | -- | -- | No | Uncertainty |
| 2-Hexanone | -- | -- | 0.55 | 0.55 | 0.55 | Average | 1 / 9 | 12600 | 4E-05 | 4E-05 | -- | No | HQ(s) less than one |
| 4-Methyl-2-pentanone | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 100000 | 0.000007 | 4E-06 | -- | No | Not detected |
| Acetone | -- | -- | 12 | 250 | 102 | Average | 9 / 9 | NSV | -- | -- | -- | No | Uncertainty |
| Benzene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 100 | 0.007 | 0.004 | -- | No | Not detected |
| Bromochloromethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Bromodichloromethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Bromoform | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 1147000 | 3E-07 | 2E-07 | -- | No | Not detected |
| Bromomethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Carbon disulfide | 0.23 | 2.30 | -- | -- | 1.15 | 1/2 Max MDL | 0 / 9 | 94.1 | 0.02 | 0.01 | -- | No | Not detected |
| Carbon tetrachloride | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.0006 | -- | No | Not detected |
| Chlorobenzene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 100 | 0.004 | 0.002 | -- | No | Not detected |
| Chloroethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Chloroform | 0.14 | 0.25 | -- | -- | 0.125 | 1/2 Max MDL | 0 / 9 | 300 | 0.0008 | 0.0004 | -- | No | Not detected |
| Chloromethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| cis-1,2-Dichloroethene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.001 | -- | No | Not detected |
| cis-1,3-Dichloropropene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.001 | -- | No | Not detected |
| Cyclohexane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Dibromochloromethane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Dichlorodifluoromethane (Freon-12) | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Ethylbenzene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 100 | 0.007 | 0.004 | -- | No | Not detected |
| Isopropylbenzene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| m- and p-Xylene | -- | -- | 0.4 | 0.4 | 0.4 | Average | 1 / 9 | 100 | 0.004 | 0.004 | -- | No | HQ(s) less than one |
| Methyl acetate | -- | -- | 8.1 | 8.1 | 8.1 | Average | 1 / 9 | NSV | -- | -- | -- | No | Uncertainty |
| Methylcyclohexane | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| Methylene chloride | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| Methyl-tert-butyl ether (MTBE) | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | NSV | -- | -- | -- | No | Not detected |
| o-Xylene | -- | -- | 0.15 | 0.15 | 0.15 | Average | 1 / 9 | 100 | 0.0015 | 0.0015 | -- | No | HQ(s) less than one |
| Styrene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 100 | 0.004 | 0.002 | -- | No | Not detected |
| Tetrachloroethene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| Toluene | -- | -- | 2.9 | 2.9 | 2.9 | Average | 1 / 9 | 100 | 0.03 | 0.03 | -- | No | HQ(s) less than one |
| trans-1,2-Dichloroethene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.001 | -- | No | Not detected |
| trans-1,3-Dichloropropene | 0.43 | 0.70 | -- | -- | 0.35 | 1/2 Max MDL | 0 / 9 | 300 | 0.002 | 0.001 | -- | No | Not detected |
| Trichloroethene | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.001 | -- | No | Not detected |
| Trichlorofluoromethane (Freon-11) | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 16400 | 2E-05 | 1E-05 | -- | No | Not detected |
| Vinyl chloride | 0.21 | 0.35 | -- | -- | 0.175 | 1/2 Max MDL | 0 / 9 | 300 | 0.001 | 0.0006 | -- | No | Not detected |

TABLE 6

**Hazard Quotients for Analytes in Surface Soil at Site 7**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background$^1$ | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PEST/PCB (UG/KG)** | | | | | | | | | | | | | |
| Aroclor-1016 | 6.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 17 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1221 | 6.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 17 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1232 | 6.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 17 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1242 | 6.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 17 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1248 | 6.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 17 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1254 | -- | -- | 50 | 50 | 50 | Average | 2 / 17 | 160 | 0.3 | 0.3 | -- | No | HQ(s) less than one |
| Aroclor-1260 | -- | -- | 4.2 | 940 | 377.3 | Gamma Adjusted KM-UCL | 11 / 17 | 160 | 6 | 2.4 | -- | No | Low magnitude of exc |
| Aroclor-1262 | 14.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 9 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| Aroclor-1268 | 14.00 | 76.00 | -- | -- | 38 | 1/2 Max MDL | 0 / 9 | 160 | 0.5 | 0.2 | -- | No | Not detected |
| **METAL (MG/KG)** | | | | | | | | | | | | | |
| Aluminum | -- | -- | 2600 | 6600 | 4747.059 | Average | 17 / 17 | NSV | -- | -- | 9340 | No | Consistent with backg |
| Antimony | -- | -- | 0.063 | 0.4 | 0.183333 | Average | 12 / 17 | 5 | 0.08 | 0.04 | -- | No | HQ(s) less than one |
| Arsenic | -- | -- | 1.3 | 3.5 | 2.329412 | Average | 17 / 17 | 6.8 | 0.5 | 0.3 | 6.24 | No | Consistent with backg |
| Barium | -- | -- | 6.4 | 33 | 18.56471 | Average | 17 / 17 | 110 | 0.3 | 0.2 | 105 | No | Consistent with backg |
| Beryllium | -- | -- | 0.15 | 0.47 | 0.325882 | Average | 17 / 17 | 2.5 | 0.2 | 0.1 | 1.04 | No | Consistent with backg |
| Cadmium | -- | -- | 0.024 | 0.52 | 0.168615 | Average | 13 / 17 | 32 | 0.02 | 0.005 | 1.09 | No | Consistent with backg |
| Calcium | -- | -- | 150 | 397000 | 40526.88 | Average | 17 / 17 | NSV | -- | -- | 3560 | No | Macronutrient |
| Chromium (hexavalent) | -- | -- | 0.3 | 0.3 | 0.3 | Average | 1 / 1 | 0.4 | 0.8 | 0.8 | -- | No | HQ(s) less than one |
| Chromium | -- | -- | 5 | 26 | 15.78 | 95% Student's-t UCL | 17 / 17 | 10 | 3 | 2 | 27.3 | No | Consistent with backg |
| Cobalt | -- | -- | 0.93 | 2.8 | 1.898235 | Average | 17 / 17 | 13 | 0.2 | 0.1 | 5.41 | No | Consistent with backg |
| Copper | -- | -- | 2.2 | 15 | 4.876471 | Average | 17 / 17 | 70 | 0.2 | 0.07 | 43.6 | No | Consistent with backg |
| Cyanide | -- | -- | 0.027 | 0.32 | 0.155 | 95% KM (t) UCL | 5 / 9 | 1 | 0.3 | 0.2 | -- | No | HQ(s) less than one |
| Iron | -- | -- | 3900 | 15000 | 7682.353 | Average | 17 / 17 | NSV | -- | -- | 17300 | No | Consistent with backg |
| Lead | -- | -- | 2.7 | 82 | 21.38824 | Average | 17 / 17 | 120 | 0.7 | 0.2 | 95.8 | No | Consistent with backg |
| Magnesium | -- | -- | 210 | 626000 | 75039.88 | Average | 17 / 17 | NSV | -- | -- | 1830 | No | Macronutrient |
| Manganese | -- | -- | 16 | 130 | 60.52941 | Average | 17 / 17 | 220 | 0.6 | 0.3 | 208 | No | Consistent with backg |
| Mercury | -- | -- | 0.0062 | 0.047 | 0.0209 | Average | 8 / 17 | 0.05 | 0.9 | 0.4 | 0.99 | No | HQ(s) less than one |
| Nickel | -- | -- | 1.2 | 24 | 8.229412 | Average | 17 / 17 | 38 | 0.6 | 0.2 | 15.1 | No | HQ(s) less than one |
| Potassium | -- | -- | 240 | 431000 | 57079.82 | Average | 17 / 17 | NSV | -- | -- | 986 | No | Macronutrient |
| Selenium | -- | -- | 0.34 | 1 | 0.509 | 95% KM (t) UCL | 9 / 17 | 0.52 | 2 | 0.98 | 2.76 | No | Consistent with backg |
| Silver | -- | -- | 0.019 | 0.14 | 0.050455 | Average | 11 / 17 | 560 | 0.0003 | 9E-05 | 8.7 | No | Consistent with backg |
| Sodium | -- | -- | 8.8 | 4880 | 1728.157 | Average | 7 / 17 | NSV | -- | -- | -- | No | Macronutrient |
| Thallium | -- | -- | 0.042 | 0.24 | 0.151 | 95% KM (t) UCL | 15 / 17 | 0.05 | 5 | 3 | 0.441 | No | Consistent with backg |
| Vanadium | -- | -- | 6.9 | 120 | 63.38 | 95% Chebyshev (Mean, Sd) UCL | 17 / 17 | 60 | 2 | 1.1 | 26.1 | No | Low magnitude of exc |
| Zinc | -- | -- | 5.3 | 260 | 56.58824 | Average | 17 / 17 | 120 | 2 | 0.5 | 142 | No | EPC-based HQ less tha |

**Notes**

COC - Contaminant of concern
EPC - Exposure point concentration
ESV - Ecological screening value
FOD - Frequency of detection
HQ - Hazard quotient
MDL - Method detection limit
NSV - No screening value

TABLE 7

**Hazard Quotients for Analytes in Surface Soil at Site 9**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| **Analyte** | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background**[3] | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VOA (UG/KG)** | | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2,2-Tetrachloroethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| 1,1,2-Trichloroethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethane | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.001 | -- | No | HQ(s) less than one |
| 1,1-Dichloroethene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| 1,2,3-Trichlorobenzene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| 1,2,4-Trichlorobenzene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 100 | 0.007 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dibromo-3-chloropropane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| 1,2-Dibromoethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 5000 | 0.0001 | 0.0001 | -- | No | HQ(s) less than one |
| 1,2-Dichlorobenzene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 100 | 0.007 | 0.003 | -- | No | HQ(s) less than one |
| 1,2-Dichloroethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 870000 | 0.000001 | 0.0000004 | -- | No | HQ(s) less than one |
| 1,2-Dichloropropane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| 1,3-Dichlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| 1,4-Dichlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 100 | 0.003 | 0.002 | -- | No | HQ(s) less than one |
| 2-Butanone | -- | -- | 4 | 8.1 | 6.8 | Average | 4 / | 4 | NSV | -- | -- | -- | No | Uncertainty |
| 2-Hexanone | -- | -- | 7.4 | 7.4 | 7.4 | Average | 1 / | 4 | 12600 | 0.0006 | 0.0006 | -- | No | HQ(s) less than one |
| 4-Methyl-2-pentanone | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 100000 | 7E-06 | 0.000003 | -- | No | HQ(s) less than one |
| Acetone | -- | -- | 35 | 67 | 52.5 | Average | 4 / | 4 | NSV | -- | -- | -- | No | Uncertainty |
| Benzene | -- | -- | 0.21 | 4.3 | 2.255 | Average | 2 / | 4 | 100 | 0.04 | 0.02 | -- | No | HQ(s) less than one |
| Bromochloromethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Bromodichloromethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Bromoform | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 1147000 | 2.87707E-07 | 1.4385E-07 | -- | No | HQ(s) less than one |
| Bromomethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Carbon disulfide | -- | -- | 1.1 | 8.4 | 4.75 | Average | 2 / | 4 | 94.1 | 0.09 | 0.05 | -- | No | HQ(s) less than one |
| Carbon tetrachloride | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Chlorobenzene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 100 | 0.003 | 0.002 | -- | No | HQ(s) less than one |
| Chloroethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Chloroform | 0.18 | 0.29 | -- | -- | 0.145 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0005 | -- | No | HQ(s) less than one |
| Chloromethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| cis-1,2-Dichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| cis-1,3-Dichloropropene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Cyclohexane | -- | -- | 3.4 | 3.4 | 3.4 | Average | 1 / | 4 | NSV | -- | -- | -- | No | Uncertainty |
| Dibromochloromethane | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Dichlorodifluoromethane (Freon-12) | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Ethylbenzene | -- | -- | 1.7 | 1.7 | 1.7 | Average | 1 / | 4 | 100 | 0.02 | 0.02 | -- | No | HQ(s) less than one |
| Isopropylbenzene | -- | -- | 1.1 | 1.1 | 1.1 | Average | 1 / | 4 | NSV | -- | -- | -- | No | Uncertainty |
| m- and p-Xylene | -- | -- | 4.3 | 4.3 | 4.3 | Average | 1 / | 4 | 100 | 0.043 | 0.043 | -- | No | HQ(s) less than one |
| Methyl acetate | 1.10 | 4.10 | -- | -- | 2.05 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| Methylcyclohexane | -- | -- | 6.5 | 6.5 | 6.5 | Average | 1 / | 4 | NSV | -- | -- | -- | No | Uncertainty |
| Methylene chloride | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Methyl-tert-butyl ether (MTBE) | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | NSV | -- | -- | -- | No | Not detected |
| o-Xylene | -- | -- | 2.9 | 2.9 | 2.9 | Average | 1 / | 4 | 100 | 0.029 | 0.029 | -- | No | HQ(s) less than one |
| Styrene | -- | -- | 1.8 | 1.8 | 1.8 | Average | 1 / | 4 | 100 | 0.02 | 0.02 | -- | No | HQ(s) less than one |
| Tetrachloroethene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Toluene | -- | -- | 8.6 | 8.6 | 8.6 | Average | 1 / | 4 | 100 | 0.09 | 0.09 | -- | No | HQ(s) less than one |
| trans-1,2-Dichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| trans-1,3-Dichloropropene | 0.47 | 0.66 | -- | -- | 0.33 | 1/2 Max MDL | 0 / | 4 | 300 | 0.002 | 0.001 | -- | No | HQ(s) less than one |
| Trichloroethene | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| Trichlorofluoromethane (Freon-11) | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / | 4 | 16400 | 2.0122E-05 | 1.0061E-05 | -- | No | HQ(s) less than one |

TABLE 7

**Hazard Quotients for Analytes in Surface Soil at Site 9**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vinyl chloride | 0.23 | 0.33 | -- | -- | 0.165 | 1/2 Max MDL | 0 / 4 | 300 | 0.001 | 0.0006 | -- | No | HQ(s) less than one |
| **SVOA (UG/KG)** | | | | | | | | | | | | | |
| 1,1-Biphenyl | 35.00 | 480.00 | -- | -- | 240 | 1/2 Max MDL | 0 / 10 | 60000 | 0.008 | 0.004 | -- | No | HQ(s) less than one |
| 1,2,4,5-Tetrachlorobenzene | 3.50 | 7.80 | -- | -- | 3.9 | 1/2 Max MDL | 0 / 4 | NSV | -- | -- | -- | No | Not detected |
| 2,2'-Oxybis(1-chloropropane) | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 2,3,4,6-Tetrachlorophenol | 7.10 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 4 | NSV | -- | -- | -- | No | Not detected |
| 2,4,5-Trichlorophenol | 35.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2,4,6-Trichlorophenol | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2,4-Dichlorophenol | 7.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2,4-Dimethylphenol | 71.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2,4-Dinitrophenol | 350.00 | 1610.00 | -- | -- | 805 | 1/2 Max MDL | 0 / 10 | 100 | 16 | 8 | -- | No | Not detected |
| 2,4-Dinitrotoluene | 35.00 | 321.00 | -- | -- | 160.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 2,6-Dinitrotoluene | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Chloronaphthalene | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Chlorophenol | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2-Methylnaphthalene | 2.10 | 84.00 | -- | -- | 42 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| 2-Methylphenol | 14.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| 2-Nitroaniline | 35.00 | 321.00 | -- | -- | 160.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 2-Nitrophenol | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 3,3'-Dichlorobenzidine | 121.00 | 1500.00 | -- | -- | 750 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 3-Nitroaniline | 71.00 | 320.00 | -- | -- | 160 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4,6-Dinitro-2-methylphenol | 35.00 | 1610.00 | -- | -- | 805 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Bromophenyl-phenylether | 3.50 | 321.00 | -- | -- | 160.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloro-3-methylphenol | 14.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chloroaniline | 35.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Chlorophenyl-phenylether | 3.50 | 321.00 | -- | -- | 160.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Methylphenol | 7.10 | 15.00 | -- | -- | 7.5 | 1/2 Max MDL | 0 / 4 | 100 | 0.2 | 0.08 | -- | No | HQ(s) less than one |
| 4-Nitroaniline | 71.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| 4-Nitrophenol | 71.00 | 320.00 | -- | -- | 160 | 1/2 Max MDL | 0 / 10 | 100 | 3 | 2 | -- | No | Not detected |
| Acenaphthene | -- | -- | 0.6 | 0.6 | 0.6 | Average | 1 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acenaphthylene | -- | -- | 1.1 | 3.6 | 2.433333333 | Average | 3 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Acetophenone | 35.00 | 160.00 | -- | -- | 80 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Anthracene | -- | -- | 2 | 12 | 4.7 | Average | 4 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Atrazine | 35.00 | 480.00 | -- | -- | 240 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Benzaldehyde | 35.00 | 480.00 | -- | -- | 240 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Benzo(a)anthracene | -- | -- | 10 | 150 | 46.25 | Average | 4 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(a)pyrene | -- | -- | 1.8 | 46 | 23.11428571 | Average | 7 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(b)fluoranthene | -- | -- | 16 | 370 | 106.75 | Average | 4 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(g,h,i)perylene | -- | -- | 14 | 91 | 37.6 | Average | 5 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Benzo(k)fluoranthene | -- | -- | 91 | 91 | 91 | Average | 1 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| bis(2-Chloroethoxy)methane | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Chloroethyl)ether | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| bis(2-Ethylhexyl)phthalate | -- | -- | 12 | 91 | 39.66666667 | Average | 3 / 10 | NSV | -- | -- | -- | No | Uncertainty |
| Butylbenzylphthalate | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Caprolactam | 35.00 | 4000.00 | -- | -- | 2000 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Carbazole | 71.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Chrysene | -- | -- | 12 | 170 | 91 | Average | 2 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Dibenz(a,h)anthracene | -- | -- | 3.1 | 3.1 | 3.1 | Average | 1 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Dibenzofuran | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Diethylphthalate | 6.20 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100000 | 0.002 | 0.0008 | -- | No | HQ(s) less than one |
| Dimethyl phthalate | 7.10 | 320.00 | -- | -- | 160 | 1/2 Max MDL | 0 / 10 | 200000 | 0.002 | 0.0008 | -- | No | HQ(s) less than one |

TABLE 7

**Hazard Quotients for Analytes in Surface Soil at Site 9**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| Analyte | Minimum Detection Limit | Maximum Detection Limit | Minimum Detection | Maximum Detection | EPC | EPC Basis | FOD | ESV | Maximum-based HQ | EPC-based HQ | Background[3] | COC? | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Di-n-butylphthalate | 35.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 200000 | 0.0008 | 0.0004 | -- | No | HQ(s) less than one |
| Di-n-octylphthalate | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Fluoranthene | -- | -- | 3.6 | 210 | 51.72 | Average | 5 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Fluorene | 2.90 | 110.00 | -- | -- | 55 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Hexachlorobenzene | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 1000000 | 0.0002 | 0.00008 | -- | No | HQ(s) less than one |
| Hexachlorobutadiene | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Hexachlorocyclopentadiene | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 10000 | 0.02 | 0.008 | -- | No | HQ(s) less than one |
| Hexachloroethane | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Indeno(1,2,3-cd)pyrene | -- | -- | 16 | 88 | 37.5 | Average | 4 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Isophorone | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| Naphthalene | 2.10 | 84.00 | -- | -- | 42 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| n-Nitroso-di-n-propylamine | 7.10 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | NSV | -- | -- | -- | No | Not detected |
| n-Nitrosodiphenylamine | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 20000 | 0.008 | 0.004 | -- | No | HQ(s) less than one |
| Nitrobenzene | 3.50 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 40000 | 0.004 | 0.002 | -- | No | HQ(s) less than one |
| Pentachlorophenol | 71.00 | 321.00 | -- | -- | 160.5 | 1/2 Max MDL | 0 / 10 | 5000 | 0.06 | 0.03 | -- | No | HQ(s) less than one |
| Phenanthrene | -- | -- | 2.1 | 130 | 27.31666667 | Average | 6 / 10 | NSV | -- | -- | -- | No | See Total LMW PAHs |
| Phenol | 7.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 10 | 100 | 2 | 0.8 | -- | No | EPC-based HQ less than one |
| Pyrene | -- | -- | 5.7 | 320 | 60.5875 | Average | 8 / 10 | NSV | -- | -- | -- | No | See Total HMW PAHs |
| Total cresols | 121.00 | 161.00 | -- | -- | 80.5 | 1/2 Max MDL | 0 / 6 | NSV | -- | -- | -- | No | Not detected |
| Low Molecular Weight PAHs[1] | -- | -- | 2.1 | 142 | 89.04 | KM (Chebyshev | -- / -- | 29000 | 0.005 | 0.0031 | -- | No | HQ(s) less than one |
| High Molecular Weight PAHs[2] | -- | -- | 1.8 | 1536 | 1324 | (use when k<= | -- / -- | 1,100 | 1 | 1.2 | -- | No | Low magnitude of exceedance |
| **METAL (MG/KG)** | | | | | | | | | | | | | |
| Aluminum | -- | -- | 2600 | 8100 | 4580 | Average | 10 / 10 | NSV | -- | -- | 9340 | No | Consistent with background |
| Antimony | -- | -- | 0.098 | 0.88 | 0.3256 | Average | 5 / 10 | 5 | 0.2 | 0.07 | -- | No | HQ(s) less than one |
| Arsenic | -- | -- | 0.62 | 3 | 1.769 | Average | 10 / 10 | 6.8 | 0.4 | 0.3 | 6.24 | No | Consistent with background |
| Barium | -- | -- | 8.9 | 60 | 21.96 | Average | 10 / 10 | 110 | 0.5 | 0.2 | 105 | No | Consistent with background |
| Beryllium | -- | -- | 0.17 | 0.5 | 0.2925 | Average | 8 / 10 | 2.5 | 0.2 | 0.1 | 1.04 | No | Consistent with background |
| Cadmium | -- | -- | 0.03 | 0.34 | 0.164 | Average | 9 / 10 | 32 | 0.01 | 0.005 | 1.09 | No | Consistent with background |
| Calcium | -- | -- | 900 | 7900 | 3895 | Average | 10 / 10 | NSV | -- | -- | 3560 | No | Macronutrient |
| Chromium (hexavalent) | -- | -- | 0.15 | 1.05 | 0.575 | Average | 4 / 4 | 0.4 | 3 | 1.4 | -- | No | Low magnitude of exceedance |
| Chromium | -- | -- | 7.8 | 20 | 13.28 | Average | 10 / 10 | 10 | 2 | 1 | 27.3 | No | Consistent with background |
| Cobalt | -- | -- | 0.64 | 6.1 | 2.185 | Average | 10 / 10 | 13 | 0.5 | 0.2 | 5.41 | No | HQ(s) less than one |
| Copper | -- | -- | 1.8 | 16 | 7.16 | Average | 10 / 10 | 70 | 0.2 | 0.1 | 43.6 | No | Consistent with background |
| Cyanide | 0.05 | 0.06 | -- | -- | 0.029 | 1/2 Max MDL | 0 / 4 | 1 | 0 | 0 | -- | No | Not detected |
| Iron | -- | -- | 3200 | 16000 | 8940 | Average | 10 / 10 | NSV | -- | -- | 17300 | No | Consistent with background |
| Lead | -- | -- | 1.9 | 37 | 13.61 | Average | 10 / 10 | 120 | 0.3 | 0.1 | 95.8 | No | Consistent with background |
| Magnesium | -- | -- | 606 | 2950 | 1374 | Average | 10 / 10 | NSV | -- | -- | 1830 | No | Macronutrient |
| Manganese | -- | -- | 15 | 230 | 71.3 | Average | 10 / 10 | 220 | 1 | 0.3 | 208 | No | EPC-based HQ less than one |
| Mercury | -- | -- | 0.012 | 0.11 | 0.0525 | Average | 4 / 10 | 0.05 | 2 | 1 | 0.99 | No | Consistent with background |
| Nickel | -- | -- | 1.1 | 23 | 8.04 | Average | 10 / 10 | 38 | 0.6 | 0.2 | 15.1 | No | HQ(s) less than one |
| Potassium | -- | -- | 230 | 1460 | 654.4 | Average | 10 / 10 | NSV | -- | -- | 986 | No | Macronutrient |
| Selenium | -- | -- | 0.25 | 1.1 | 0.576666667 | Average | 9 / 10 | 0.52 | 2 | 1 | 2.76 | No | Consistent with background |
| Silver | -- | -- | 0.041 | 3.9 | 0.71425 | Average | 8 / 10 | 560 | 0.01 | 0.001 | 8.7 | No | Consistent with background |
| Sodium | -- | -- | 17.6 | 143 | 45.91666667 | Average | 6 / 10 | NSV | -- | -- | -- | No | Macronutrient |
| Thallium | -- | -- | 0.077 | 0.15 | 0.116666667 | Average | 6 / 10 | 0.05 | 3 | 2 | 0.441 | No | Consistent with background |
| Vanadium | -- | -- | 4.7 | 24 | 13.6 | Average | 10 / 10 | 60 | 0.4 | 0.2 | 26.1 | No | Consistent with background |
| Zinc | -- | -- | 6.1 | 51 | 27.81111111 | Average | 9 / 10 | 120 | 0.4 | 0.2 | 142 | No | Consistent with background |

**Notes**

COC - Contaminant of concern

EPC - Exposure point concentration

ESV - Ecological screening value

TABLE 7

**Hazard Quotients for Analytes in Surface Soil at Site 9**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| **Analyte** | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background[3]** | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

FOD - Frequency of detection
HQ - Hazard quotient
MDL - Method detection limit
NSV - No screening value

TABLE 8

**Hazard Quotients for Analytes in Surface Soil at AOC D**

***Expanded Site Investigation Report***

***NRL-CBD, Chesapeake Beach, Maryland***

| **Analyte** | **Minimum Detection Limit** | **Maximum Detection Limit** | **Minimum Detection** | **Maximum Detection** | **EPC** | **EPC Basis** | **FOD** | **ESV** | **Maximum-based HQ** | **EPC-based HQ** | **Background[1]** | **COC?** | **Rationale** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | -- | -- | 100 | 3000 | 1817 | 95% Student's-t UCL | 14 /14 | 120 | 25 | 15 | 96 | Yes | HQ(s) greater than one. |

**Notes**

COC - Contaminant of concern

EPC - Exposure point concentration

# Appendix H

# Building 76 Historical Records Review

TECHNICAL MEMORANDUM

# Building 76 Historical Records Search Naval Research Laboratory - Chesapeake Bay Detachment, Chesapeake Beach, Maryland

| | |
|---|---|
| PREPARED FOR: | NAVFAC Washington |
| COPY TO: | NRL |
| PREPARED BY: | CH2M HILL |
| DATE: | March 3, 2020 |

## Introduction

This technical memorandum presents a summary of the historical record search conducted for Building 76 at Naval Research Laboratory – Chesapeake Bay Detachment (NRL-CBD), Chesapeake Beach, Maryland. CH2M HILL (CH2M) has prepared this document under the Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Washington, Comprehensive Long-term Environmental Action – Navy (CLEAN) 9000 Contract N62470-16-D-9000, Contract Task Order JU23.

During a site visit for the former Small Arms Range (UXO 3) in June 2018, representatives of the Navy and Maryland Department of the Environment (MDE) observed debris along the hillside that bounds the Building 76 area to the west and south. It was speculated that the debris observed along the hillside slopes could be representative of a potential disposal area and that additional information about Building 76 should be collected. The Navy tasked CH2M to perform a historical records search for the Building 76 area to document the past historical practices at Building 76 and identify the potential for a release to the environment from these past historical practices at Building 76.

## Facility and Site-Specific Background Information

### Facility Background

NRL-CBD is located at 5813 Bayside Road in Calvert County, Maryland south of the town of Chesapeake Beach, Maryland. NRL-CBD is located approximately 40 miles southeast of Washington, DC and occupies approximately 160 acres along the western shoreline of the Chesapeake Bay (**Figure 1**). The facility is bounded by the Chesapeake Bay to the east and residential housing areas to the north, south, and west. The facility is separated into an eastern and western portion, separated by Bayside Road (Maryland State Route 261).

The mission of NRL-CBD is to provide and maintain facilities for use by the research divisions of the Naval Research Laboratory in Washington, D.C. for the testing, development, and evaluation of radar, radio, optical, and fire control equipment, along with other research projects requiring a maritime environment or open skies, but with land-based support facilities (NEESA, 1984).

The original acquisition of land for NRL-CBD was made in 1941 and construction progressed rapidly during the war years. Major expansion occurred in 1953–54 with construction of a large laboratory building, shop facilities, and complete utility systems (NEESA, 1984).

## Site-Specific Background

Building 76 is located in the southeastern corner of the western portion (west of State Route 261) of the facility (**Figure 2**). In general, there is limited documentation about historic activities at Building 76. Most of the historical knowledge associated with Building 76 is derived from the *Initial Assessment Study,* referred to herein as the IAS, conducted by the Navy (NEESA, 1984). The IAS states that NRL-CBD operated a Maintenance and Support Branch at Building 76, also known as the Public Works Division, which provided services for grounds maintenance, carpentry, masonry, electrical work, plumbing, and paint maintenance; a machine shop; and general support services for research and development groups from NRL-DC. The IAS later states that Building 76 was constructed in 1953 and was used to support the Public Works Division and housed a portion of the Public Works Division including the grounds maintenance and carpentry divisions.

In addition to the Public Works Division housed inside Building 76, the IAS reports that a 300-gallon underground storage tank (UST) is located next to Building 76 but, does not specify where the UST is located. The UST was reported to be used for the disposal of waste oils which included used crankcase oil, spent gasoline used as a degreaser, paint thinner (mineral spirits and other solvents used in paint thinning and cleanup operations), and was mixed with Number 6 fuel oil from the power plant. The tank contents were emptied by a contractor and disposed of off-site one or two times per year. While the UST operations are located near Building 76 they appear to have been a separate operation and unrelated to the potential debris disposal that was observed along the hillside west and south of Building 76.

Currently Building 76 is used for storage for laboratory equipment used for research and development.

# Historical Record Search

To support the historical records search, a review of available information was conducted. The historical records search consisted of: a site visit, a document search of available records at NRL-CBD, a review of historical aerial photographs and photographs obtained from NRL-CBD, and interviews with personnel from NRL-CBD. Freedom of Information Act records searches with regulatory agencies (U.S. Environmental Protection Agency [USEPA] and MDE) were not conducted. NRL-CBD is not currently and historically has not been regulated by USEPA; therefore, Building 76 records were unlikely to be available. Additionally, in consultation with MDE, it was determined that records for Building 76 did not exist.

## Site Visit

A site visit at the Building 76 area was conducted on January 8, 2019 to obtain information about the current site setting, as well as to confirm the presence of debris material observed along the hillside to the west and south of Building 76. CH2M representatives met with Navy personnel from NAVFAC Washington and NRL-CBD to reconnaissance the area. Table 1 below presents a list of the personnel that participated in the Building 76 site visit.

Table 1. Site Visit Participants

| Name | Organization |
|---|---|
| Ryan Mayer | NAVFAC Washington |
| Scott Lonesome | NRL-DC |
| Harold Rolfs | NRL-CBD |
| Bill Drury | NRL-CBD |

Table 1. Site Visit Participants

| Name | Organization |
|---|---|
| Larry Carpenter | NRL-CBD |
| Andrew Bogdanski | CH2M HILL |
| Stephen Dronfield | CH2M HILL |

Upon arrival at the installation, the Navy and CH2M personnel met at the NRL-CBD administrative building and proceeded to Building 76 to perform the site reconnaissance. Throughout the site walk, Navy personnel took photographs of observations made during the visit, and these photographs are presented in a photo log as **Attachment 1**. The photo log displays observations noted during the site reconnaissance and provides summaries of the observations while **Attachment 1 - Figure 1** displays the Building 76 area and notes the locations and orientations of the photographs.

The group first walked along the parking lot apron starting to the west of Building 76 and moved southward along the steep hillside that bounds Building 76 to the south. The asphalt apron along the western portion of Building 76 is generally flat and used as an access drive for Building 76. A few Conex box storage containers are located on the apron between Building 76 and the access drive. There were no visual observations of historical filling or environmental releases noted in this area. Adjacent to the south side of Building 76, in the asphalt-covered apron, were various used research equipment and dumpsters which are stored for off-site disposal or recycling. The asphalt apron in the southern area is bounded by a one-to-two-foot-high soil berm along the top of the hillside. A stormwater catch basin located in the asphalt conveys stormwater into a pipe, which transports it down the hillside to the south where it discharges to a surface water body. There were no visible indications of buried waste observed in this area; however, minor surficial trash, likely wind-blown from the dumpsters, was observed on the ground surface along southern hillside (**Attachment 1, Photos 4, 5, 6, and 7**).

Further west of Building 76 and the asphalt apron lies an open flat grassy area that is suspected to have been created by filling. This grassy area is not bounded by a berm and the sidewall of the western extent exhibits erosion rills and exposed construction debris (i.e., large concrete and asphalt chunks, rebar). This area represents the likely source of the earlier observations of debris in the Building 76 area. Discussion with NRL-CBD personnel suggested that the western hillside area had been built-up using construction debris after the completion of Building 76. The original stormwater outfall from the western parking lot area was located along the western hillside area; however, this location is now currently located in the middle of the grassy area. NRL-CBD personnel noted that stormwater in the western catch basin would backup, which necessitated a new outfall. During excavation activities to install the new pipe for the outfall numerous construction debris items were encountered (**Attachment 1, Photos 1, 2, and 3**) further supporting the idea that the grassy area was constructed by landfilling activities. The excavated debris was segregated and consisted of concrete, scrap metal, and at least one empty crushed drum (**Attachment 1, Photo 3**).

The team then proceeded to drive to the bottom of the southern hillside and walked the length of the area back to the top of the Building 76 western hillside. Approaching the top of the western hillside, the team observed numerous locations of uncovered construction debris approximately 6–10 feet below ground surface (bgs), especially around the current stormwater outfall where erosion is pronounced (**Attachment 1, Photos 8 and 9**). Surficial debris down the valley and hillside appeared to be eroded from the same 6–10 feet bgs layer of construction debris at the top of the western hillside. The western hillside is bounded by an erosion channel which transports surface water runoff from other areas of the facility (**Attachment 1, Photo 10**). Debris was not observed beyond the west of this channel. Because the channel is located at a significantly lower elevation than the top of the hillside it is unlikely that fill extends this far west, but surface debris items noted likely transported down the hillside as they eroded out from higher elevations.

## Document Search

Following the site visit, CH2M reviewed historical records held at the NRL-CBD facility. These facility records mainly consisted of architectural drawings, utility and engineering plans, and a few old reports and forms. The only document relevant to Building 76 that was discovered was an architectural drawing dated from 1952 that showed the Building 76 area with the planned topography grading elevations and utilities (**Attachment 2**). This drawing confirmed the earlier discussions about the grassy area on the western side of Building 76 being filled-in to create a flat surface and showed the original grading elevations when Building 76 was constructed. No further relevant documents were found at the NRL-CBD facility.

Following the records search, the original grading elevations were incorporated into the project GIS and the original grading and current grading elevations were overlain to approximate the horizontal and vertical limits of the land filling that have occurred west of Building 76 (**Figure 3**). This comparison revealed that the horizontal extents were approximately 135 feet by 105 feet encompassing an area of approximately 0.26 acre. The vertical extent of fill was determined to be approximately 4 feet thick on the eastern edge (where the existing asphalt apron ends) and extents to an approximate depth of 20 feet along the western edge of the hillside. Cross-sectional lines oriented north to south (A to A’ ) and west to east (B-B’) are shown on **Figure 3**. The cross-sectional views of the estimated depth of fill placement[1] along these lines are presented on **Figures 4 and 5**.

## Historical Photograph Review

### Aerial Photographs

A series of historic aerial photographs (**Attachment 3**) covering the timeframe of 1938 to 1971 were reviewed to aid in the understanding of the land use of the Building 76 area and determine if signs of land disturbance or filling could be observed which would help establish a timeframe for the landfilling activities that occurred west of Building 76.

The aerial photograph from 1938 pre-dates the construction of the Building 76 and the establishment of NRL-CBD in 1941, and serves as a baseline for site conditions pre-Navy ownership (**Attachment 3, Figure 1**). In the 1938 aerial photograph, the Building 76 area, including the hillside to the west and south, is shown to be a cleared farm field with no buildings or structures in the vicinity.

The next aerial photograph reviewed was dated 1952, which immediately pre-dates the construction of Building 76 (**Attachment 3, Figure 2**). In this aerial it can be observed that land in portions of the Building 76 area (within the Building 76 footprint) have been disturbed and the area on top of the hill is relatively open, with vehicle parking and possible staging of laboratory equipment. It was also observed that the hillside was undergoing ecological succession, reverting from farm fields and starting to populate with trees and shrubs.

In the 1957 aerial photograph (**Attachment 3, Figure 3**), it was observed that Building 76 had been constructed, including the existing asphalt apron around the building. The hillside to the south and west had been cleared and graded and appeared to be maintained as mowed grass areas. There are no signs of soil disturbance or filling activities noted.

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[1] For the purpose of this conceptual cross-section, the vertical elevation datum for the historical and current elevation contours were assumed to be the same.

Aerial photographs from 1960, 1964, 1969, 1970, and 1971 (**Attachment 3, Figures 4 through 8**) show the Building 76 area little changed from the 1957, with the exception of the hillsides to the west and south slowly becoming more vegetated with mature trees and the hillside converting from mowed grass areas to a wooded area.

### Facility Photographs

In addition to the historic aerial photographs, historic photographs previously provided by NRL were reviewed to aid in the understanding of land use at Building 76. In a photograph dated October 1951 (**Attachment 3, Figure 9**), the area of Building 76 has been disturbed and is being used as a dirt parking lot for vehicles and equipment consistent with the 1952 aerial photograph. An April 1955 photograph (**Attachment 3, Figure 10**) shows Building 76 constructed. An asphalt apron is located around the building and the hillside to the south and west of Building 76 has been graded and maintained as a mowed grass area. This is consistent with the aerial photograph from 1957.

In an aerial photograph dated August 1977 (**Attachment 3, Figure 11**), the Building 76 area remains unchanged from the 1957 photograph, with the exception of the hillsides to the west and south becoming vegetated with trees and brush. There are signs of vegetation clearing to the west of Building 76 corresponding to the area identified through the topographic comparison. The photograph shows an area extending into the wooded hillside that has been cleared of trees. There do not appear to be signs of ground disturbance or excavation in the photograph.

In an April 1989 photograph (**Attachment 3, Figure 12**), the previously cleared area is still visible. There are no signs of filling or excavation; however, the ground surface appears to be disturbed and the area looks to be used for equipment storage.

## Interview Questionnaires

As the last step of the historical records search, interview questionnaires were provided to select personnel from NRL-CBD. It should be noted that the historical landfilling that occurred west of Building 76 likely occurred sometime in the late-1970s, based on the photographic review, and there are no current NRL-CBD employees who also worked at NRL-CBD in the 1970s. Therefore, there are no known personnel who would have had direct first-hand knowledge of the activities that might have occurred. Instead three facility personnel from NRL-CBD were identified based on their longevity as an NRL-CBD employee and their historical knowledge of the facility. Survey interview forms were provided (**Attachment 4**) to solicit information on the historical operations of Building 76, with an emphasis on landfilling operations that may have occurred at Building 76. Interviewee 1, while a long-time employee at NRL-CBD, was unable to provide any information on the historical use at Building 76 as he is employed in a building located in a separate area of the facility from Building 76.

Interviewee 2 did not have any first-hand knowledge of the landfilling at Building 76. However, he did have some knowledge of the type of debris that is located in the filled area due to utility line repair work he was involved with. Interviewee 2 stated that during repair work to a stormwater line, a trench approximately 100 feet long by 8 feet deep was excavated though the filled area to replace a stormwater pipe. During the trench excavation, he noted that concrete and steel within the fill were encountered. The only records of the area that were known to him was the drawing identified in **Attachment 2** that showed the utility network, as well as the topographic grading plan from the construction of Building 76.

Interviewee 3, like Interviewees 1 and 2, did not have any first-hand knowledge of the landfilling at Building 76. Similar to Interviewee 2, he was also involved in the utility line repair work at Building 76 and noted that concrete and railroad tracks were encountered in the trench excavation during the repair work. Similarly, Interviewee 3 was also only aware of the drawing showing the utility line and topographic grading plan from the constriction of Building 76 (referred to as stormwater map).

# Findings

Based on the historical records search and the information gathered through the site visit, the document search, the historical photo review, and the interviews, a better understanding of the historical use and operations of the Building 76 area and the potential for an environmental release has been collected.

Building 76 was constructed in 1953 and historically it housed the Public Works Division, which provided services for grounds maintenance, carpentry, masonry, electrical work, plumbing, and paint maintenance; a machine shop; and general support services. Currently, Building 76 is used for storage for laboratory equipment used for research and development.

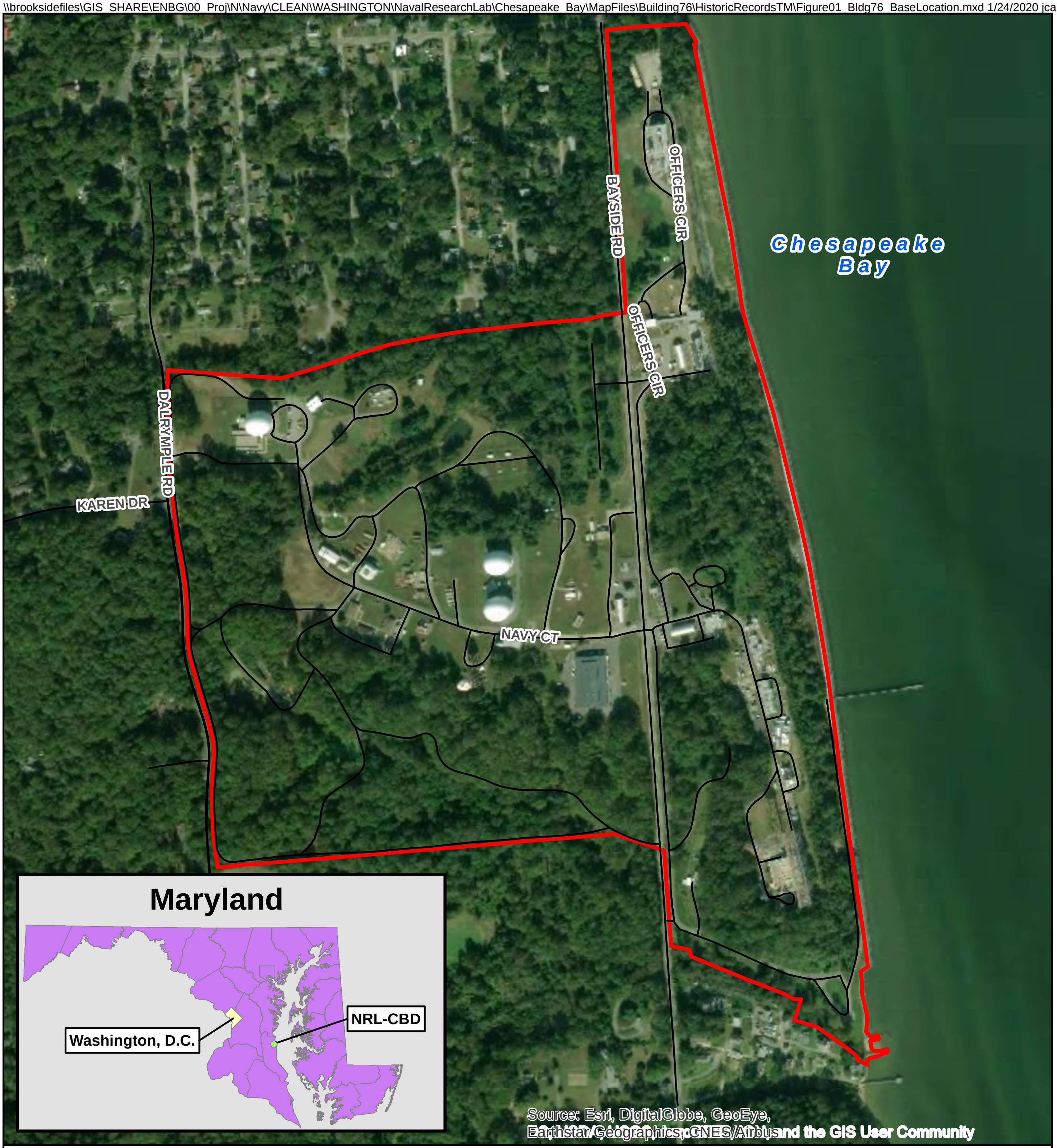
The site visit confirmed the presence of buried debris in the subsurface to the west of Building 76 and was observed to consist of concrete and metal that was intermixed with soil. This observation was further supported by the comparison of the historical and current topographic grading plans, showing the disparity in the ground surface elevations to the west of Building 76 and the likely placement of fill material. Additionally, the observations by NRL-CBD personnel noted during the interviews, confirmed the type of debris material (concrete and steel) that was likely placed. The August 1977 photograph provides an approximate start date to when landfilling may have occurred, while the August 1989 photograph provides a conservative end date to landfilling operations. Given the small size of the area, 0.26 acre, it is unlikely that landfilling occurred for a duration of 12 years and probably ended much earlier than 1989. Additionally, the information gathered during the historical records search supports that landfilling was limited to the hillside slope along the western edge of Building 76 and did not extend to additional areas, such as the southern hillside slope.

The information gathered during the Building 76 historical records search indicates that there is the potential for a release to the environment from the past landfilling that occurred in the area west of Building 76. The Navy should consider sampling environmental media within the area of the landfilling to determine whether a release has occurred.

# References

Naval Energy and Environmental Support Activity (NEESA). 1984. *Initial Assessment Study of Naval Research Laboratory, Washington D.C*. March.

# Figures



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Legend**

___ Road

🟥 Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 1**
**Base Location Map**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

**Legend**

- ⊕ Catch Basin
- ⬟ Outlet
- → Storm Sewer Line with Flow Direction
- 🟥 Disposal Area
- ▢ Building Outline

**Figure 2**

**Building 76 Disposal Area Location Map**

Building 76 Historical Records Search

*NRL Chesapeake Bay Detachment*

*Chesapeake Beach, Maryland*

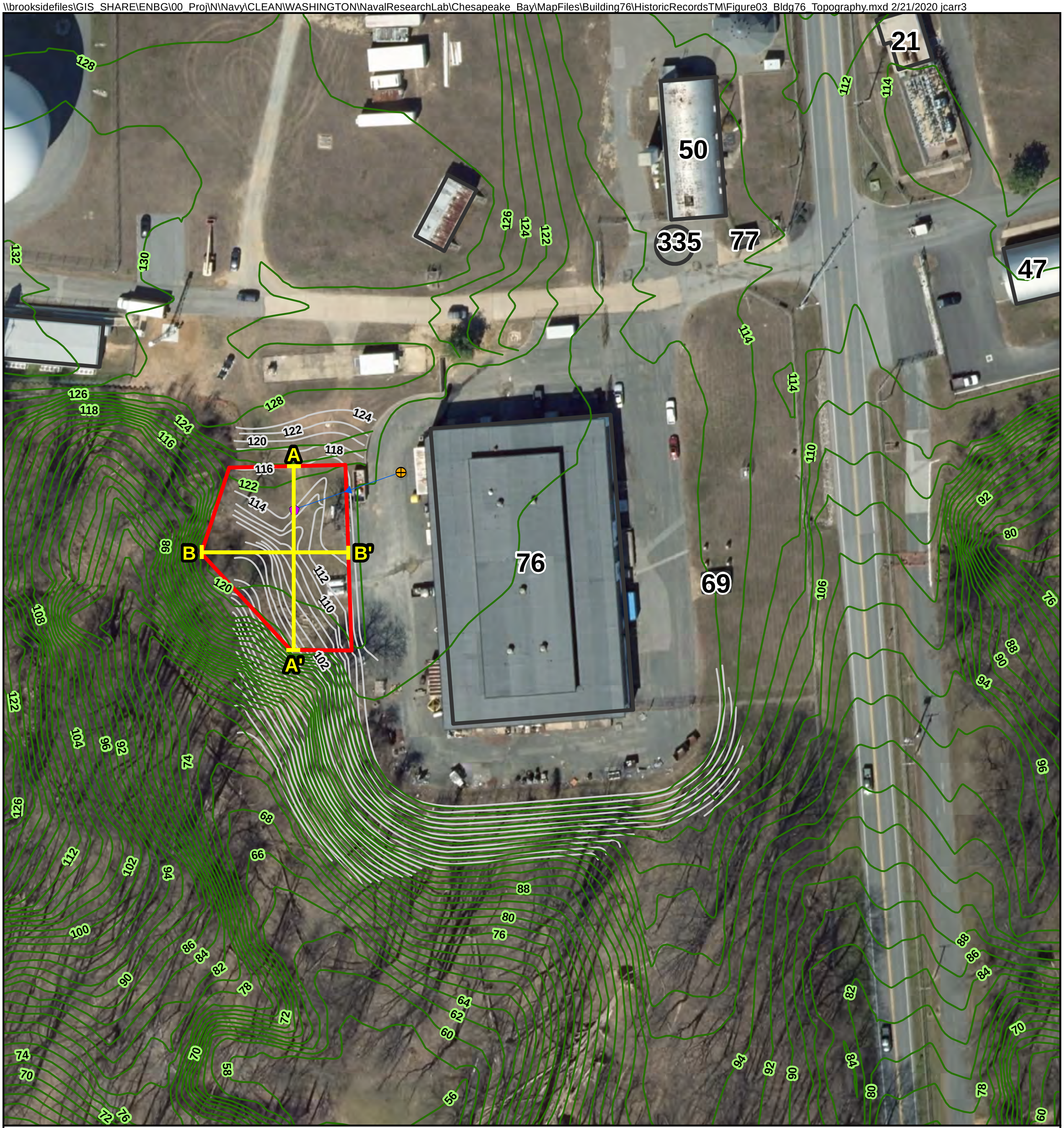
N

0 50 100 Feet

1 inch = 100 feet

Imagery: Calvert County, MD - 2017

ch2m



**Legend**

⊕ Catch Basin

⬟ Outlet

🟨 Cross Section Line

→ Storm Sewer Line with Flow Direction

— Current Topo Line 2 Ft.

— Historic Topo Line 2 Ft.

🟥 Disposal Area

⬛ Building Outline

Imagery: Calvert County, MD - 2017

N

0 50 100
Feet

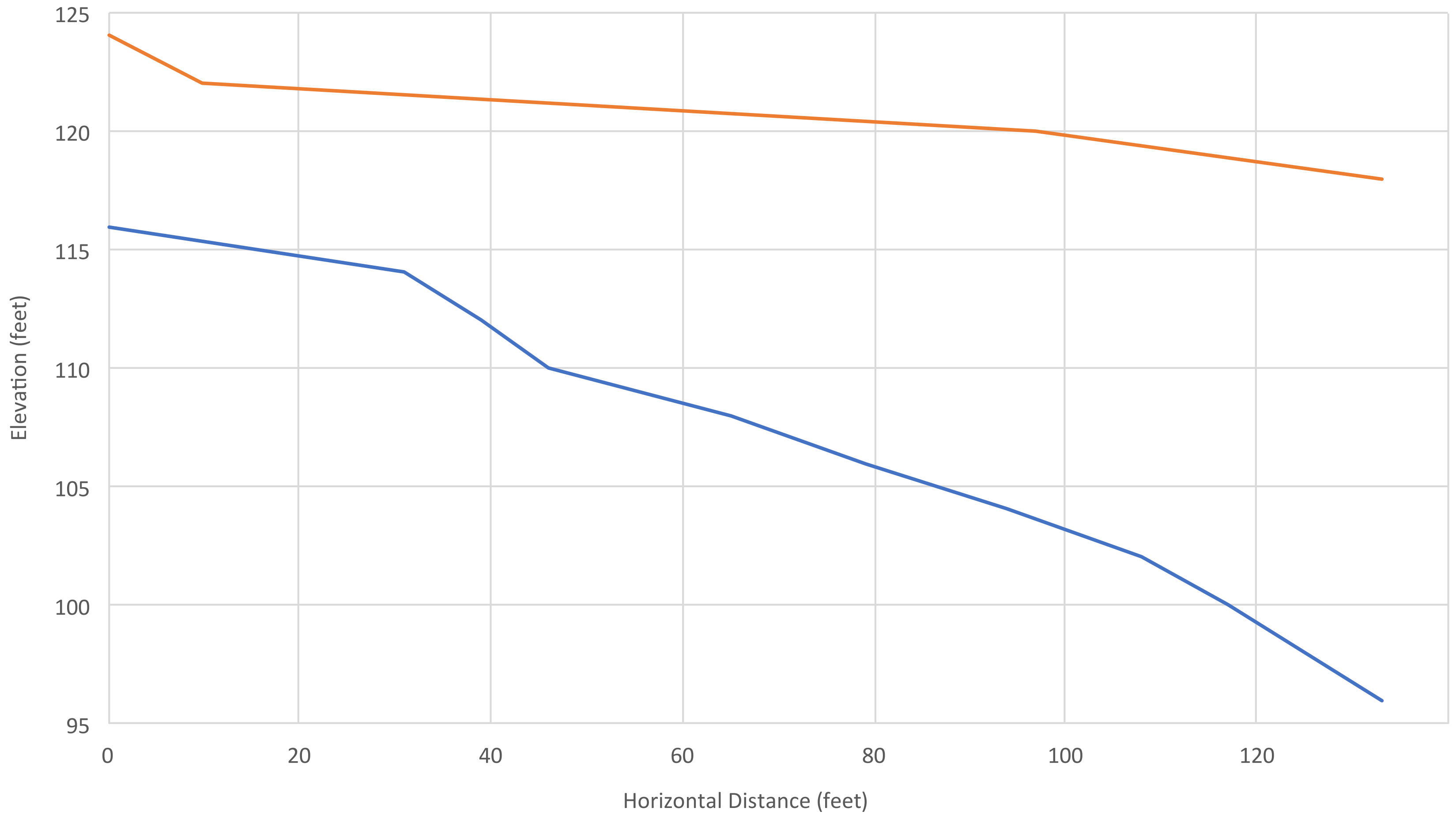
1 inch = 100 feet

## Figure 3

## Building 76 Disposal Area Current and Historic Topography

Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

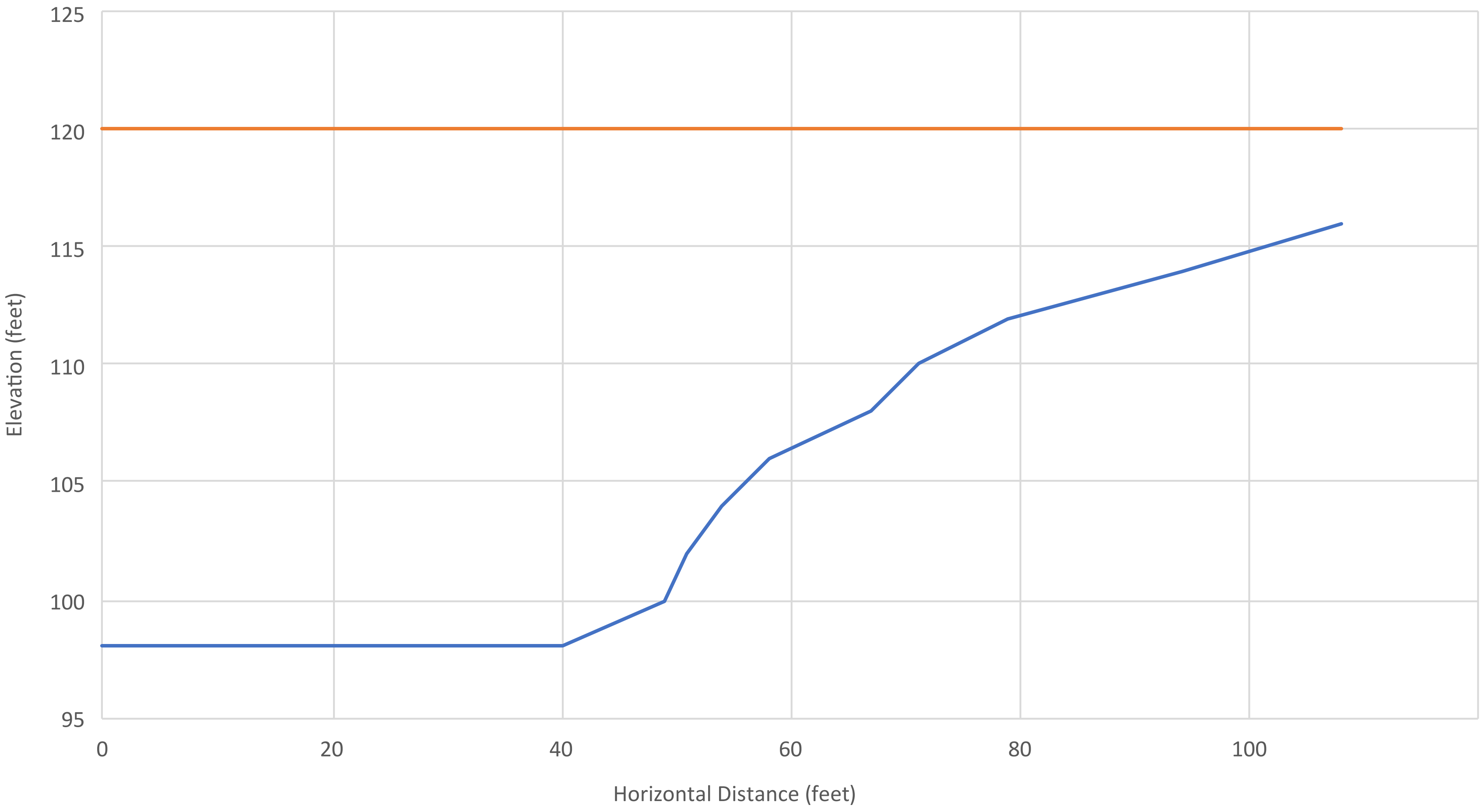


**LEGEND**

🟧 Current elevation (2009)

🟦 Historical elevation (1952)

**Figure 4.**
**Building 76 Disposal Area Cross Section A to A'**
**Elevation Difference 1940 to 2020**
*Building 76 Historical Records Search*
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*



**LEGEND**

- Current elevation (2009)
- Historical elevation (1952)

**Figure 5.**

**Building 76 Disposal Area Cross Section B to B'**

**Elevation Difference 1940 to 2020**

*Building 76 Historical Records Search*

*NRL Chesapeake Bay Detachment*

*Chesapeake Beach, Maryland*

# Attachment 1
# Site Visit Photographic Log

ch2m

# PHOTOGRAPHIC LOG

| | | |
|---|---|---|
| Naval Research Laboratory - Chesapeake Beach, MD | Site Location:<br>Building 76 | Project Number:<br>692409CH |

Photo No. 1

Date: 01-08-2019

Description:
Surficial debris and erosion along the hillside west of Building 76.

Photo No. 2

Date: 01-08-2019

Description:
Exposed construction debris along the western hillside.

| | | |
|---|---|---|
| Naval Research Laboratory - Chesapeake Beach, MD | Site Location:<br>Building 76 | Project Number:<br>692409CH |

| | |
|---|---|
| Photo No.<br>3 | Date:<br>01-08-2019 |

Description:
Surficial trash along western hillside.

| | |
|---|---|
| Photo No.<br>4 | Date:<br>01-08-2019 |

Description:
Southern hillside and valley.

# PHOTOGRAPHIC LOG

| | | |
|---|---|---|
| Naval Research Laboratory - Chesapeake Beach, MD | Site Location:<br>Building 76 | Project Number:<br>692409CH |

Photo No. 5

Date: 01-08-2019

Description:
Southern hillside with no visible debris.

Photo No. 6

Date: 01-08-2019

Description:
Southern hillside with no visible debris.

# PHOTOGRAPHIC LOG

| | | |
|---|---|---|
| Naval Research Laboratory - Chesapeake Beach, MD | Site Location:<br>Building 76 | Project Number:<br>692409CH |

Photo No. 7

Date: 01-08-2019

Description:
Southern hillside with no visible debris.

Photo No. 8

Date: 01-08-2019

Description:
Exposed construction debris and western hillside stormwater outfall (black pipe to left).

# PHOTOGRAPHIC LOG

| | | |
|---|---|---|
| Naval Research Laboratory - Chesapeake Beach, MD | Site Location:<br>Building 76 | Project Number:<br>692409CH |

Photo No. 9

Date: 01-08-2019

Description:
Construction debris on the western hillside.

Photo No. 10

Date: 01-08-2019

Description:
Ravine at the bottom of the western hillside.

Photo Location and Direction

▲ Transformer Bank

⊕ Catch Basin

⬟ Outlet

→ Wastewater Line with Flow Direction

- - Ditch

→ Storm Sewer Line with Flow Direction

▭ Building Outline

Imagery: Calvert County, MD - 2017

N

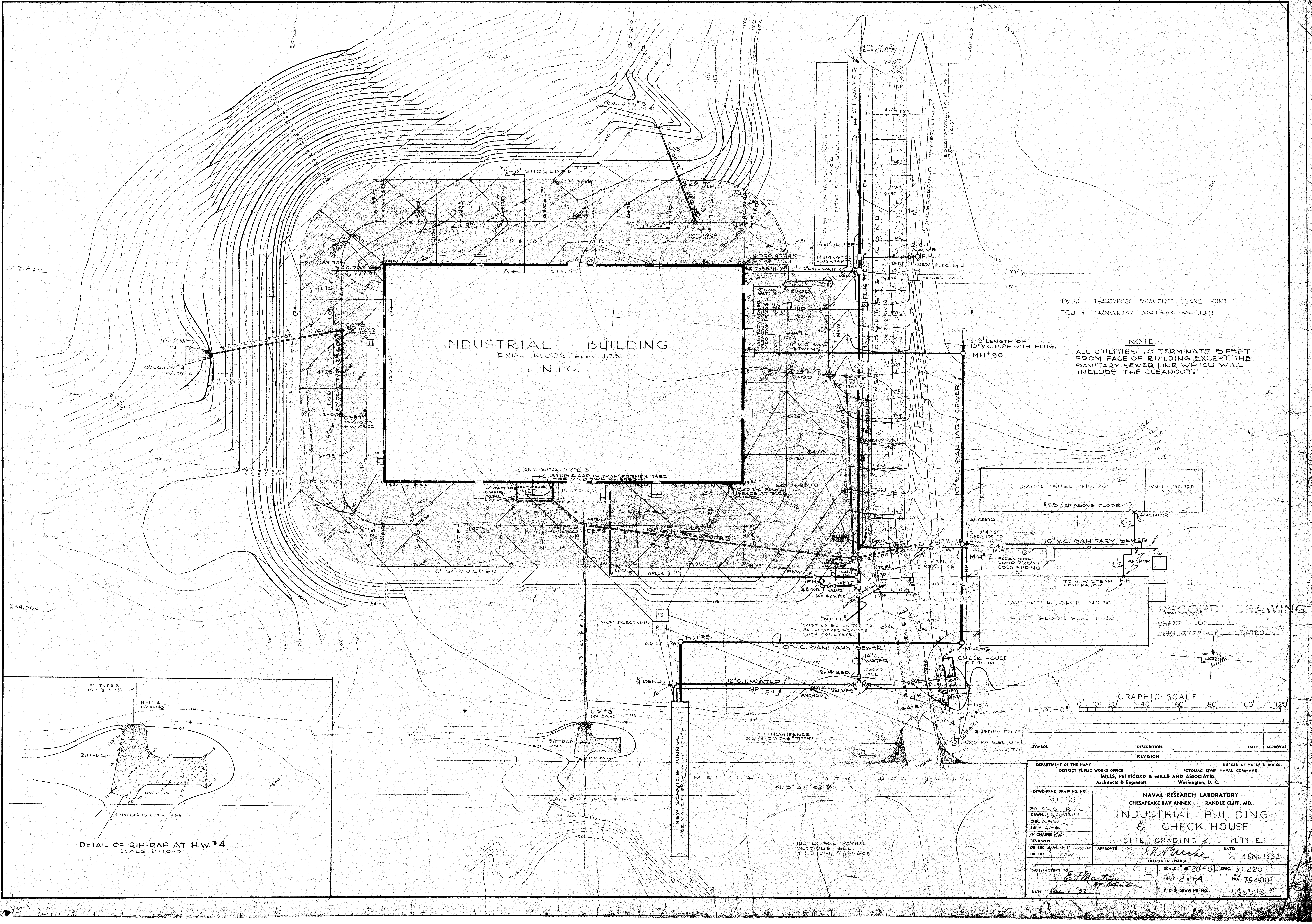
0 50 100 Feet

1 inch = 100 feet

**Figure 1**
**Building 76 Photo Locations**
Building 76 Site Visit
*NRL-CBD*
*Chesapeake Beach, Maryland*

ch2m

# Attachment 2
# Historical Documents



TWPJ = TRANSVERSE WEAKENED PLANE JOINT
TCJ = TRANSVERSE CONTRACTION JOINT

NOTE

ALL UTILITIES TO TERMINATE 5 FEET FROM FACE OF BUILDING, EXCEPT THE SANITARY SEWER LINE WHICH WILL INCLUDE THE CLEANOUT.

NOTE FOR PAVING SECTIONS SEE Y & D DWG. # 595605

DETAIL OF RIP-RAP AT H.W. #4
SCALE 1" = 10'-0"

RECORD DRAWING
SHEET ___ OF ___
SEE LETTER NOY ___ DATED ___

GRAPHIC SCALE
1" - 20'-0"
0 10' 20' 40' 60' 80' 100' 120'

| SYMBOL | DESCRIPTION | DATE | APPROVAL |
|---|---|---|---|
| | | | |

REVISION

DEPARTMENT OF THE NAVY
DISTRICT PUBLIC WORKS OFFICE
BUREAU OF YARDS & DOCKS
POTOMAC RIVER NAVAL COMMAND
MILLS, PETTICORD & MILLS AND ASSOCIATES
Architects & Engineers
Washington, D. C.

DPWO-PRNC DRAWING NO.
30369
DES. A.F.S. R.J.K.
DRWN. G.S.J. C.S.T.R. G.S. E.A.E.
CHK. A.F.S.
SUP'V. A.F.S.
IN CHARGE
REVIEWED
DB 300 WHS-NJT
DB 101 CFW

NAVAL RESEARCH LABORATORY
CHESAPEAKE BAY ANNEX
RANDLE CLIFF, MD.
INDUSTRIAL BUILDING
& CHECK HOUSE
SITE, GRADING & UTILITIES

APPROVED: J.N. Burke
OFFICER IN CHARGE
DATE: 4 Dec. 1952

SATISFACTORY TO E.F. Martinez by direction
DATE Dec 1 '52

SCALE 1" = 20'-0"
SPEC. 36220
SHEET 12 OF 64
NOy 75400
Y & D DRAWING NO. 595598

# Attachment 3
# Historical Photographs

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\Building76\HistoricRecordsTM\Figure1_NRL_CBD_1938_aerial.mxd 2/20/2020 jcarr3

**Legend**

Disposal Area

Building 76 Outline

Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

N

0 150 300 600
Feet

1 inch = 600 feet

**Figure 1**
**1938 historic imagery**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

**Legend**

🟥 Disposal Area

▢ Building 76 Outline

⌐¬ Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 2**
**1952 historic imagery**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

**Legend**

- 🟥 Disposal Area
- ▭ Building 76 Outline
- ▭ Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

N

0 150 300 600 Feet

1 inch = 600 feet

**Figure 3**
**1957 historic imagery**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

**Legend**

🟥 Disposal Area

⬛ Building 76 Outline

▭ Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

N

0 150 300 600 Feet

1 inch = 600 feet

**Figure 4**
**1960 historic imagery**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

**Legend**

🟥 Disposal Area

⬛ Building 76 Outline

Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 5**

**1964 historic imagery**

Building 76 Historical Records Search

*NRL Chesapeake Bay Detachment*

*Chesapeake Beach, Maryland*

ch2m

**Legend**

🟥 Disposal Area

⬛ Building 76 Outline

Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 6**

**1969 historic imagery**

Building 76 Historical Records Search

*NRL Chesapeake Bay Detachment*

*Chesapeake Beach, Maryland*

ch2m

**Legend**

- 🟥 Disposal Area
- ▭ Building 76 Outline
- ⌐ ┘ Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 7**
**1970 historic imagery**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

ch2m

**Legend**

🟥 Disposal Area

▢ Building 76 Outline

⌐¬ Naval Research Laboratory-Chesapeake Bay Detachment (NRL-CBD) Base Boundary

1 inch = 600 feet

**Figure 8**

**1971 historic imagery**

Building 76 Historical Records Search

*NRL Chesapeake Bay Detachment*

*Chesapeake Beach, Maryland*

ch2m

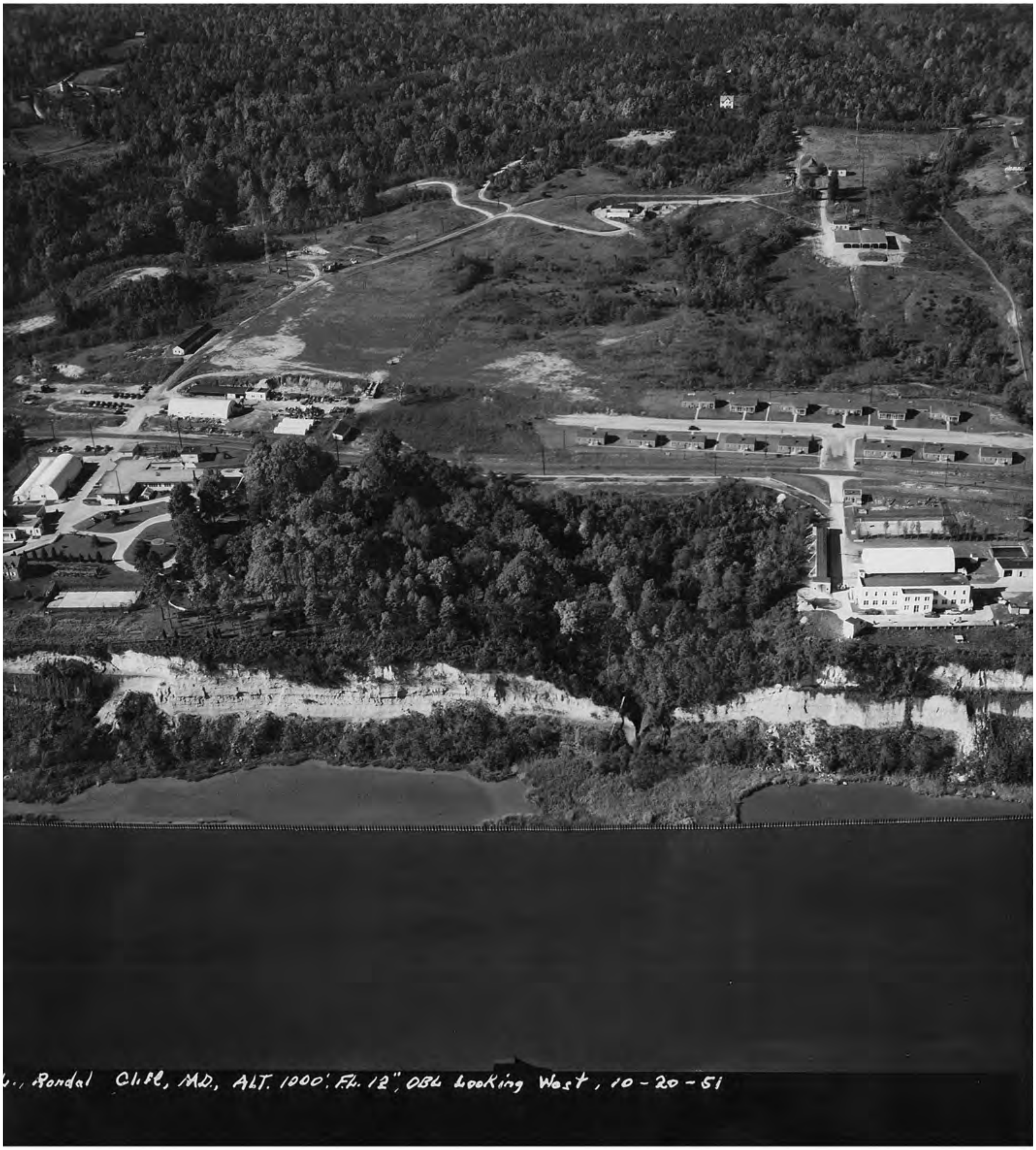


**Figure 9**
**October 1951**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

\\Orion\BD\Navy_Graphics_Proj_2016_Figures\NavyClean_Blg76_Historic_FES0123201125WDC

3 NRL, Chesapeake Bay Annex, Randle Cliff, Md 4/5/55 K-17-12" ALT. 1000' View Looking West

**Figure 10**
**April 1955**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

**Figure 11**
**August 1977**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

**Figure 12**
**April 1989**
Building 76 Historical Records Search
*NRL Chesapeake Bay Detachment*
*Chesapeake Beach, Maryland*

# Attachment 4
# Interview Forms

# INTERVIEW FORM
# BUILDING 76: NAVAL RESEARCH LABORATORY – CHESAPEAKE BAY DETACHMENT (NRL-CBD), CHESAPEAKE BEACH, MARYLAND

| | |
|---|---|
| **Date of Interview Form Completion** | **8/28/2019** |
| **Interviewee Name** | [redacted] |
| **Title** | **Physical Science Technician** |
| **Organization** | **Chemistry Division Code 6186** |
| **Address** | **5813 Bayside Road,** [redacted]<br>**Chesapeake Beach, MD 30732** |
| **Phone** | [redacted] |
| **Email** | [redacted] |
| **CH2M HILL Staff conducting Interview (if applicable)** | |

## 1. Background Information

During a site visit by the Navy and Maryland Department of the Environment (MDE), construction type debris was observed along the steep hillside to the west and south of Building 76. As a result, the Navy tasked CH2M to perform a historical records search to determine past historical practices and the potential for releases to the environment related to the observed waste surrounding Building 76.

Building 76 (Industrial Building) is located on the western portion of NRL-CBD and is currently used primarily for storage. Historically, Building 76 was known to house industrial trade shops for the electrical, mechanical and plumbing trade branches. No known waste disposal activities have been documented at or near Building 76. However, erosion of the hillside to the west of Building 76 has exposed construction debris buried in the subsurface.

The Navy is requesting additional information about the historical use of Building 76 and the immediate surrounding area to complete an evaluation for the potential of a release of contaminants to the environment. The questions identified below are provided to enhance the understanding of the historical activities related to the Building 76 area at NRL-CBD.

## 2. Interview Questions:

1. Do you have any first-hand knowledge or information regarding the location of this site?

I did not work at building 76, therefore, I have no knowledge of what goes on in and around that building what so ever.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

same

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

same

# INTERVIEW FORM
# BUILDING 76: NAVAL RESEARCH LABORATORY – CHESAPEAKE BAY DETACHMENT (NRL-CBD), CHESAPEAKE BEACH, MARYLAND

| | |
|---|---|
| **Date of Interview Form Completion** | 12-11-2019 |
| **Interviewee Name** | [redacted] |
| **Title** | small craft operator |
| **Organization** | NRL - CBD code 3522 |
| **Address** | 5813 Bayside Rd<br>ches. beach md 20732 |
| **Phone** | [redacted] |
| **Email** | [redacted] |
| **CH2M HILL Staff conducting Interview (if applicable)** | |

## 1. Background Information

During a site visit by the Navy and Maryland Department of the Environment (MDE), construction type debris was observed along the steep hillside to the west and south of Building 76. As a result, the Navy tasked CH2M to perform a historical records search to determine past historical practices and the potential for releases to the environment related to the observed waste surrounding Building 76.

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INTERVIEW FORM
SITE INVESTIGATION: NAVAL RESEARCH LABORATORY – CHESAPEAKE BAY DETACHMENT (NRL-CBD), CHESAPEAKE BEACH, MARYLAND

---

## 2. Interview Questions:

1. Do you have any first-hand knowledge or information regarding the location of this site?

Due to the excavation of a New storm Drain to Replace a last existing Storm Drain, we have some knowledge of the material at this site.

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

In the course of Excavating the site a Ditch through the formention area 100 Ft Long By averge Depth of 8 Ft was Created the only material we uncovered was concrete Blocks and Various Pieces of Steel

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

The only Drawing we had showed the old storm drain outfall that had been buried

# INTERVIEW FORM
# BUILDING 76: NAVAL RESEARCH LABORATORY – CHESAPEAKE BAY DETACHMENT (NRL-CBD), CHESAPEAKE BEACH, MARYLAND

| | |
|---|---|
| **Date of Interview Form Completion** | |
| **Interviewee Name** | [redacted] |
| **Title** | Customer Liaison Manager |
| **Organization** | NRL |
| **Address** | ~~4555~~<br>5813 Bay Side road<br>Chesapeake Beach MD 20732 |
| **Phone** | [redacted] |
| **Email** | [redacted] |
| **CH2M HILL Staff conducting Interview (if applicable)** | |

## 1. Background Information

During a site visit by the Navy and Maryland Department of the Environment (MDE), construction type debris was observed along the steep hillside to the west and south of Building 76. As a result, the Navy tasked CH2M to perform a historical records search to determine past historical practices and the potential for releases to the environment related to the observed waste surrounding Building 76.

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The Navy is requesting additional information about the historical use of Building 76 and the immediate surrounding area to complete an evaluation for the potential of a release of contaminants to the environment. The questions identified below are provided to enhance the understanding of the historical activities related to the Building 76 area at NRL-CBD.

## 2. Interview Questions:

1. Do you have any first-hand knowledge or information regarding the location of this site?

Just when we conducted a excavation job -

2. Do you have any first-hand knowledge or information regarding materials disposed of at this site (e.g., type of material/chemical, quantity, media [solid, liquid], timeframe of disposal [year(s)], and duration of disposal of site use)?

I know of rail road track and con crete.

3. Are you aware of any reports, drawings, maps, and/or other documents with additional details regarding this site?

StormWater map.

# Appendix I
# Radiological Survey Report for April 3, 2018

DRAFT TECHNICAL MEMORANDUM

# Radiological Survey Report 3 April 2018
# Naval Research Laboratory - Chesapeake Bay Detachment
# Chesapeake Beach, Maryland

| | |
|---|---|
| PREPARED FOR: | Ryan Mayer/NAVFAC Washington<br>Scott Lonesome/Naval Research Laboratory |
| COPY TO: | Jeff Woodward/CH2M HILL<br>Andy Bogdanski/CH2M HILL<br>Tony Mason, CHP, RRPT/CH2M HILL<br>Simon Fong/CH2M HILL |
| PREPARED BY: | CH2M HILL |
| DATE: | May 4, 2018 |

## Introduction

This technical memorandum has been prepared by CH2M HILL, Inc. (CH2M) under the Comprehensive Long-term Environmental Action – Navy (CLEAN) Contract N62470-16-D-9000, Contract Task Order JU23, for submittal to the Naval Facilities Engineering Command (NAVFAC) Washington. CH2M has been contracted to perform environmental characterization in support of the Department of the Navy's (Navy) Environmental Restoration Program. During the Expanded Site Inspection planning activities, CH2M was informed that three of the Environmental Restoration (ER) Sites at Naval Research Laboratory - Chesapeake Bay Detachment (NRL-CBD), Site 3 - Landfill No. 1, Site 4 - Landfill No. 2, and Site 5 – Landfill No. 3, had been identified as impacted by the potential for the presence of general radiological material (GRAM) through the Historical Radiological Assessment Report for the Naval Research Laboratory (CH2M, 2016).

As a precautionary measure to protect site worker safety, CH2M implemented radiological monitoring by a qualified radiation technician during intrusive activities performed at Sites 3, 4, and 5. The radiological monitoring included routine measurements of excavated material using a Ludlum 2221 survey meter with a Ludlum 44-10, 2-inch by 2-inch, sodium iodide (NaI) detector (Ludlum 2221/44-10) and a Bicron Micro Rem Tissue-Equivalent Survey Meter (Bicron Micro Rem). An action level of twice background was used to initiate a response of "safely pause, investigate, and notify project management." A complete list of instrumentation present onsite is provided in **Table 1** and the calibration certificates are provided in **Attachment 1**. Initial detector operational checks were performed through the collection of 20 static measurements and were used to establish +/- 20 percent acceptable count rates (ACR). Daily source checks were performed each morning to ensure detector responses within the +/- 20 percent ACR. The initial and daily instrument source checks are provided in **Attachment 2**.

Table 1. Radiological Instrumentation

| Survey Meter/Detector | Serial Number | Calibration Due Date |
|---|---|---|
| Ludlum 2360/43-93 | 274959/PR293983 | 3/28/2019 |
| Bicron Micro Rem | 9000 | 3/10/2019 |
| Ludlum 2221/44-10 | 190201/PR150873 | 3/16/2019 |
| Ludlum 2221/44-10 | 102034/PR164003 | 1/23/2019 |
| Ludlum 3/44-9 | 131898/PR194693 | 3/16/2019 |

# Discovery of the Unknown Radiological Object

On 3 April 2018, test pitting was in progress at Site 4, Test Pit #6 (**Figure 1**). Miscellaneous debris, including what appeared to be rusted metal, was encountered at approximately 3 feet below ground surface (bgs), becoming more persistent at approximately 6.5 feet bgs. It was decided that the debris and soil would be staged separately from the soil excavated to that point. At the discretion of the radiological technician, measurements using a Ludlum 2221/44-10 NaI detector were taken as close as safely possible to the excavator bucket containing soil and/or debris. The technician used personal protective equipment, including nitrile gloves. If the measurement was at or near the established instrument background level (i.e., mean 4,521 counts per minute [cpm]), the soil and debris were staged and another measurement of the material was taken at the top of the material pile. If that measurement was confirmed to be below twice the established instrument background levels (i.e., 9,042 cpm), the excavation continued. Background levels for the Ludlum 2221/44-10 and the Bicron Micro Rem were established by calculating the mean of 10 static measurements from a location of similar geologic characteristics as the site. The background measurement summary is provided in **Attachment 3**.

The excavation continued and the procedure described above was followed. Similar debris was encountered and no elevated measurements were identified. When the excavation reached approximately 9.5 feet bgs, the excavator picked up debris different from what had been encountered previously, including pieces of what appeared to be the same rusted metal and what appeared to be wires (three total). Since this material had not been encountered to this point, the work was safely paused and the wire was scanned with the Ludlum 2221/44-10 at a distance of approximately 1.5 to 2 feet. The wire was located near the top of the stockpile (top height of approximately 3 feet). Elevated levels above background were reported at approximately 20,000 cpm. Work was safely paused and a senior radiological consultant was notified. It was decided that a separate staging location (on a plastic liner) would be created to place the potentially radioactive item(s) that were found. An additional measurement taken slightly higher up on the stockpile confirmed the elevated count rate as approximately 35,000 cpm. Due to the unknown source of the elevated measurements and potential presence of removable activity, personnel frisks were performed with the Ludlum 3/44-9 during the inspection process whenever the technician left the soil area and separate staging location, with all measurements consistent with background.

Believing that the wire was the potential source of radiation, the wire was safely moved to the new staging location by the radiation technician and scanned using the Ludlum 2221/44-10 and Ludlum 3/44-9. Upon further inspection, no elevated measurements above background were identified on the wire. The radiation technician then observed, a large piece of what appeared to be rusted metal at the top of the stockpile, near where the wire had been removed. This object was identified as a potential source of the elevated readings and a measurement using the Ludlum 2221/44-10 was taken at approximately 1.5 to 2 feet, which was the closest distance that a reading could be obtained. The count rate was approximately 100,000 cpm and work was safely paused. The excavator bucket was scanned using the Ludlum 3/44-9 and no elevated measurements above background were observed. The CH2M Project Manager, Activity Manager and NAVFAC Washington Navy Technical Representative were then notified. NRL base personnel were already onsite and oversaw the inspection process and backfill of the excavation.

It was determined that the rusted object was the source of the elevated measurements and the object, along with the shovel used to transport the item, were moved to the separate staging area where only the radiation technician worked. A sketch and photograph of the object are provided in **Figures 2** and **3,** respectively. The object appeared to be partially rusted, approximately 2 feet in length and approximately 8 inches in diameter. The object had a hole in the center which allowed the radiation technician to observe the wall thickness which was noted to be approximately 1/8 inch thick. The object was observed to be rounded on one end with a square base on the other with a wire protruding from the square end. The object weighed approximately 20 to 30 pounds however, it was partially covered with soil and the hole through the center could have contained additional soil. The object was observed to be weighted more heavily on both the rounded and square ends. There were no discernable markings or labels on the object and it is unclear what the object is.

To better assess the radiation present in the item, measurements were taken, as close to the item as possible (but not on direct contact to prevent contaminating the meter in the event removable contamination was present). **Table 2** summarizes the measurements that were taken. The Ludlum 2221/44-10 was used to identify a potential "hot spot" on the object and the Bicron Micro Rem was used to measure dose rate. Scanning of the object indicated elevated measurements near the rounded end of the object. Although the outer metal casing of the item appeared to be approximately 1/8 inch in thickness in the center, no reasonable estimate of the shielding at the rounded end could be made. Measurements were approximately 20 to 30 percent less towards the square base. The measurements in **Table 2** were taken at the identified hot spot and the hot spot is shown on the sketch in **Figure 2**.

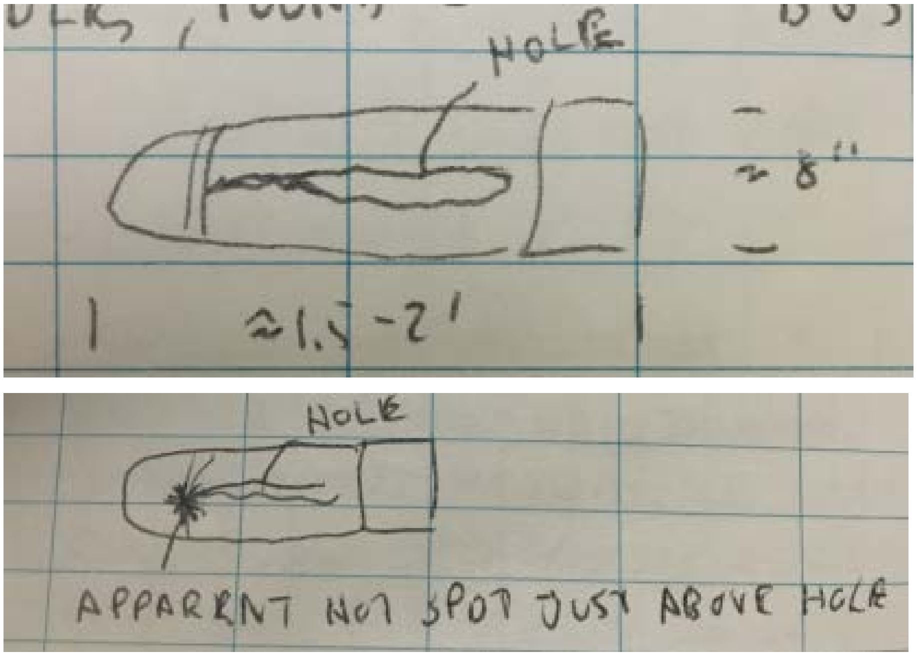

Figure 2. Sketch of the Radiological Object

Figure 3. Photograph of the Radiological Object

Table 2. Measurement Summary

| Instrument | Measurement (near contact) | Notes |
|---|---|---|
| Ludlum 2221/44-10 | ~550,000 cpm | |
| Bicron Microrem | 400 microrem/hour | |
| Ludlum 2360/43-93 | 9,587 cpm beta | One-minute static count |
| Ludlum 2360/43-93 | 11 cpm alpha | One-minute static count |

After the inspection of the radiological object, the senior radiological consultant was notified of the information that was collected and it was decided that the object would be bagged and placed back in the bottom of the test pit. Two smears were taken on the item to identify if removable contamination was present. Field screening with the Ludlum 2360/43-93 alpha/beta instrument did not identify removable activity above background on the smears. Field screening included holding the smear as close to the detector face without contact and observing whether 1-minute integrated alpha and beta counts were representative of a 1-minute integrated area background taken away from the worksite. The results of the smear count were less than the background count. The object was placed in two black contractor trash bags and two radiological labels were placed on the bag for identification. The object was safely placed in the excavator bucket and deposited in the excavation at a depth of approximately 9.5 feet bgs.

The shovel that was used to move the item was frisked using the Ludlum 3/44-9 and a Masslin wipe was used and field screened with the Ludlum 2360/43-93 to identify removable contamination. No elevated activity was identified. The plastic used as staging for the item was frisked and a swipe was collected and field screened. No elevated activity was identified. The soil pile was scanned again using the Ludlum 2221/44-10 and no elevated measurements above background were identified. It was determined by the radiation technician that no loose contamination remained at the site. The backfill of the test pit was completed. Global Positioning System location of the test pits available to reference the location in the future and the datum information is provided in **Table 3**.

**Table 3. Global Positioning System Location and Datum Information**

| | |
|---|---|
| Northing: | 361,487 |
| Easting: | 1,444,969 |
| Projected Coordinate System: | NAD 1983 StatePlane Maryland FIPS 1900 Feet |
| Projection: | Lambert Conformal Conic |
| False Easting: | 1312335.958 |
| False Northing: | 0 |
| Central Meridian: | -77 |
| Standard Parallel 1: | 38.3 |
| Standard Parallel 2: | 39.45 |
| Latitude of Origin: | 37.66666667 |
| Linear Unit: | Foot |

# Reference

CH2M HILL. 2016. *Historical Radiological Assessment Report, History of the Use of General Radioactive Materials 1923 to 2014, Naval Research Laboratory, Washington, D.C.* December.

# Figures

R:\ENBG\00_Proj\N\Navy\CLEAN\WASHINGTON\NavalResearchLab\Chesapeake_Bay\MapFiles\692409_Expanded_UFP_SAP\Figure01_Site4_TestPitLocations.mxd 5/3/2018 jcarr3

**Legend**

- ▬ ESI Test Pit Location
- ▬ SI Test Pit Location
- ▬ ESI Test Pit Location with Unknown Radiological Object
- ▭ Site Boundary
- ▭ CBD Boundary

Figure 1
Site 4 Landfill No. 2
Test Pit Locations
Radiological Survey Report
NRL Chesapeake Bay Detachment
Chesapeake Beach, Maryland

N

0 15 30
Feet

1 inch = 30 feet

Notes:
SI = Site Inspection
ESI = Expanded Site Inspection

# Attachment 1
# Calibration Certificates

**Safety and Ecology Corporation**
*2800 Solway Road*
*Knoxville, TN 37931*

**SEC PROCEDURE #** SEC-IS-418 Rev 2

*Page 1 of 1*

*3/28/2018*

# Calibration Certificate

## Calibration Certificate for 2360,Serial # 274959, Bar Code # ,Property # SEC-7158

**Date:** 03/28/18 **Date Last Cal. Expires:** 11/17/18 **Technician:** Carl Hall

**Location:** 999999, **Reason For Calibration:** Short Cycled

**EQUIPMENT USED DURING CALIBRATION**

**MODEL:** 500-2 **SERIAL #:** 132896 **CAL DUE:** 04/20/18

**MODEL:** **SERIAL #:** **CAL DUE:**

**AS FOUND DATA** **Geotropism:** SAT **AS FOUND Instrument Condition:** SAT **AS LEFT Instrument Condition:** SAT

☐ **New Batteries?** **Battery Check:** SAT **AS FOUND Mechanical Zero:** 0 **AS LEFT Mechanical Zero:** 0

| HIGH VOLTAGE (+/- 10% tolerance) | | AS FOUND HV | AS LEFT HV |
|---|---|---|---|
| | 500 V: | 511 V | AF V |
| | 1000 V: | 1006 V | AF V |
| | 1500 V: | 1499 V | AF V |

**AF HV Setting:** 650 V **AL HV Setting:** 650 V

| WINDOW SETTINGS | AS FOUND | AS LEFT |
|---|---|---|
| BT (4 mV +/- .4 mV): | 4 mV | AF mV |
| BW (40 mV +/- 4 mV): | 40 mV | AF mV |
| AT (120 mV +/- 10 mV): | 120 mV | AF mV |

## RATE METER

| SCALE | RATE CPM | AS FOUND | % ERROR | AS LEFT | % ERROR |
|---|---|---|---|---|---|
| x.1 or x1 | 100 | 100 | 0.00% | AF | 0.00% |
| | 250 | 250 | 0.00% | AF | 0.00% |
| | 400 | 400 | 0.00% | AF | 0.00% |
| x1 or x10 | 1000 | 1000 | 0.00% | AF | 0.00% |
| | 2500 | 2500 | 0.00% | AF | 0.00% |
| | 4000 | 4000 | 0.00% | AF | 0.00% |
| x10 or x100 | 10K | 10 | 0.00% | AF | 0.00% |
| | 25K | 25 | 0.00% | AF | 0.00% |
| | 40K | 40 | 0.00% | AF | 0.00% |
| x100 or x1000 | 100K | 100 | 0.00% | AF | 0.00% |
| | 250K | 250 | 0.00% | AF | 0.00% |
| | 400K | 400 | 0.00% | AF | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## DIGITAL SCALER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 250:** | 250 | **% ERR:** | 0.00% | **AL 250:** | AF | **% ERR:** | 0.00% |
| **AF 2500:** | 2500 | **% ERR:** | 0.00% | **AL 2500:** | AF | **% ERR:** | 0.00% |
| **AF 25K:** | 25 K | **% ERR:** | 0.00% | **AL 25K:** | AF K | **% ERR:** | 0.00% |
| **AF 250K:** | 250 K | **% ERR:** | 0.00% | **AL 250K:** | AF K | **% ERR:** | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## REPRODUCIBILITY

| | | | |
|---|---|---|---|
| **x.1 or x1 Scale:** | 250 | 250 | 250 |
| **x1 or x10 Scale:** | 2500 | 2500 | 2500 |
| **x10 or x100 Scale:** | 25 K | 25 K | 25 K |
| **x100 or x1000 Scale:** | 250 K | 250 K | 250 K |

☑ **Are the Individual Counts Within 10% of the Average?**

**Audio Response:** SAT
**Overload Light:** SAT
**Low Battery (2.2V):** SAT

**Comments:** Married as a set with: Model: 43-93 Serial #: PR293983 Bar Code #:

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** 03/28/19

**Performed by:** **Reviewed by:** **Date:** 3-28-18

**Printed Name:** Carl Hall

**Safety and Ecology Corporation** **SEC PROCEDURE #** **SEC-IS-420 Rev 3**

*2800 Solway Road, Knoxville, TN 37931* *Page 1 of 1*

## *Calibration Certificate*

*3/28/2018*

### *Calibration Certificate for 43-93,Serial # PR293983, Bar Code # ,Property # SEC-7164*

**Date:** 03/28/18 **Date Last Cal. Expires:** 11/17/18 **Technician:** Carl Hall

**Location:** 999999, **Reason For Calibration:** Short Cycled

**EQUIPMENT USED DURING CALIBRATION** **MODEL:** 2360 **SERIAL #:** 274959 **CAL DUE** 03/28/19

**NIST TRACEABLE SOURCES USED**

**Efficiencies from last calibration**

| | | |
|---|---|---|
| **Pu:** | 24.50 | % |
| **Tc:** | 21.71 | % |
| **Th:** | 22.15 | % |
| **SrY:** | 36.38 | % |

| SOURCE | ISOTOPE | ACTIVITY | 2π | ASSAY DATE |
|---|---|---|---|---|
| 5744-06 | Sr-90 | 15975 dpm | 11,209 cpm | 3/5/2018 |
| 5746-06 | Tc-99 | 31899 dpm | 20,000 cpm | 3/5/2018 |
| 5747-06 | Pu-239 | 25796 dpm | 13,098 cpm | 3/5/2018 |
| 5748-06 | Th-230 | 34898 dpm | 17,699 cpm | 3/5/2018 |

## AS FOUND DATA

**AS FOUND Instrument Condition:** SAT

**Calibration Setpoints**

**HV :** 650 **V**

**Threshold Beta:** 4 - 40 **mV Alpha:** 120 **mV**

| **Back ground:** | **Alpha** | | **Beta** | | **AF 4 π Efficiencies** | **A-B XTLK** |
|---|---|---|---|---|---|---|
| **Back ground:** | 0 | **CPM** | 182 | **CPM** | | |
| **Pu-239:** | 6147 | **CPM** | 437 | **CPM** | **23.83%** | 4.15% |
| **Tc-99:** | 2 | **CPM** | 7246 | **CPM** | **22.14%** | |
| **Th-230:** | 7702 | **CPM** | **N/A** | | **22.07%** | |
| **SrY-90:** | **N/A** | | 6235 | **CPM** | **37.89%** | |

☑ **Is the As Found Data within 20% of the efficiency from the last cal.?**

**AS LEFT Instrument Condition: SAT**

**AS LEFT DATA after repair, HV adjust or Plateau**

**HV :** 650 **V**

| | **Alpha** | | **Beta** | | **AL 4 π Efficiencies** | **A-B XTLK** |
|---|---|---|---|---|---|---|
| **Back ground:** | 0 | **CPM** | 182 | **CPM** | | |
| **Pu-239:** | 6147 | **CPM** | 437 | **CPM** | **23.83%** | 4.15% |
| **Tc-99:** | 2 | **CPM** | 7246 | **CPM** | **22.14%** | |
| **Th-230:** | 7702 | **CPM** | **N/A** | | **22.07%** | |
| **SrY-90:** | **N/A** | | 6235 | **CPM** | **37.89%** | |

**"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section**

**Reproducibility : Isotope:** Sr-90 6123 6278 6149 **Average:** 6183.3 ☑ **Are the individual counts within 10% of the average?**

If the As Found data (even after repair) is within 10% of the last calibration and the B-A Xtalk is <1% and the A-B Xtalk is <10%, then the technician may N/A the Plateau Data and go directly to Comments. Geometry of source = flush to surface, except gas proportional probes = 1/8" from surface unless otherwise specified.

## PLATEAU DATA

**Source 1:** Tc-99 **Source 2:** Th-230

| | **Response (CPM)** | | | **Response (CPM)** | | | **Background (CPM)** | | |
|---|---|---|---|---|---|---|---|---|---|
| **High Voltage** | **A ch.** | **B ch.** | **Net Eff.** | **A ch.** | **B ch.** | **Net Eff.** | **A ch.** | **B ch.** | **Net A to B Xtalk: <10%** |
| N/A | | | | | | | | | N/A |
| | | | | | | | | | N/A |
| | | | | | | | | | N/A |
| | | | | | | | | | N/A |
| | | | | | | | | | N/A |
| | | | | | | | | | N/A |

| | **Pu-239** | **Tc-99** | **Th-230** | **SrY-90** |
|---|---|---|---|---|
| **2 Pi Efficiencies:** | **46.93%** | **35.32%** | **43.52%** | **54.00%** |

**Comments:** **Married as a set with:** **Model:** 2360 **Serial #:** 274959 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** **03/28/19**

**Performed by:** **Reviewed by:** **Date:** 3-28-18

**Printed Name:** Carl Hall

# Calibration Certificate

**ThermoFisher**
SCIENTIFIC

The world leader
in serving science

| Report Number | Calibration Date |
|---|---|
| 00360141-9000 | 10-Mar-18 |
| **Manufacturer** | **Recommended Cal Due** |
| Thermo Scientific | 10-Mar-19 |
| **Instrument** | **As Found Condition** |
| Micro Rem AO | Out of Tolerance |
| **Serial Number** | **PO Number - Rev# / Rel#** |
| 9000 | N/A |

**Thermo Eberline LLC**
312 Miami St.
W. Columbia, S.C. 29170
USA

Calibration Standards used have calibration traceable to N.I.S.T.
Refer to back of the page for Certificate of Test & Calibration & Conformance

| Test Equipment | Calibration Standards |
|---|---|
| 87V S/N 35480109 Cal Due 15-Aug-18<br>80K-40 S/N HVP-015 Cal Due 15-Nov-18 | MP2 S/N 788 Cal Due 26-Jun-18<br>Cs-137 10 mCi S/N 733 Cal Due 28-Feb-19<br>Cs-137 10 Ci S/N 375 Cal Due 28-Feb-19 |

| Instrument Checkout Procedure | Probe Checkout Procedure |
|---|---|
| IWI024 rev. 16 Sep 14D | N/A |

**Environmental Conditions**

Temperature (°C): 20.9　Relative Humidity (%): 27.3　Barometric Pressure (in Hg): 29.87

**Calibration Data**

**Preliminaries:**

5 VDC +/- .5 VDC: Yes　-4.5 VDC +/- .25 VDC: Yes　1 mVDC +/- .5 mVDC: Yes

Mechanical Zero: Yes　Geotropism: Yes

**Isotopic Linearity:**

| *Range* | *Test Point (mR/h)* | *Tolerance (µrem/h)* | *As Found (µrem/h)* | *AF Dev. (%)* | *AF In Tolerance* | *As Left (µrem/h)* | *AL Dev. (%)* |
|---|---|---|---|---|---|---|---|
| X1000 | 160 | 144000 - 176000 | 165000 | 3.13 | Yes | 160000 | 0.00 |
| X1000 | 40 | 36000 - 44000 | 40000 | 0.00 | Yes | 40000 | 0.00 |
| X100 | 16 | 14400 - 17600 | 15500 | -3.13 | Yes | 16000 | 0.00 |
| X100 | 4 | 3600 - 4400 | 3500 | -12.50 | No | 3800 | -5.00 |
| X10 | 1.6 | 1440 - 1760 | 1600 | 0.00 | Yes | 1600 | 0.00 |
| X10 | .4 | 360 - 440 | 350 | -12.50 | No | 400 | 0.00 |
| X1 | .16 | 144 - 176 | 130 | -18.75 | No | 160 | 0.00 |

**Pulser Linearity:**

| *Range* | *Test Point (CPM)* | *Tolerance (µrem/h)* | *As Found (µrem/h)* | *AF Dev. (%)* | *AF In Tolerance* | *As Left (µrem/h)* | *AL Dev. (%)* |
|---|---|---|---|---|---|---|---|
| X1 | 16000 | Pulser Ref = 160 | 160 | N/A | Yes | 160 | N/A |
| X1 | 4000 | 36 - 44 | 40 | 0.00 | Yes | 40 | 0.00 |
| X.1 | 1600 | 14.4 - 17.6 | 20 | 25.00 | No | 16 | 0.00 |
| X.1 | 400 | 3.6 - 4.4 | 5 | 25.00 | No | 3.8 | -5.00 |

| | | | |
|---|---|---|---|
| Electronic Technician | TEST 3<br>Sandra Spears | Administrator | QC 5 |

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*2800 Solway Road, Knoxville, TN 37931*

# Calibration Certificate

**SEC PROCEDURE #** SEC-IS-403 Rev 3

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*3/17/2018*

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## *Calibration Certificate for 2221,Serial # 190201, Bar Code # ,Property # SEC-5296*

**Date:** 03/16/18 **Date Last Cal. Expires:** 01/23/19 **Technician:** Noah Keebler

**Location:** 999999, **Reason For Calibration:** Due for Calibration

**EQUIPMENT USED DURING CALIBRATION**

**MODEL:** 500-2 **SERIAL #:** 268940 **CAL DUE:** 04/20/18

**MODEL:** **SERIAL #:** **CAL DUE:**

## AS FOUND DATA

**Geotropism:** SAT **AS FOUND Instrument Condition:** SAT **AS LEFT Instrument Condition:** SAT

| HIGH VOLTAGE (+/- 10% tolerance) | AS FOUND HV | AS LEFT HV |
|---|---|---|
| 500 V: | 504 V | AF V |
| 1000 V: | 994 V | AF V |
| 1500 V: | 1495 V | AF V |

☐ **New Batteries?**

**Threshold ratio: 100=10mV**

**AF THRESHOLD:** 10 mV

**AL THRESHOLD:** 10 mV

**AF Mechanical Zero:** 0

**AL Mechanical Zero:** 0

**AF HV Reading:** 1150 V

**AL HV Reading:** 875 V

## RATE METER

| SCALE | RATE CPM | AS FOUND | % ERROR | AS LEFT | % ERROR |
|---|---|---|---|---|---|
| x.1 or x1 | 100 | 100 | 0.00% | AF | 0.00% |
| | 250 | 250 | 0.00% | AF | 0.00% |
| | 400 | 400 | 0.00% | AF | 0.00% |
| x1 or x10 | 1000 | 1000 | 0.00% | AF | 0.00% |
| | 2500 | 2500 | 0.00% | AF | 0.00% |
| | 4000 | 4000 | 0.00% | AF | 0.00% |
| x10 or x100 | 10K | 10 | 0.00% | AF | 0.00% |
| | 25K | 25 | 0.00% | AF | 0.00% |
| | 40K | 40 | 0.00% | AF | 0.00% |
| x100 or x1000 | 100K | 100 | 0.00% | AF | 0.00% |
| | 250K | 250 | 0.00% | AF | 0.00% |
| | 400K | 400 | 0.00% | AF | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## DIGITAL SCALER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 250:** | 250 | **% ERR:** | 0.00% | **AL 250:** | AF | **% ERR:** | 0.00% |
| **AF 2500:** | 2500 | **% ERR:** | 0.00% | **AL 2500:** | AF | **% ERR:** | 0.00% |
| **AF 25K:** | 25 K | **% ERR:** | 0.00% | **AL 25K:** | AF K | **% ERR:** | 0.00% |
| **AF 250K:** | 250.1 K | **% ERR:** | 0.04% | **AL 250K:** | AF K | **% ERR:** | 0.04% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## LOG SCALE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 200:** | 200 | **% ERR:** | 0.00% | **AL 200:** | AF | **% ERR:** | 0.00% |
| **AF 2000:** | 2000 | **% ERR:** | 0.00% | **AL 2000:** | AF | **% ERR:** | 0.00% |
| **AF 20K:** | 20 K | **% ERR:** | 0.00% | **AL 20K:** | AF K | **% ERR:** | 0.00% |
| **AF 200K:** | 200 K | **% ERR:** | 0.00% | **AL 200K:** | AF K | **% ERR:** | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## REPRODUCIBILITY

| | | | |
|---|---|---|---|
| **x.1 or x1 Scale:** | 250 | 250 | 250 |
| **x1 or x10 Scale:** | 2500 | 2500 | 2500 |
| **x10 or x100 Scale:** | 25 K | 25 K | 25 K |
| **x100 or x1000 Scale:** | 250 K | 250 K | 250 K |

☑ **Are the Individual Counts Within 10% of the Average?**

**Audio Response:** SAT
**Audio Divide:** SAT
**Push Buttons:** SAT
**Lamp:** SAT
**Scaler/Digital:** SAT

☑ **Fast / Slow Response Function Properly?**

**Comments:** **Married as a set with:** **Model:** 44-10 **Serial #:** PR150873 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** **03/16/19**

**Performed by:**

**Reviewed by:** **Date:** 3/16/18

**Printed Name:** Noah Keebler

**Safety and Ecology Corporation** **SEC PROCEDURE #** SEC-IS-415 Rev 3
**2800 Solway Road, Knoxville, TN 37931** *Page 1 of 1*
**Calibration Certificate** *3/17/2018*

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## Calibration Certificate for 44-10,Serial # PR150873, Bar Code # ,Property # SEC-5177

**Date:** 03/16/18 **Date Last Cal. Expires:** 04/13/12 **Technician:** Noah Keebler
**Location:** 999999, **Reason For Calibration:** Due for Calibration

### EQUIPMENT USED DURING CALIBRATION

**MODEL:** 2221 **SERIAL #:** 190201 **CAL DUE:** 03/16/19
**MODEL:** **SERIAL #:** **CAL DUE:**

### NIST TRACEABLE SOURCES USED

| SOURCE | ISOTOPE | ACTIVITY | 2π | ASSAY DATE |
|---|---|---|---|---|
| 99CS250-0288 | Cs-137 | 6.0658 uCi | | 1/3/2017 |

**Efficiency from Last Calibration:** 0.55 % **HV From Last Calibration:** 1150 V **Calibration Threshold:** 10 mV

**1 MINUTE COUNTS (CPM)**

### AS FOUND DATA

**AS FOUND Instrument Condition:** SAT
**HV:** 875 V
**Center:** 86860
**Background:** 4034
**4 π Probe Efficiency:** Cs-137 **0.62%**

### AS LEFT DATA after repair of HV adjust

**AS LEFT Instrument Condition: SAT**
**HV:** 875 V
**Center:** 86860
**Background:** 4034
**4 π Probe Efficiency:** Cs-137 **0.62%**

**"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section**

☑ **Is the As Found Efficiency Within 20% of the efficiency from the last cal.?**

**Reproducibility:** **Isotope:**Cs-137 86860 86784 86889 **Average:** 86844 ☑ **Are the individual counts within 10% of the average?**

* If As Found Efficiency (even after repair) is within 10% of the last calibration and uniformity is <10%, the technician may N/A the Plateau Data and proceed to Comments. Geometry = NaI probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

### PLATEAU AND SET POINT DATA (CPM)

| High Voltage | Source Response | Background | HV | CENTER | Background | 4 π Efficiency |
|---|---|---|---|---|---|---|
| 725 | 82647 | 3399 | V | | | Cs-137 |
| 750 | 84853 | 3692 | | | | |
| 775 | 84925 | 3835 | | | | |
| 800 | 84998 | 3909 | | | | |
| 825 | 85165 | 3836 | | | | |
| 850 | 85516 | 3957 | | | | |
| 875 | 86860 | 4034 | | | | |

**Comments:** **Married as a set with:** **Model:** 2221 **Serial #:** 190201 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** **03/16/19**

**Performed by:** **Reviewed by:** **Date:** 3/16/18

**Printed Name:** Noah Keebler

**Safety and Ecology Corporation**
*2800 Solway Road, Knoxville, TN 37931*

# Calibration Certificate

**SEC PROCEDURE #** SEC-IS-403 Rev 3

*Page 1 of 1*
*3/16/2018*

## *Calibration Certificate for 2221,Serial # 102034, Bar Code # ,Property # SEC-6478*

**Date:** 03/15/18 **Date Last Cal. Expires:** 01/23/19 **Technician:** Noah Keebler

**Location:** 999999, **Reason For Calibration:** Short Cycled

### EQUIPMENT USED DURING CALIBRATION

**MODEL:** 500-2 **SERIAL #:** 268940 **CAL DUE:** 04/20/18

**MODEL:** **SERIAL #:** **CAL DUE:**

## AS FOUND DATA

**Geotropism:** SAT **AS FOUND Instrument Condition:** SAT **AS LEFT Instrument Condition: SAT**

| **HIGH VOLTAGE** | | **AS FOUND HV** | **AS LEFT HV** |
|---|---|---|---|
| **(+/- 10% tolerance)** | **500 V:** | 507 V | AF V |
| | **1000 V:** | 998 V | AF V |
| | **1500 V:** | 1492 V | AF V |

☐ **New Batteries?**

**Threshold ratio: 100=10mV**

**AF THRESHOLD:** 10.1 mV

**AL THRESHOLD:** 10 mV

**AF Mechanical Zero:** 0

**AL Mechanical Zero:** 0

**AF HV Reading:** 1100 V

**AL HV Reading:** 760 V

## RATE METER

| SCALE | RATE CPM | AS FOUND | % ERROR | AS LEFT | % ERROR |
|---|---|---|---|---|---|
| **x.1 or x1** | **100** | 100 | 0.00% | AF | 0.00% |
| | **250** | 250 | 0.00% | AF | 0.00% |
| | **400** | 400 | 0.00% | AF | 0.00% |
| **x1 or x10** | **1000** | 1000 | 0.00% | AF | 0.00% |
| | **2500** | 2500 | 0.00% | AF | 0.00% |
| | **4000** | 4000 | 0.00% | AF | 0.00% |
| **x10 or x100** | **10K** | 10 | 0.00% | AF | 0.00% |
| | **25K** | 25 | 0.00% | AF | 0.00% |
| | **40K** | 40 | 0.00% | AF | 0.00% |
| **x100 or x1000** | **100K** | 100 | 0.00% | AF | 0.00% |
| | **250K** | 250 | 0.00% | AF | 0.00% |
| | **400K** | 400 | 0.00% | AF | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## DIGITAL SCALER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 250:** | 250 | **% ERR:** | 0.00% | **AL 250:** | AF | **% ERR:** | 0.00% |
| **AF 2500:** | 2500 | **% ERR:** | 0.00% | **AL 2500:** | AF | **% ERR:** | 0.00% |
| **AF 25K:** | 25.03 K | **% ERR:** | 0.12% | **AL 25K:** | AF K | **% ERR:** | 0.12% |
| **AF 250K:** | 250.2 K | **% ERR:** | 0.08% | **AL 250K:** | AF K | **% ERR:** | 0.08% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## LOG SCALE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 200:** | 200 | **% ERR:** | 0.00% | **AL 200:** | AF | **% ERR:** | 0.00% |
| **AF 2000:** | 2000 | **% ERR:** | 0.00% | **AL 2000:** | AF | **% ERR:** | 0.00% |
| **AF 20K:** | 20 K | **% ERR:** | 0.00% | **AL 20K:** | AF K | **% ERR:** | 0.00% |
| **AF 200K:** | 200 K | **% ERR:** | 0.00% | **AL 200K:** | AF K | **% ERR:** | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## REPRODUCIBILITY

| | | | |
|---|---|---|---|
| **x.1 or x1 Scale:** | 250 | 250 | 250 |
| **x1 or x10 Scale:** | 2500 | 2500 | 2500 |
| **x10 or x100 Scale:** | 25 K | 25 K | 25 K |
| **x100 or x1000 Scale:** | 250 K | 250 K | 250 K |

☑ **Are the Individual Counts Within 10% of the Average?**

**Audio Response:** SAT
**Audio Divide:** SAT
**Push Buttons:** SAT
**Lamp:** SAT
**Scaler/Digital:** SAT

☑ **Fast / Slow Response Function Properly?**

**Comments:** **Married as a set with:** **Model:** 44-10 **Serial #:** PR164003 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** **03/15/19**

**Performed by:** **Reviewed by:** **Date:** 3/15/18

**Printed Name:** Noah Keebler

***Safety and Ecology Corporation*** **SEC PROCEDURE #** **SEC-IS-415 Rev 3**

***2800 Solway Road, Knoxville, TN 37931*** ***Page 1 of 1***

## ***Calibration Certificate***

***3/16/2018***

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### *Calibration Certificate for 44-10,Serial # PR164003, Bar Code # ,Property # SEC-6030*

**Date:** 03/15/18 **Date Last Cal. Expires:** 01/22/19 **Technician:** Noah Keebler

**Location:** 999999, **Reason For Calibration:** Short Cycled

**EQUIPMENT USED DURING CALIBRATION**

**MODEL:** 2221 **SERIAL #:** 102034 **CAL DUE:** 03/15/19

**MODEL:** **SERIAL #:** **CAL DUE:**

**NIST TRACEABLE SOURCES USED**

| SOURCE | ISOTOPE | ACTIVITY | 2π | ASSAY DATE |
|---|---|---|---|---|
| 99CS250-0288 | Cs-137 | 6.0658 uCi | | 1/3/2017 |

**Efficiency from Last Calibration:** 0.67 % **HV From Last Calibration:** 1100 V **Calibration Threshold:** 10 mV

**1 MINUTE COUNTS (CPM)**

### AS FOUND DATA

**AS FOUND Instrument Condition:** SAT

**HV:** 760 V

**Center:** 91420

**Background:** 4832

**4 π Probe Efficiency:** Cs-137 **0.64%**

### AS LEFT DATA after repair of HV adjust

**AS LEFT Instrument Condition: SAT**

**HV:** 760 V

**Center:** 91420

**Background:** 4832

**4 π Probe Efficiency:** Cs-137 **0.64%**

**"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section**

☑ **Is the As Found Efficiency Within 20% of the efficiency from the last cal.?**

**Reproducibility:** **Isotope:**Cs-137 91420 91539 91687 **Average:** 91549 ☑ **Are the individual counts within 10% of the average?**

* If As Found Efficiency (even after repair) is within 10% of the last calibration and uniformity is <10%, the technician may N/A the Plateau Data and proceed to Comments. Geometry = NaI probes are 4 1/2" from source. All other probes are in contact with surface unless otherwise specified.

### PLATEAU AND SET POINT DATA (CPM)

| High Voltage | Source Response | Background |
|---|---|---|
| 650 | 80414 | 4130 |
| 675 | 80667 | 4283 |
| 700 | 80372 | 4298 |
| 750 | 85632 | 4731 |
| 760 | 91420 | 4832 |
| 775 | 113556 | 5079 |
| | | |
| | | |
| | | |

| HV | CENTER | Background | 4 π Efficiency |
|---|---|---|---|
| V | | | Cs-137 |

**Comments:** **Married as a set with:** **Model:** 2221 **Serial #:** 102034 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** **03/15/19**

**Performed by:** **Reviewed by:**____________________ **Date:**______

**Printed Name:** Noah Keebler

***Safety and Ecology Corporation***
*2800 Solway Road, Knoxville, TN 37931*
***Calibration Certificate***

**SEC PROCEDURE #** SEC-IS-405 Rev 2

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*3/17/2018*

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***Calibration Certificate for 3,Serial # 131898, Bar Code # ,Property # PFL-151***

**Date:** 03/16/18 **Date Last Cal. Expires:** 08/05/17 **Technician:** Noah Keebler

**Location:** 999999, **Reason For Calibration:** Due for Calibration

**EQUIPMENT USED DURING CALIBRATION**

**MODEL:** 500-2 **SERIAL #:** 268940 **CAL DUE:** 04/20/18

**MODEL:** **SERIAL #:** **CAL DUE:**

**AS FOUND DATA** **Geotropism:** SAT **AS FOUND Instrument Condition:** SAT **AS LEFT Instrument Condition: SAT**

**HIGH VOLTAGE (+/- 10% tolerance)**

| | AS FOUND HV | AS LEFT HV |
|---|---|---|
| 500 V: | N/A | AF |
| 1000 V: | N/A | AF |
| 1500 V: | N/A | AF |

**HV Range 400-1500V:** SAT

☐ **New Batteries?** **Battery Check:** SAT **Alarm:** N/A

**AS FOUND Mechanical Zero:** 0 **AS LEFT Mechanical Zero:** 0

**AS FOUND THRESHOLD:** 32.8 mV **AS LEFT THRESHOLD:** 32.8 mV

**AS FOUND HV Reading:** 900 V **AS LEFT HV Reading:** 900 V

## RATE METER

| SCALE | RATE CPM | AS FOUND | % ERROR | AS LEFT | % ERROR |
|---|---|---|---|---|---|
| x.1 or x1 | 100 | 100 | 0.00% | AF | 0.00% |
| | 250 | 250 | 0.00% | AF | 0.00% |
| | 400 | 400 | 0.00% | AF | 0.00% |
| x1 or x10 | 1000 | 1000 | 0.00% | AF | 0.00% |
| | 2500 | 2500 | 0.00% | AF | 0.00% |
| | 4000 | 4000 | 0.00% | AF | 0.00% |
| x10 or x100 | 10K | 10 | 0.00% | AF | 0.00% |
| | 25K | 25 | 0.00% | AF | 0.00% |
| | 40K | 40 | 0.00% | AF | 0.00% |
| x100 or x1000 | 100K | 100 | 0.00% | AF | 0.00% |
| | 250K | 250 | 0.00% | AF | 0.00% |
| | 400K | 400 | 0.00% | AF | 0.00% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## DIGITAL SCALER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **AF 250:** | 250 | **% ERR:** | 0.00% | **AL 250:** | AF | **% ERR:** | 0.00% |
| **AF 2500:** | 2500 | **% ERR:** | 0.00% | **AL 2500:** | AF | **% ERR:** | 0.00% |
| **AF 25K:** | 25 K | **% ERR:** | 0.00% | **AL 25K:** | AF K | **% ERR:** | 0.00% |
| **AF 100K:** | 100.1 K | **% ERR:** | 0.10% | **AL 100K:** | AF K | **% ERR:** | 0.10% |

☑ **Is the As Found Data Within 20% of the Set Point?**

## REPRODUCIBILITY

| | | | |
|---|---|---|---|
| **x.1 or x1 Scale:** | 250 | 250 | 250 |
| **x1 or x10 Scale:** | 2500 | 2500 | 2500 |
| **x10 or x100 Scale:** | 25 K | 25 K | 25 K |
| **x100 or x1000 Scale:** | 250 K | 250 K | 250 K |

☑ **Are the Individual Counts Within 10% of the Average?**

☑ **Fast / Slow Response Switch Functions Properly?**

**Audio Response:** SAT **Audio Divide:** N/A

**Push Buttons:** SAT **Lamp:** N/A

**Scaler/Digital:** SAT

**Comments** **Married as a set with:** **Model:** 44-9 **Serial #:** PR194693 **Bar Code #:**

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

**Date Instrument is Due For Next Calibration:** 03/16/19

**Performed by:** **Reviewed by:** **Date:** 3/16/18

**Printed Name:** Noah Keebler

**Safety and Ecology Corporation** **SEC PROCEDURE #** SEC-IS-407 Rev 2
2800 Solway Road, Knoxville, TN 37931
**Calibration Certificate**

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3/17/2018

## Calibration Certificate for 44-9,Serial # PR194693, Bar Code # ,Property # SEC-5620

**Date:** 03/16/18 **Date Last Cal. Expires:** 08/05/17 **Technician:** Noah Keebler

**Location:** 999999, **Reason For Calibration:** Due for Calibration

### EQUIPMENT USED DURING CALIBRATION

**MODEL:** 3 **SERIAL #** 131898 **CAL DUE:** 03/16/19

**MODEL:** **SERIAL #** **CAL DUE:**

### NIST TRACEABLE SOURCES USED

| SOURCE | ISOTOPE | ACTIVITY | 2π | ASSAY DATE |
|---|---|---|---|---|
| 4072-02 | Tc-99 | 28299 dpm | 17,700 cpm | 1/3/2017 |
| 4076-02 | Sr-90 | 10516 dpm | 7,378 cpm | 1/3/2017 |

Geometry = in contact with surface unless otherwise specified.

**PREVIOUS Tc-99 EFFICIENCY:** 13.52 % **Calibration Voltage:** 900 V **Calibration Threshold:** 32.8 mV

**AS FOUND Instrument Condition:** SAT

**AS LEFT Instrument Condition:** SAT

## AS FOUND DATA

### 1 MINUTE COUNTS (CPM)

| | | | | AVERAGE |
|---|---|---|---|---|
| **AF Background:** | 39 | | | |
| **Tc-99 Count:** | 3744 | 3759 | 3827 | 3776.7 |
| **Sr-90 Count:** | 2695 | | | |

### 4 π Efficiencies

**Tc-99 EFF:** 13.21% **Sr-90 EFF:** 25.26%

## AS LEFT DATA

### 1 MINUTE COUNTS (CPM)

| | | | | AVERAGE |
|---|---|---|---|---|
| **AL Background:** | 39 | | | |
| **Tc-99 Count:** | 3744 | 3759 | 3827 | 3776.7 |
| **Sr-90 Count:** | 2695 | | | |

### 4 π Efficiencies

**Tc-99 EFF:** 13.21% **Sr-90 EFF:** 25.26%

**"AF" in the AL Efficiency fields means to refer to the AF Efficiencies in the AS FOUND DATA Section**

- ☑ **Is the AS FOUND efficiency within 20% of efficiency from last calibration?**
- ☑ **Reproducibility: Are the individual counts within 10% of the average?**
- ☑ **Does the probe meet final acceptance criteria?**
- ☑ **Calibration sticker attached?**

**Comments:** **Married as a set with:** **Model:** 3 **Serial #:** 131898 **Bar Code #:**

**Date Instrument is Due For Next Calibration:** **03/16/19**

**Performed by:** **Reviewed by:** **Date:** 3/16/18

**Printed Name:** Noah Keebler

# Attachment 2
# Initial and Daily Instrument Source Checks

**Attachment 2 - Initial and Daily Instrument Source Checks**

| **Initial Instrument Setup** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number:<br>NRL CBD Intrusive PN# 474183 | Model:<br>L2360 / L43-93 | Serial Number:<br>274959 / PR293983 | | a Isotope<br>Th-230 | a Source SN<br>1295/92 | a dpm<br>4,260 | b Isotope<br>Sr-90 | b Source SN<br>S-2787 | b dpm<br>19,500 | Cal Due<br>3/28/2019 | |
| **Date** | **a Source CPM** | **a Bkg CPM** | **a Net CPM** | **b Source CPM** | **b Bk CPM** | **b Net CPM** | **HV** | **Power** | **DISP** | **INITIAL** | **Notes** |
| 3/31/18 | 562 | 1 | 561 | 2312 | 198 | 2114 | ok | ok | ok | MW | Calibration at bottom left corner of detector, with detector face up |
| 3/31/18 | 544 | 1 | 543 | 2330 | 239 | 2091 | ok | ok | ok | MW | |
| 3/31/18 | 574 | 0 | 574 | 2400 | 242 | 2158 | ok | ok | ok | MW | |
| 3/31/18 | 557 | 1 | 556 | 2269 | 218 | 2051 | ok | ok | ok | MW | |
| 3/31/18 | 578 | 0 | 578 | 2313 | 217 | 2096 | ok | ok | ok | MW | |
| 3/31/18 | 537 | 2 | 535 | 2372 | 243 | 2129 | ok | ok | ok | MW | |
| 3/31/18 | 525 | 1 | 524 | 2391 | 188 | 2203 | ok | ok | ok | MW | |
| 3/31/18 | 539 | 1 | 538 | 2300 | 216 | 2084 | ok | ok | ok | MW | |
| 3/31/18 | 584 | 1 | 583 | 2406 | 187 | 2219 | ok | ok | ok | MW | |
| 3/31/18 | 547 | 1 | 546 | 2352 | 214 | 2138 | ok | ok | ok | MW | |
| 3/31/18 | 574 | 1 | 573 | 2349 | 245 | 2104 | ok | ok | ok | MW | |
| 3/31/18 | 555 | 0 | 555 | 2277 | 218 | 2059 | ok | ok | ok | MW | |
| 3/31/18 | 554 | 1 | 553 | 2343 | 225 | 2118 | ok | ok | ok | MW | |
| 3/31/18 | 567 | 1 | 566 | 2351 | 231 | 2120 | ok | ok | ok | MW | |
| 3/31/18 | 536 | 1 | 535 | 2354 | 204 | 2150 | ok | ok | ok | MW | |
| 3/31/18 | 601 | 0 | 601 | 2311 | 199 | 2112 | ok | ok | ok | MW | |
| 3/31/18 | 577 | 1 | 576 | 2322 | 210 | 2112 | ok | ok | ok | MW | |
| 3/31/18 | 541 | 0 | 541 | 2365 | 204 | 2161 | ok | ok | ok | MW | |
| 3/31/18 | 615 | 2 | 613 | 2380 | 214 | 2166 | ok | ok | ok | MW | |
| 3/31/18 | 572 | 0 | 572 | 2360 | 220 | 2140 | ok | ok | ok | MW | |
| **Instrument Ranges** | Average: | Average: | | Average: | Average: | | | **ACR** | **+20%** | **-20%** | |
| | 561.95 | 0.8 | | 2342.85 | 216.6 | | | **a NET** | **673** | **449** | |
| | | | | | | | | **b NET** | **2551** | **1701** | |

| Beta | | Alpha | |
|---|---|---|---|
| 1 sig | 3 sig | 1 sig | 3 sig |
| 38.377 | 115.13 | 23.038355 | 69.11506 |
| Upper | Lower | Upper | Lower |
| 2458 | 2227.72 | 631.06506 | 492.8349 |

**Attachment 2 - Initial and Daily Instrument Source Checks**

| **Initial Instrument Setup** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number:<br>NRL CBD Intrusive PN# 474183 | Model:<br>L2360 / L43-93 | Serial Number:<br>274959 / PR293983 | | a Isotope<br>Th-230 | a Source SN<br>1295/92 | a dpm<br>4,260 | b Isotope<br>Sr-90 | b Source SN<br>S-2787 | b dpm<br>19,500 | Cal Due<br>3/28/2019 | |
| **Date** | **a Source CPM** | **a Bkg CPM** | **a Net CPM** | **b Source CPM** | **b Bkg CPM** | **b Net CPM** | **HV** | **Power** | **DISP** | **INITIAL** | **NOTES** |
| 4/2/18 | 856 | 0 | 856 | 4396 | 238 | 4158 | ok | ok | ok | MW | Second Calibration. Sources set at center of detector face. |
| 4/2/18 | 906 | 0 | 906 | 4301 | 232 | 4069 | ok | ok | ok | MW | |
| 4/2/18 | 884 | 0 | 884 | 4395 | 219 | 4176 | ok | ok | ok | MW | |
| 4/2/18 | 939 | 2 | 937 | 4427 | 249 | 4178 | ok | ok | ok | MW | |
| 4/2/18 | 911 | 2 | 909 | 4324 | 204 | 4120 | ok | ok | ok | MW | |
| 4/2/18 | 902 | 1 | 901 | 4422 | 249 | 4173 | ok | ok | ok | MW | |
| 4/2/18 | 876 | 2 | 874 | 4350 | 216 | 4134 | ok | ok | ok | MW | |
| 4/2/18 | 894 | 0 | 894 | 4290 | 235 | 4055 | ok | ok | ok | MW | |
| 4/2/18 | 918 | 0 | 918 | 4367 | 254 | 4113 | ok | ok | ok | MW | |
| 4/2/18 | 900 | 1 | 899 | 4333 | 239 | 4094 | ok | ok | ok | MW | |
| 4/2/18 | 842 | 1 | 841 | 4392 | 226 | 4166 | ok | ok | ok | MW | |
| 4/2/18 | 918 | 2 | 916 | 4418 | 210 | 4208 | ok | ok | ok | MW | |
| 4/2/18 | 904 | 0 | 904 | 4442 | 251 | 4191 | ok | ok | ok | MW | |
| 4/2/18 | 884 | 1 | 883 | 4436 | 242 | 4194 | ok | ok | ok | MW | |
| 4/2/18 | 942 | 0 | 942 | 4364 | 231 | 4133 | ok | ok | ok | MW | |
| 4/2/18 | 892 | 0 | 892 | 4357 | 214 | 4143 | ok | ok | ok | MW | |
| 4/2/18 | 875 | 2 | 873 | 4316 | 209 | 4107 | ok | ok | ok | MW | |
| 4/2/18 | 909 | 0 | 909 | 4362 | 237 | 4125 | ok | ok | ok | MW | |
| 4/2/18 | 869 | 1 | 868 | 4370 | 245 | 4125 | ok | ok | ok | MW | |
| 4/2/18 | 952 | 1 | 951 | 4360 | 222 | 4138 | ok | ok | ok | MW | |
| **Instrument Ranges** | Average: | Average: | | Average: | Average: | | | **ACR** | **+20%** | **-20%** | |
| | 898.65 | 0.8 | | 4371.1 | 231.1 | | | **a NET** | **1077** | **719** | |
| | | | | | | | | **b NET** | **4968** | **3312** | |

| Beta | | Alpha | |
|---|---|---|---|
| 1 sig | 3 sig | 1 sig | 3 sig |
| 44.6612 | 133.9835 | 28.0305754 | 84.091726 |
| Upper | Lower | Upper | Lower |
| 4505.08 | 4237.116 | 982.741726 | 814.55827 |

**Attachment 2 - Initial and Daily Instrument Source Checks**

## Initial Instrument Setup

| Project Name/Number: | Model: | Serial Number: | Calibration Due: | Remarks: |
|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | microRem | 09000 | 3/10/2019 | taken on contact |

| Date | Isotope | Serial Number | Source Activity (µCi) | Source Check µrem/hr | Background µrem/hr | Net µrem/hr | HV | BATT | DISP | INITIAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 7 | 53 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 4 | 66 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 8 | 52 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 55 | 3 | 52 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 5 | 65 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 50 | 6 | 44 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 65 | 6 | 59 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 6 | 64 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 8 | 52 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 6 | 64 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 10 | 50 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 7 | 63 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 8 | 52 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 3 | 67 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 65 | 7 | 58 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 4 | 66 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 8 | 52 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 80 | 10 | 70 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 11 | 59 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 8 | 62 | ok | ok | ok | MW |
| **Instrument Ranges** | | **+20%** | **-20%** | Average: | Average: | | | | | |
| | **NET** | **70** | **47** | 65.25 | 6.75 | | | | | |

## Attachment 2 - Initial and Daily Instrument Source Checks

**Initial Instrument Setup**

| Project Name/Number: | Model (Scaler/Detector): | Serial Number: | Calibration Due: | Remarks: |
|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | L-2221 / L44-10 | 190201 / PR150873 | 3/16/2019 | 6 inches from source |

| Date | Isotope | Serial Number | Source Activity (µCi) | Source Check CPM | Background CPM | Net CPM | HV | BATT | DISP | INITIAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77526 | 4635 | 72891 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77444 | 4985 | 72459 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75402 | 4639 | 70763 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76733 | 4988 | 71745 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77769 | 5086 | 72683 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75416 | 5400 | 70016 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77048 | 5029 | 72019 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77735 | 4929 | 72806 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76681 | 4835 | 71846 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75282 | 4657 | 70625 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74499 | 5189 | 69310 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 78119 | 4963 | 73156 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76728 | 5033 | 71695 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 73314 | 5277 | 68037 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74267 | 4916 | 69351 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75717 | 4652 | 71065 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75509 | 5499 | 70010 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 78135 | 5257 | 72878 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77512 | 4944 | 72568 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74953 | 5349 | 69604 | ok | ok | ok | MW |
| **Instrument Ranges** |  | **+20%** | **-20%** | Average: | Average: |  |  |  |  |  |
|  | **NET** | **85531** | **57022** | 76289.45 | 5013.1 |  |  |  |  |  |

**Attachment 2 - Initial and Daily Instrument Source Checks**

**Initial Instrument Setup**

| Project Name/Number: | Model (Scaler/Detector): | Serial Number: | Calibration Due: | Remarks: |
|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | L-2221 / L44-10 | 102034 / PR164003 | 1/23/2019 | 6 inches from source |

| Date | Isotope | Serial Number | Source Activity (µCi) | Source Check CPM | Background CPM | Net CPM | HV | BATT | DISP | INITIAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75857 | 5677 | 70180 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 79165 | 4844 | 74321 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 81346 | 5444 | 75902 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77824 | 5649 | 72175 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77775 | 5437 | 72338 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 80004 | 5292 | 74712 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 78297 | 5099 | 73198 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76876 | 5230 | 71646 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 78768 | 5805 | 72963 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 82517 | 5765 | 76752 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 80219 | 5557 | 74662 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 78962 | 5607 | 73355 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 79680 | 5793 | 73887 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76886 | 5324 | 71562 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76701 | 6293 | 70408 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74836 | 5920 | 68916 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 77919 | 5116 | 72803 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76455 | 5502 | 70953 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 80753 | 5487 | 75266 | ok | ok | ok | MW |
| 3/31/18 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 79893 | 5933 | 73960 | ok | ok | ok | MW |
| **Instrument Ranges** | | **+20%** | **-20%** | Average: | Average: | | | | | |
| | **NET** | **87597** | **58399** | 78536.65 | 5538.7 | | | | | |

**Attachment 2 - Initial and Daily Instrument Source Checks**

| **Initial Instrument Setup** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number:<br>NRL CBD Intrusive PN# 474183 | | Model (Scaler/Detector):<br>L-3 / L44-9 | | Serial Number:<br>131898 / PR194693 | | Calibration Due:<br>3/16/2019 | | | Remarks:<br>180-2 sample holder, middle | |
| **Date** | **Isotope** | **Serial Number** | **Source Activity (dpm)** | **Source Check CPM** | **Background CPM** | **Net CPM** | **HV** | **BATT** | **DISP** | **INITIAL** |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1535 | 35 | 1500 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1454 | 28 | 1426 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1487 | 33 | 1454 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1532 | 41 | 1491 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1474 | 39 | 1435 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1441 | 41 | 1400 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1415 | 40 | 1375 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1438 | 32 | 1406 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1464 | 25 | 1439 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1496 | 38 | 1458 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1508 | 37 | 1471 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1494 | 36 | 1458 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1475 | 31 | 1444 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1474 | 32 | 1442 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1469 | 27 | 1442 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1416 | 36 | 1380 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1524 | 35 | 1489 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1440 | 41 | 1399 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1553 | 32 | 1521 | ok | ok | ok | MW |
| 3/31/18 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1497 | 40 | 1457 | ok | ok | ok | MW |
| **Instrument Ranges** | | **+20%** | **-20%** | Average: | Average: | | | | | |
| | **NET** | **1733** | **1156** | 1479.3 | 34.95 | | | | | |

**Attachment 2 - Initial and Daily Instrument Source Checks**

**Daily Response Check**

| Project Name/Number: | Model: | Serial Number: | a Isotope | a Source SN | a dpm | b Isotope | b Source SN | b dpm | Cal Due | |
|---|---|---|---|---|---|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | L2360 / L43-93 | 274959 / PR293983 | Th-230 | 1295/92 | 4,260 | Sr-90 | S-2787 | 19,500 | 3/28/2019 | |

| Date/Time | a Source CPM | a Bkg CPM | a Net CPM | b Source CPM | b Bkg CPM | b Net CPM | HV | Power | DISP | INITIAL | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4/2/2018 8:30 | 558 | 0 | 558 | 3504 | 212 | 3292 | ok | ok | ok | MW | Counting mechanism checked on 04/02/2018. Five checks performed, each confirmed at 1 minute. Recalibration performed with source at center of detector face. Recalibration done on 4/2/2018 at 2200. |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| | | | 0 | | | 0 | | | | | |
| **Instrument Ranges** | Average: | Average: | | Average: | Average: | | | **ACR** | **+20%** | **-20%** | |
| | 558 | 0 | | 3504 | 212 | | | **a NET** | **673** | **449** | |
| | | | | | | | | **b NET** | **2551** | **1701** | |

## Attachment 2 - Initial and Daily Instrument Source Checks

**Daily Response Check**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number:<br>NRL CBD Intrusive PN# 474183 | Model:<br>L2360 / L43-93 | Serial Number:<br>274959 / PR293983 | | a Isotope<br>Th-230 | a Source SN<br>1295/92 | a dpm<br>4,260 | b Isotope<br>Sr-90 | b Source SN<br>S-2787 | b dpm<br>19,500 | Cal Due<br>3/28/2019 | |
| **Date/Time** | **a Source CPM** | **a Bkg CPM** | **a Net CPM** | **b Source CPM** | **b Bkg CPM** | **b Net CPM** | **HV** | **Power** | **DISP** | **INITIAL** | **Notes** |
| 4/3/2018 6:20 | 898 | 1 | 897 | 4395 | 254 | 4141 | ok | ok | ok | MW | Represents check against ACRs obtained on 4/2/2018. |
| 4/4/2018 6:23 | 884 | 2 | 882 | 4461 | 266 | 4195 | ok | ok | ok | MW | |
| 4/5/2018 6:21 | 873 | 0 | 873 | 4483 | 278 | 4205 | ok | ok | ok | MW | |
| 4/6/2018 6:18 | 901 | 2 | 899 | 4393 | 298 | 4095 | ok | ok | ok | MW | |
| 4/9/2018 6:20 | 912 | 1 | 911 | 4412 | 269 | 4143 | ok | ok | ok | MW | |
| 4/10/2018 6:27 | 889 | 0 | 889 | 4375 | 278 | 4097 | ok | ok | ok | MW | |
| **Instrument Ranges** | Average: | Average: | | Average: | Average: | | | **ACR** | **+20%** | **-20%** | |
| | 892.8333333 | 1 | | 4419.833333 | 273.833333 | | | **a NET** | **1077** | **449** | |
| | | | | | | | | **b NET** | **4968** | **3312** | |

## Attachment 2 - Initial and Daily Instrument Source Checks

**Daily Response Check**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number: | | Model: | | Serial Number: | | Calibration Due: | | | Remarks: | |
| NRL CBD Intrusive PN# 474183 | | microRem | | 09000 | | 3/10/2019 | | | taken on contact | |
| **Date/Time** | **Isotope** | **Serial Number** | **Source Activity (µCi)** | **Source Check µrem/hr** | **Background µrem/hr** | **Net µrem/hr** | **HV** | **BATT** | **DISP** | **INITIAL** |
| 4/2/2018 9:15 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 80 | 12 | 68 | ok | ok | ok | MW |
| 4/3/2018 6:45 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 10 | 60 | ok | ok | ok | MW |
| 4/4/2018 6:53 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 80 | 14 | 66 | ok | ok | ok | MW |
| 4/5/2018 6:30 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 60 | 11 | 49 | ok | ok | ok | MW |
| 4/6/2018 6:38 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 7 | 63 | ok | ok | ok | MW |
| 4/9/2018 6:29 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 8 | 62 | ok | ok | ok | MW |
| 4/10/2018 6:38 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 80 | 12 | 68 | ok | ok | ok | MW |
| 4/11/2018 6:43 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 80 | 10 | 70 | ok | ok | ok | MW |
| 4/12/2018 6:52 | Cs 137 | 99-0292 | 7.03uCi on 1/30/2012 | 70 | 9 | 61 | ok | ok | ok | MW |
| **Instrument Ranges** | | **+20%** | **-20%** | | | | | | | |
| | **NET** | **70** | **47** | | | | | | | |

**Attachment 2 - Initial and Daily Instrument Source Checks**

**Daily Response Check**

| Project Name/Number: | Model (Scaler/Detector): | Serial Number: | Calibration Due: | Remarks: |
|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | L-2221 / L44-10 | 190201 / PR150873 | 3/16/2019 | 6 inches from source |

| Date/Time | Isotope | Serial Number | Source Activity (µCi) | Source Check CPM | Background CPM | Net CPM | HV | BATT | DISP | INITIAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 4/2/2018 8:55 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 67376 | 4090 | 63286 | ok | ok | ok | MW |
| 4/3/2018 6:34 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 72521 | 4400 | 68121 | ok | ok | ok | MW |
| 4/4/2018 6:45 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 71816 | 3942 | 67874 | ok | ok | ok | MW |
| 4/5/2018 6:43 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 72437 | 4138 | 68299 | ok | ok | ok | MW |
| 4/6/2018 6:32 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 69636 | 4203 | 65433 | ok | ok | ok | MW |
| 4/9/2018 6:34 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 68432 | 4296 | 64136 | ok | ok | ok | MW |
| 4/10/2018 6:42 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 71395 | 4385 | 67010 | ok | ok | ok | MW |

| **Instrument Ranges** | **ACR** | **+20%** | **-20%** |
|---|---|---|---|
|  | **NET** | **87597** | **58399** |

**Attachment 2 - Initial and Daily Instrument Source Checks**

**Daily Response Check**

| Project Name/Number: | Model (Scaler/Detector): | Serial Number: | Calibration Due: | Remarks: |
|---|---|---|---|---|
| NRL CBD Intrusive PN# 474183 | L-2221 / L44-10 | 102034 / PR164003 | 1/23/2019 | 6 inches from source |

| Date/Time | Isotope | Serial Number | Source Activity (µCi) | Source Check CPM | Background CPM | Net CPM | HV | BATT | DISP | INITIAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 4/2/2018 8:50 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75651 | 5011 | 70640 | ok | ok | ok | MW |
| 4/3/2018 6:39 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74692 | 5199 | 69493 | ok | ok | ok | MW |
| 4/4/2018 6:40 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75001 | 4743 | 70258 | ok | ok | ok | MW |
| 4/5/2018 6:50 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 76489 | 5230 | 71259 | ok | ok | ok | MW |
| 4/6/2018 6:43 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74139 | 5028 | 69111 | ok | ok | ok | MW |
| 4/9/2018 6:38 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 75364 | 5186 | 70178 | ok | ok | ok | MW |
| 4/10/2018 6:48 | Cs 137 | 99-0292 | 7.03µCi on 1/30/2012 | 74624 | 5094 | 69530 | ok | ok | ok | MW |
| **Instrument Ranges** | **ACR** | **+20%** | **-20%** | | | | | | | |
| | **NET** | **85531** | **57022** | | | | | | | |

**Attachment 2 - Initial and Daily Instrument Source Checks**

| **Daily Response Check** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Project Name/Number:<br>NRL CBD Intrusive PN# 474183 | | Model (Scaler/Detector):<br>L-3 / L44-9 | | Serial Number:<br>131898 / PR194693 | | Calibration Due:<br>3/16/2019 | | | Remarks:<br>180-2 sample holder, middle | | |
| **Date/Time** | **Isotope** | **Serial Number** | **Source Activity (dpm)** | **Source Check CPM** | **Background CPM** | **Net CPM** | **HV** | **BATT** | **DISP** | **INITIAL** | |
| 4/2/2018 9:08 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1390 | 39 | 1351 | ok | ok | ok | MW | |
| 4/3/2018 6:50 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1466 | 29 | 1437 | ok | ok | ok | MW | |
| 4/4/2018 6:34 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1451 | 38 | 1413 | ok | ok | ok | MW | |
| 4/5/2018 6:54 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1502 | 29 | 1473 | ok | ok | ok | MW | |
| 4/6/2018 6:49 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1478 | 31 | 1447 | ok | ok | ok | MW | |
| 4/9/2018 6:45 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1388 | 27 | 1361 | ok | ok | ok | MW | |
| 4/10/2018 6:55 | SrY-90 | S-2787 | 19,500 dpm on 3/2/1994 | 1492 | 34 | 1458 | ok | ok | ok | MW | |
| **Instrument Ranges** | **ACR** | **+20%** | **-20%** | | | | | | | | |
| | **NET** | **1733** | **1156** | | | | | | | | |

# Attachment 3

# Background Activity Measurement Form

| | | |
|---|---|---|
| | **PROJECT NUMBER**<br>**474183.FI.DM** | **LOCATION**<br>**NRL CBD** |

# Background Activity Measurement Form

PROJECT : NRL CBD ESI LOCATION/SITE NAME : NRL CBD Sites 3, 4, 5

TYPE OF INTRUSIVE ACTIVITY: Test Pitting, Soil Boring

DATE: 4/2/2018

TECHNICIAN: M. Witmer

**INSTRUMENTATION:**

| NUMBER | Meter/Detector | S/N | CAL. DUE |
|---|---|---|---|
| 1 | L2221/44-10 | 19021/PR150873 | 3/16/2019 |
| 2 | Bicron Micro Rem | 9000 | 3/10/2019 |

**BACKGROUND LOCATION INFORMATION**

- Background measurements were taken southeast of the eastern boundary of Site 3. See field log book for diagram.
- Background measurements were collected for the Bicron Micro Rem (S/N 9000) and the L2221/44-10 (S/N 19021/PR150873). If either intstrument was identified as out of service during daily source checks, additional background measurements would be made.

**Background Measurement Summary**

| INSTRUMENT:<br>L2221/44-10 (19021/PR150873)<br>NOTES: 10, 1-min. static measurements, on contact with ground surface, values in counts per minute (CPM) | MEASUREMENTS |
|---|---|
| | 4,880 |
| | 4,109 |
| | 4,821 |
| | 4,451 |
| | 4,468 |
| | 4,342 |
| | 4,748 |
| | 4,229 |
| | 4,321 |
| | 4,841 |
| AVERAGE | 4,521 |

| INSTRUMENT:<br>Bicron Micro Rem (9000)<br>NOTES: 10 measurements, waist level, values in microRem/h (uRem/h) | MEASUREMENTS |
|---|---|
| | 2.5 |
| | 8 |
| | 3 |
| | 9 |
| | 5 |
| | 8 |
| | 5 |
| | 6 |
| | 5 |
| | 4 |
| AVERAGE | 6 |

# Appendix J
# Statistical Analysis of XRF Data

# Statistical Analysis of XRF Data
# Naval Research Laboratory – Chesapeake Bay Detachment

## Chesapeake Beach, Maryland

## Explanation of Random Number Generation Procedure:

To perform a statistical analysis of the XRF Data, field bias needed to be removed from the selection of lab analyzed samples. To accomplish this, a random number generation program was utilized to pre-select XRF grids prior to mobilization. The grids were enumerated, and the random number generator selected which of the grids would be sent to the lab for analysis. With this method, the field team did not introduce bias into the selection of the lab samples.

Prepared by
ch2m
Herndon, Virginia

# XRF Screening Results

**Project: ESI at NRL-CBD**
**XRF Sampler: Stephen Dronfield**

**Table 1: X-ray Fluorescence (XRF) Gun Results for Lead for Surface and Subsurface Soil Samples**

| | Surface Soil | | | | | | | Subsurface Soil | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Location | Sample ID | Collection | | Run 1 XRF Lead Concentration, ppm | Run 2 XRF Lead Concentration, ppm | Run 3 XRF Lead Concentration, ppm | Average XRF Lead Concentration, ppm | Sample ID | Collection | | Run 1 XRF Lead Concentration, ppm | Run 2 XRF Lead Concentration, ppm | Run 3 XRF Lead Concentration, ppm | Average XRF Lead Concentration, ppm |
| | | Date | Time[1] | | | | | | Date | Time[1] | | | | |
| 5 | CBD-AOD-SS05-000H | 4/11/2018 | 9:45 | 185.5 | 222.0 | 244.0 | 217.2 | CBD-AOD-SB05-1H02 | 4/11/2018 | 9:50 | 27.5 | 30.3 | 29.5 | 29.1 |
| 6 | CBD-AOD-SS06-000H | 4/11/2018 | 10:08 | 356.0 | 394.0 | 440.0 | 396.7 | CBD-AOD-SB06-1H02 | 4/11/2018 | 10:05 | 11.4 | 10.4 | 8.3 | 10.0 |
| 7 | CBD-AOD-SS07-000H | 4/11/2018 | 10:15 | 422.0 | 367.0 | 257.0 | 348.7 | CBD-AOD-SB07-1H02 | 4/11/2018 | 10:20 | 19.0 | 25.3 | 20.4 | 21.6 |
| 8 | CBD-AOD-SS08-000H | 4/11/2018 | 10:33 | 217.0 | 201.0 | 179.8 | 199.3 | CBD-AOD-SB08-1H02 | 4/11/2018 | 10:39 | 198.2 | 146.8 | 165.2 | 170.1 |
| 9 | CBD-AOD-SS09-000H | 4/11/2018 | 10:49 | 22.0 | 31.7 | 38.0 | 30.6 | CBD-AOD-SB09-1H02 | 4/11/2018 | 10:57 | 155.3 | 228.0 | 37.9 | 140.4 |
| 10 | CBD-AOD-SS10-000H | 4/11/2018 | 11:10 | 124.6 | 120.9 | 138.3 | 127.9 | CBD-AOD-SB10-1H02 | 4/11/2018 | 11:15 | 16.3 | 14.2 | 18.3 | 16.3 |
| 11 | CBD-AOD-SS11-000H | 4/11/2018 | 11:24 | 135.8 | 122.9 | 139.0 | 132.6 | CBD-AOD-SB11-1H02 | 4/11/2018 | 11:35 | 33.4 | 40.1 | 26.3 | 33.3 |
| 12 | CBD-AOD-SS12-000H | 4/11/2018 | 11:45 | 496.0 | 417.0 | 673.0 | 528.7 | CBD-AOD-SB12-1H02 | 4/11/2018 | 11:50 | 32.3 | 34.8 | 29.7 | 32.3 |
| | CBD-AOD-SS12P-000H | 4/11/2018 | 11:55 | 324.0 | 422.0 | 436.0 | 394.0 | CBD-AOD-SB12P-1H02 | 4/11/2018 | 12:00 | 33.3 | 45.4 | 123.8 | 67.5 |
| 13 | CBD-AOD-SS13-000H | 4/11/2018 | 13:05 | 1113.0 | 1273.0 | 1131.0 | 1172.3 | CBD-AOD-SB13-1H02 | 4/11/2018 | 13:17 | 54.1 | 29.2 | 32.6 | 38.6 |
| | CBD-AOD-SS13P-000H | 4/11/2018 | 13:11 | 1029.0 | 1354.0 | 942.0 | 1108.3 | CBD-AOD-SB13P-1H02 | 4/11/2018 | 13:23 | 41.0 | 74.1 | 32.1 | 49.1 |
| 14 | CBD-AOD-SS14-000H | 4/11/2018 | 13:29 | 85.3 | 82.7 | 175.2 | 114.4 | CBD-AOD-SB14-1H02 | 4/11/2018 | 13:35 | 18.6 | 23.2 | 16.7 | 19.5 |
| 15 | CBD-AOD-SS15-000H | 4/11/2018 | 13:41 | 226.0 | 167.5 | 417.0 | 270.2 | CBD-AOD-SB15-1H02 | 4/11/2018 | 13:46 | 31.8 | 24.0 | 30.7 | 28.8 |
| 16 | CBD-AOD-SS16-000H | 4/11/2018 | 13:53 | 304.0 | 254.0 | 238.0 | 265.3 | CBD-AOD-SB16-1H02 | 4/11/2018 | 13:58 | 49.7 | 42.0 | 65.5 | 52.4 |
| 17 | CBD-AOD-SS17-000H | 4/11/2018 | 14:11 | 502.0 | 504.0 | 577.0 | 527.7 | CBD-AOD-SB17-1H02 | 4/11/2018 | 14:16 | 149.7 | 113.0 | 107.4 | 123.4 |
| 18 | CBD-AOD-SS18-000H | 4/11/2018 | 14:26 | 939.0 | 1014.0 | 935.0 | 962.7 | CBD-AOD-SB18-1H02 | 4/11/2018 | 14:32 | 243.0 | 152.1 | 145.0 | 180.0 |
| | CBD-AOD-SS11P-000H | 4/11/2018 | 11:28 | 231.0 | 179.5 | 143.5 | 184.7 | CBD-AOD-SB11P-1H02 | 4/11/2018 | 11:41 | 31.4 | 62.1 | 19.7 | 37.7 |
| 19 | CBD-AOD-SS19-000H | 4/11/2018 | 14:42 | 379.0 | 367.0 | 271.0 | 339.0 | CBD-AOD-SB19-1H02 | 4/11/2018 | 14:48 | 10.9 | 12.0 | 16.8 | 13.2 |
| 20 | CBD-AOD-SS20-000H | 4/11/2018 | 14:59 | 405.0 | 136.4 | 85.9 | 209.1 | CBD-AOD-SB20-1H02 | 4/11/2018 | 15:05 | 96.3 | 141.0 | 100.6 | 112.6 |
| 21 | CBD-AOD-SS21-000H | 4/11/2018 | 15:15 | 192.5 | 156.8 | 192.6 | 180.6 | CBD-AOD-SB21-1H02 | 4/11/2018 | 15:25 | 56.4 | 76.2 | 75.4 | 69.3 |
| 22 | CBD-AOD-SS22-000H | 4/11/2018 | 15:35 | 764.0 | 609.0 | 650.0 | 674.3 | CBD-AOD-SB22-1H02 | 4/11/2018 | 15:41 | 16.1 | 18.6 | 17.2 | 17.3 |
| 23 | CBD-AOD-SS23-000H | 4/11/2018 | 15:48 | 869.0 | 1107.0 | 942.0 | 972.7 | CBD-AOD-SB23-1H02 | 4/11/2018 | 15:57 | 30.3 | 29.7 | 30.1 | 30.0 |
| 24 | CBD-AOD-SS24-000H | 4/11/2018 | 16:05 | 415.0 | 590.0 | 344.0 | 449.7 | CBD-AOD-SB24-1H02 | 4/11/2018 | 16:11 | 25.4 | 17.2 | 13.9 | 18.8 |
| 25 | CBD-AOD-SS25-000H | 4/11/2018 | 16:22 | 91.1 | 95.5 | 118.2 | 101.6 | CBD-AOD-SB25-1H02 | 4/11/2018 | 16:30 | 60.0 | 32.7 | 60.0 | 50.9 |
| 26 | CBD-AOD-SS26-000H | 4/12/2018 | 8:40 | 115.8 | 298.0 | 180.2 | 198.0 | CBD-AOD-SB26-1H02 | 4/12/2018 | 8:45 | 21.3 | 26.8 | 18.0 | 22.0 |
| 27 | CBD-AOD-SS27-000H | 4/12/2018 | 8:55 | 55.7 | 70.3 | 246.0 | 124.0 | CBD-AOD-SB27-1H02 | 4/12/2018 | 9:00 | 12.1 | 13.9 | 32.4 | 19.5 |
| 28 | CBD-AOD-SS28-000H | 4/12/2018 | 9:11 | 123.3 | 41.9 | 107.4 | 90.9 | CBD-AOD-SB28-1H02 | 4/12/2018 | 9:16 | 15.7 | 15.7 | 10.0 | 13.8 |
| 29 | CBD-AOD-SS29-000H | 4/12/2018 | 9:33 | 28.2 | 37.2 | 46.7 | 37.4 | CBD-AOD-SB29-1H02 | 4/12/2018 | 9:40 | 56.5 | 37.9 | 100.5 | 65.0 |

---

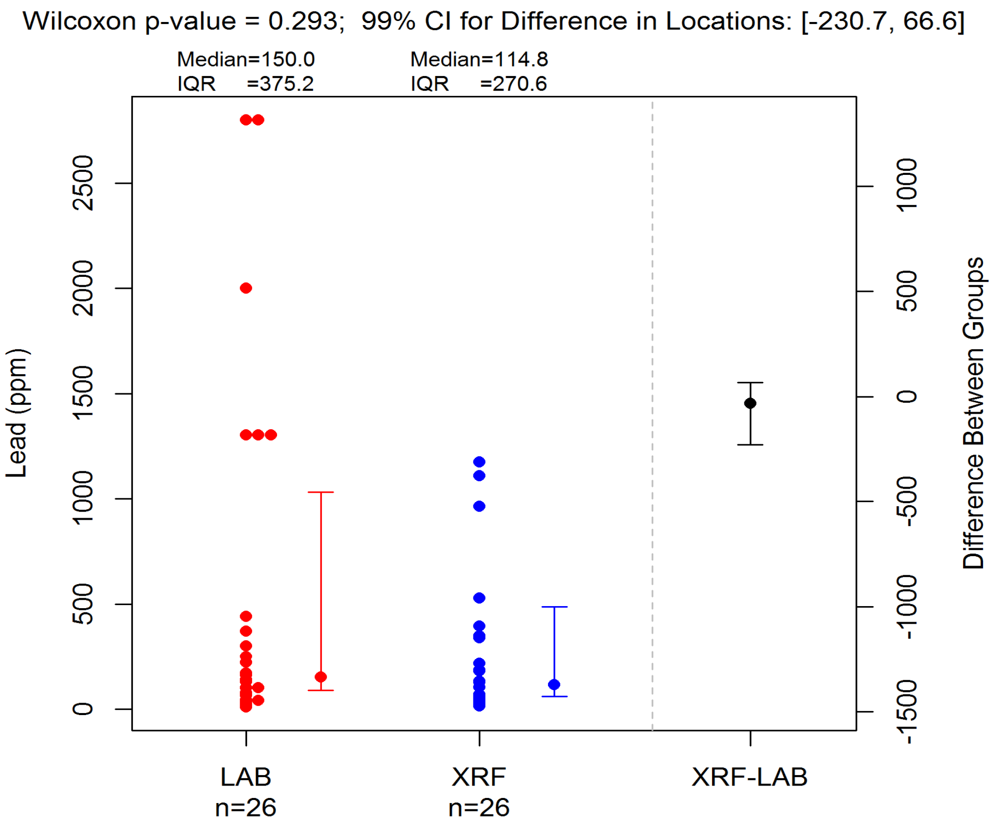
[1] Refers to the time that the sample being analyzed by the XRF, and to be sent to the lab, is removed from the 5-point composite ziplock bag

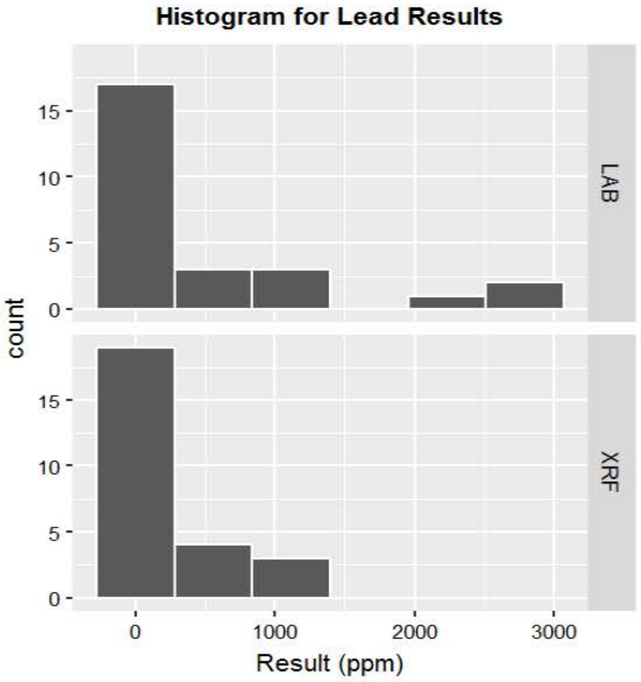
# Central Tendency Comparison Test

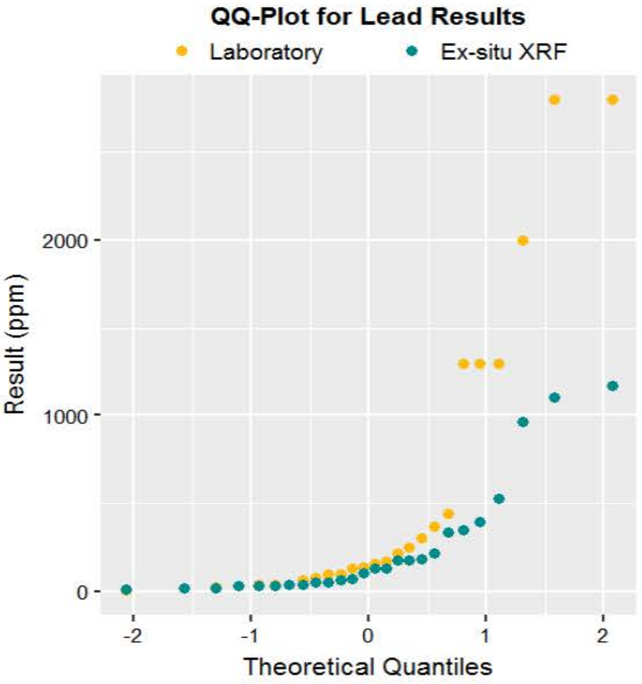
## Central Tendency Comparison Test Results

| Parameter | No. of Samples | Shapiro-Wilk Normality Test XRF Samples (p-value) | Shapiro-Wilk Normality Test Lab Samples (p-value) | F-Test for Equal Variance (p-value) | Student's t-test (p-value) | Welch's t-test (p-value) | Wilcoxon Rank Sum Test (p-value) | KS Test (p-value) | Are conc. different? | Basis of Decision |
|---|---|---|---|---|---|---|---|---|---|---|
| Lead | 26 | 0.000 | 0.000 | 0.000 | 0.097 | 0.100 | 0.293 | 0.493 | No | KS test |
| Log (Lead) | 26 | 0.385 | 0.459 | 0.307 | 0.278 | 0.278 | 0.293 | 0.493 | No | t-test |

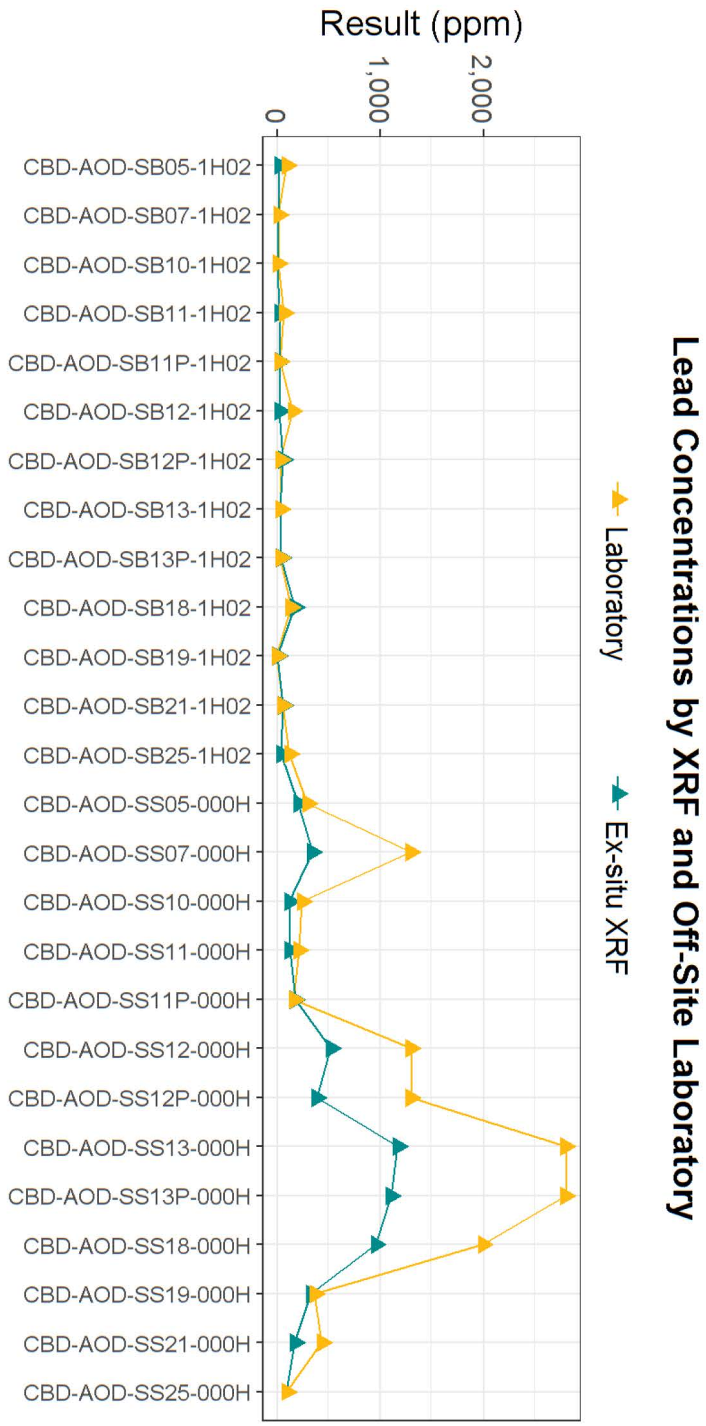
**Notes:**
KS = Kolmogorov-Smirnov



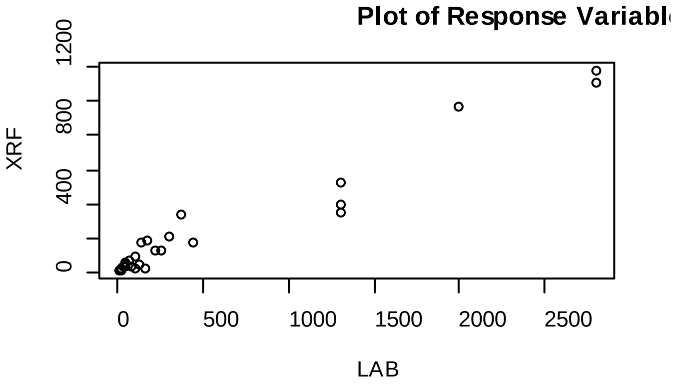

Histogram for Lead Results

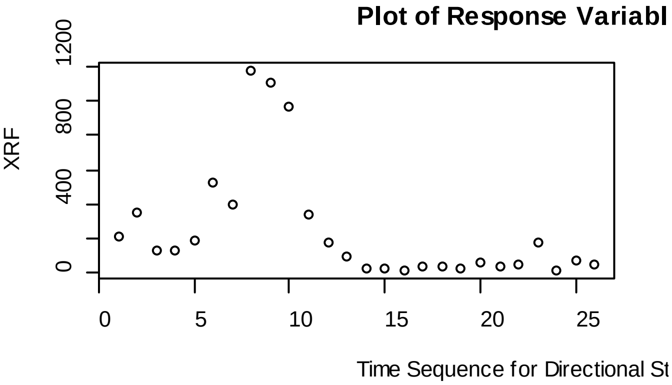

QQ-Plot for Lead Results

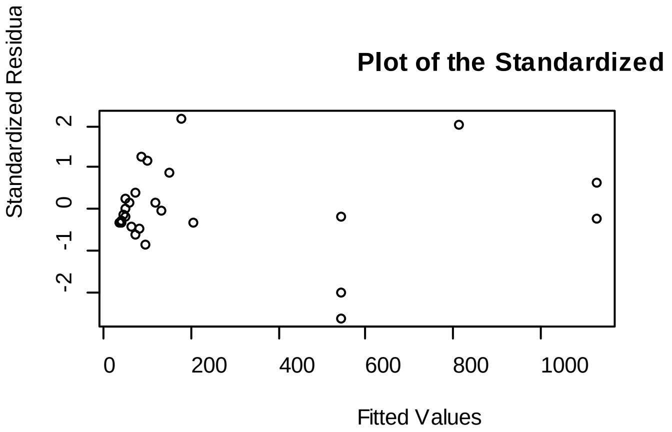
# Linear Regression Analysis

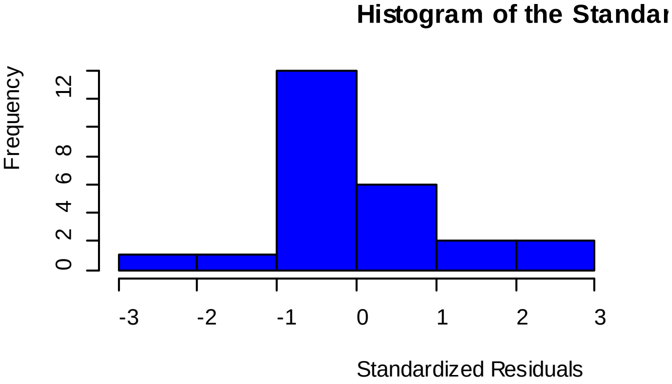

Lead Concentrations by XRF and Off-Site Laboratory
Laboratory
Ex-situ XRF
Result (ppm)
0
1,000
2,000
CBD-AOD-SB05-1H02
CBD-AOD-SB07-1H02
CBD-AOD-SB10-1H02
CBD-AOD-SB11-1H02
CBD-AOD-SB11P-1H02
CBD-AOD-SB12-1H02
CBD-AOD-SB12P-1H02
CBD-AOD-SB13-1H02
CBD-AOD-SB13P-1H02
CBD-AOD-SB18-1H02
CBD-AOD-SB19-1H02
CBD-AOD-SB21-1H02
CBD-AOD-SB25-1H02
CBD-AOD-SS05-000H
CBD-AOD-SS07-000H
CBD-AOD-SS10-000H
CBD-AOD-SS11-000H
CBD-AOD-SS11P-000H
CBD-AOD-SS12-000H
CBD-AOD-SS12P-000H
CBD-AOD-SS13-000H
CBD-AOD-SS13P-000H
CBD-AOD-SS18-000H
CBD-AOD-SS19-000H
CBD-AOD-SS21-000H
CBD-AOD-SS25-000H

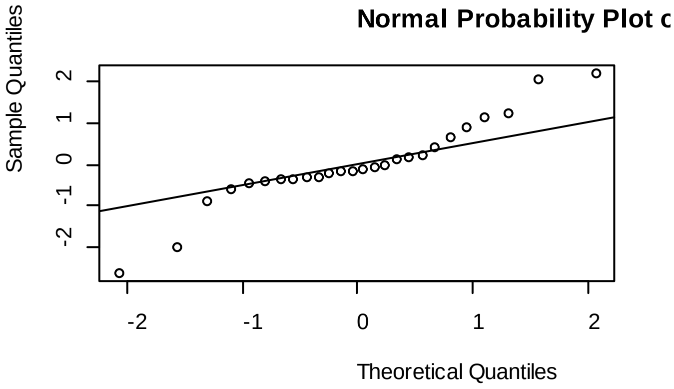
```
Call:
lm(formula = XRF ~ LAB, data = dat[dat$LAB <= mval, ])

Residuals:
   Min     1Q Median     3Q    Max 
-192.3  -25.3  -11.1   25.6  160.5 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 34.24310   18.05492   1.897     0.07 .  
LAB          0.38981    0.01826  21.344   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 76.67 on 24 degrees of freedom
Multiple R-squared:   0.95,     Adjusted R-squared:  0.9479 
F-statistic: 455.5 on 1 and 24 DF,  p-value: < 2.2e-16


ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS
USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM:
Level of Significance =  0.05 

Call:
 gvlma(x = fit) 

                    Value p-value                   Decision
Global Stat        8.6131 0.07153    Assumptions acceptable.
Skewness           0.0983 0.75388    Assumptions acceptable.
Kurtosis           1.3721 0.24145    Assumptions acceptable.
Link Function      1.3525 0.24483    Assumptions acceptable.
Heteroscedasticity 5.7901 0.01612    Assumptions NOT satisfied!
```

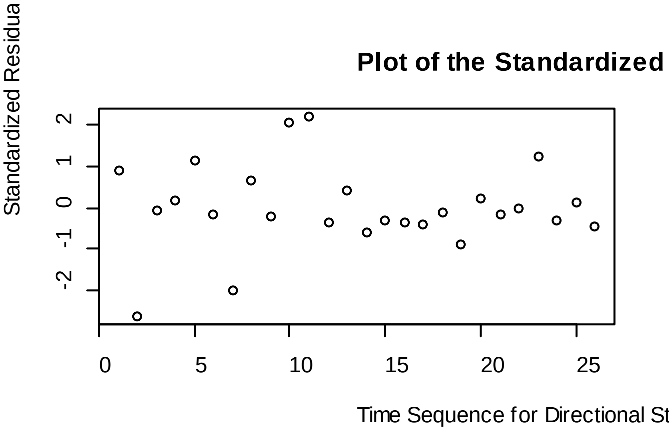

Plot of Response Variabl
XRF
0
400
800
1200
0
500
1000
1500
2000
2500
LAB

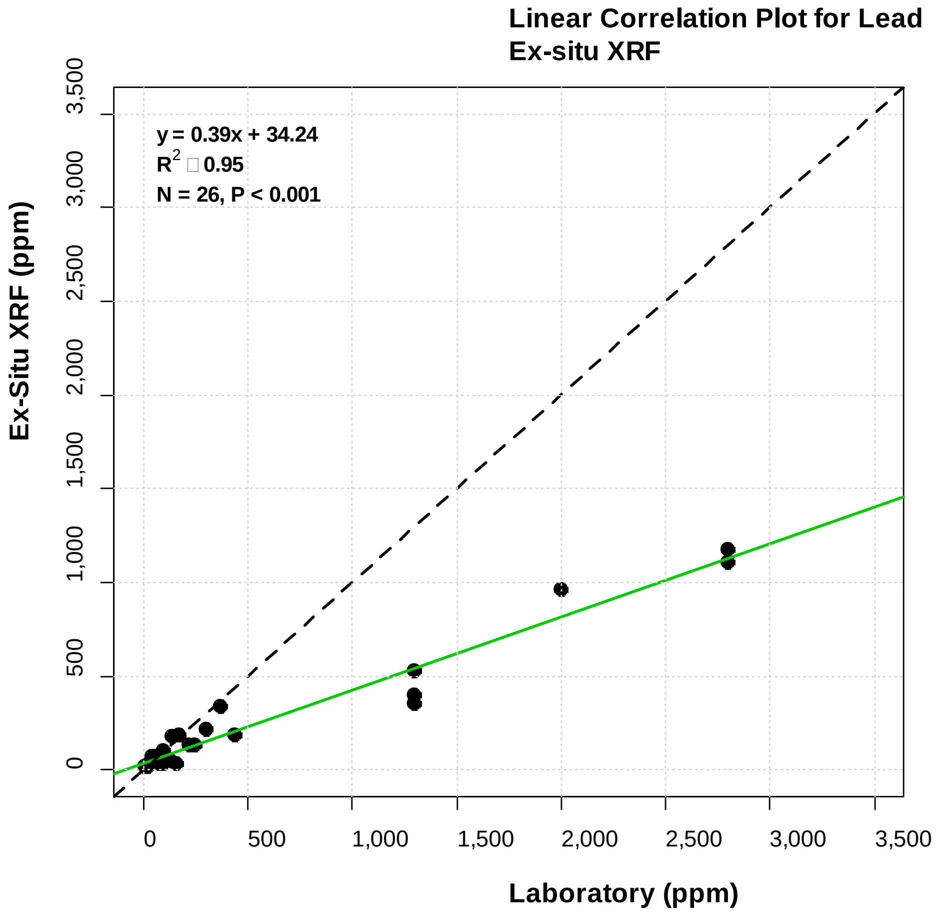

Plot of Response Variabl
XRF
0
400
800
1200
0
5
10
15
20
25
Time Sequence for Directional St

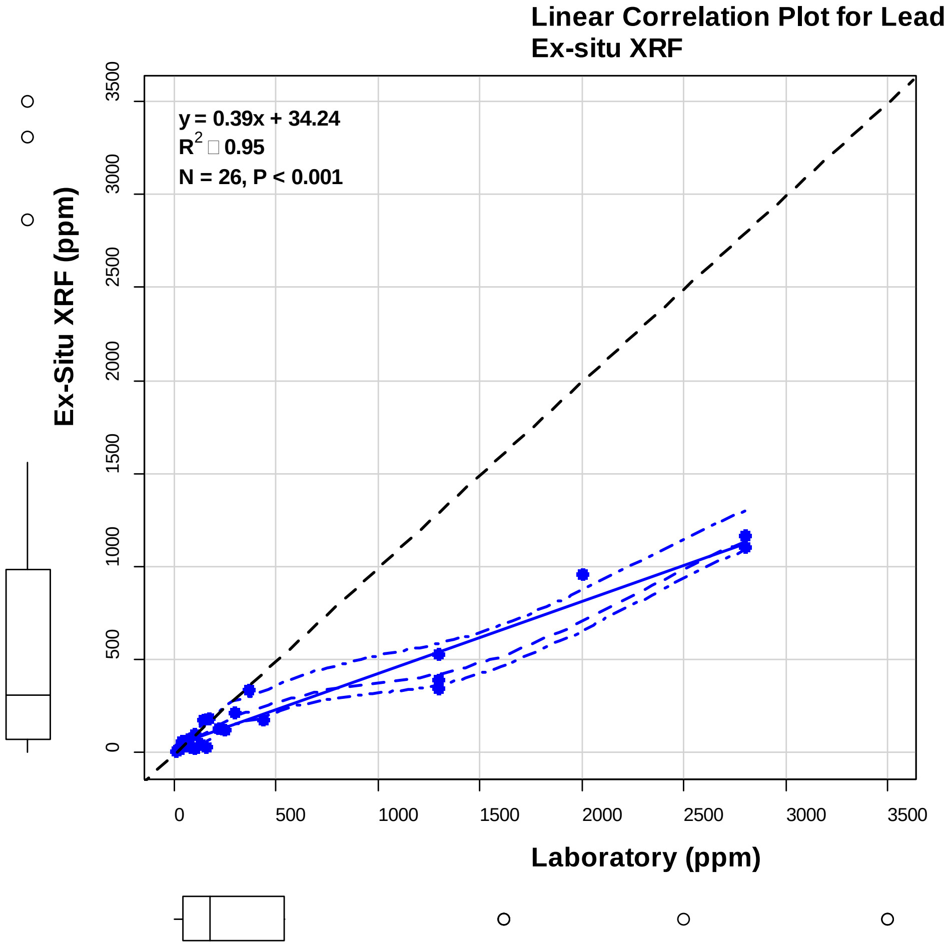

Plot of the Standardized
Standardized Residua
-2
-1
0
1
2
0
200
400
600
800
1000
Fitted Values

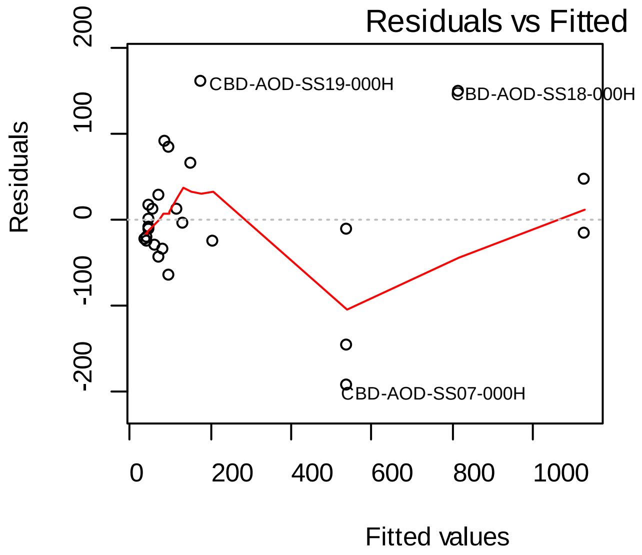

Histogram of the Standar
Frequency
0
2
4
6
8
12
-3
-2
-1
0
1
2
3
Standardized Residuals

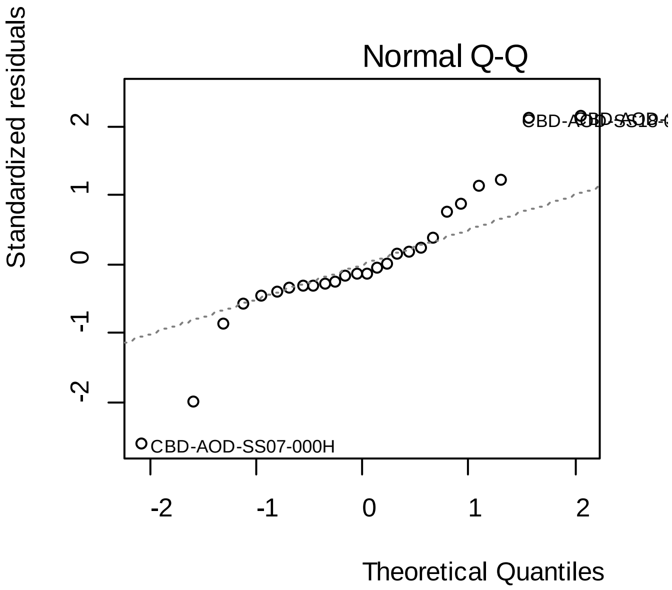

Normal Probability Plot o
Sample Quantiles
-2
-1
0
1
2
-2
-1
0
1
2
Theoretical Quantiles

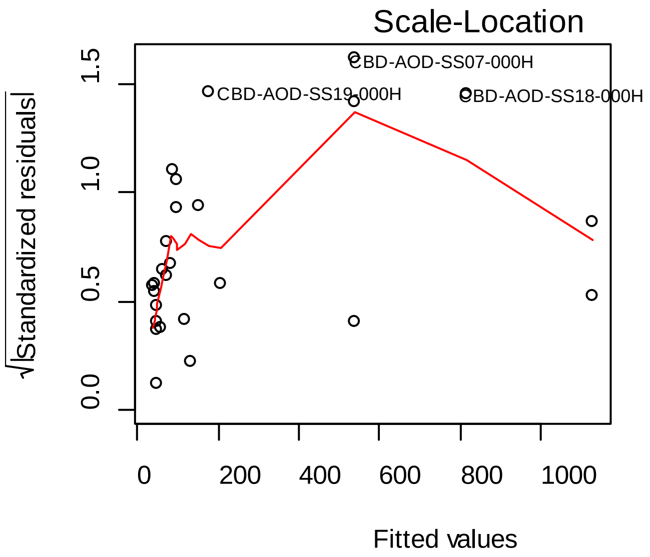

Plot of the Standardized
Standardized Residua
-2
-1
0
1
2
0
5
10
15
20
25
Time Sequence for Directional St

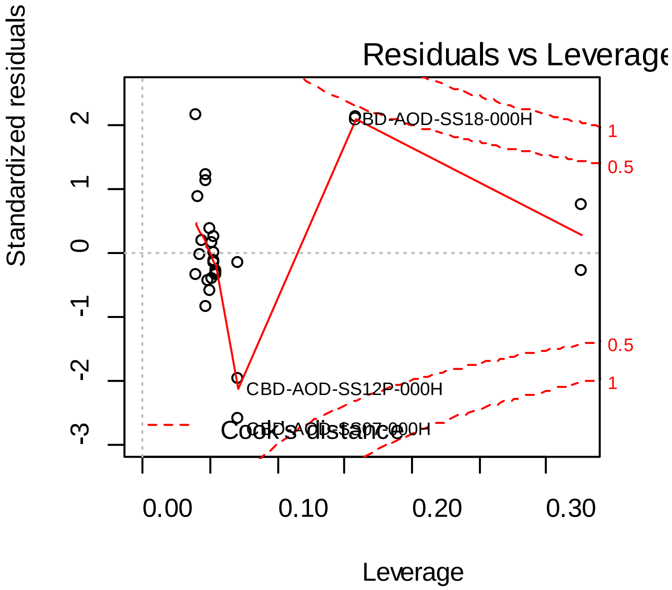

Linear Correlation Plot for Lead
Ex-situ XRF
y = 0.39x + 34.24
$R^2$ □ 0.95
N = 26, P < 0.001
Ex-Situ XRF (ppm)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
Laboratory (ppm)
0
500
1,000
1,500
2,000
2,500
3,000
3,500

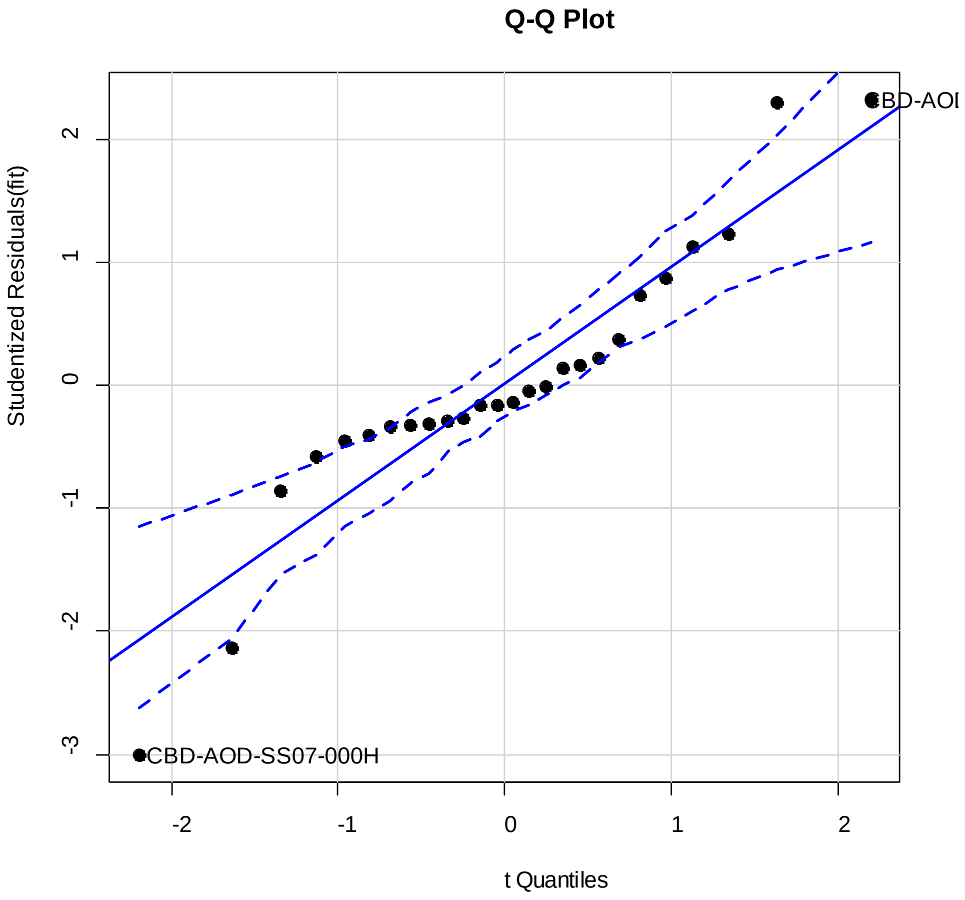

Linear Correlation Plot for Lead
Ex-situ XRF
y = 0.39x + 34.24
$R^2$ □ 0.95
N = 26, P < 0.001
Ex-Situ XRF (ppm)
0
500
1000
1500
2000
2500
3000
3500
Laboratory (ppm)
0
500
1000
1500
2000
2500
3000
3500

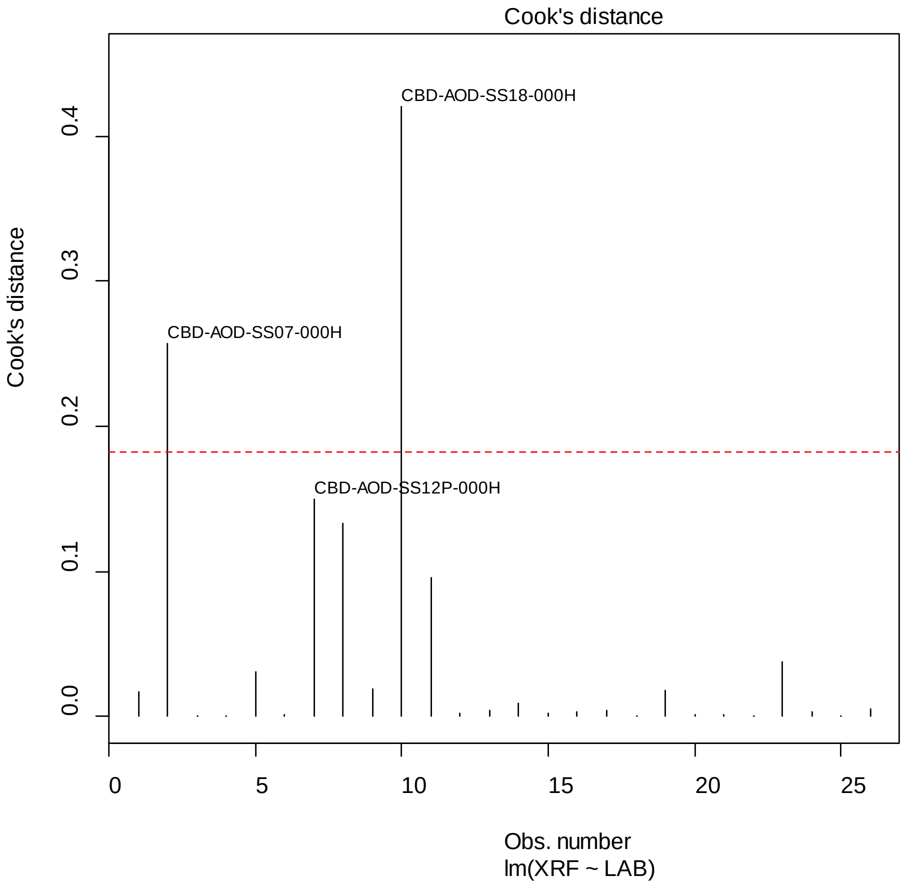

Residuals vs Fitted
Residuals
200
100
0
-100
-200
CBD-AOD-SS19-000H
CBD-AOD-SS18-000H
CBD-AOD-SS07-000H
0
200
400
600
800
1000
Fitted values

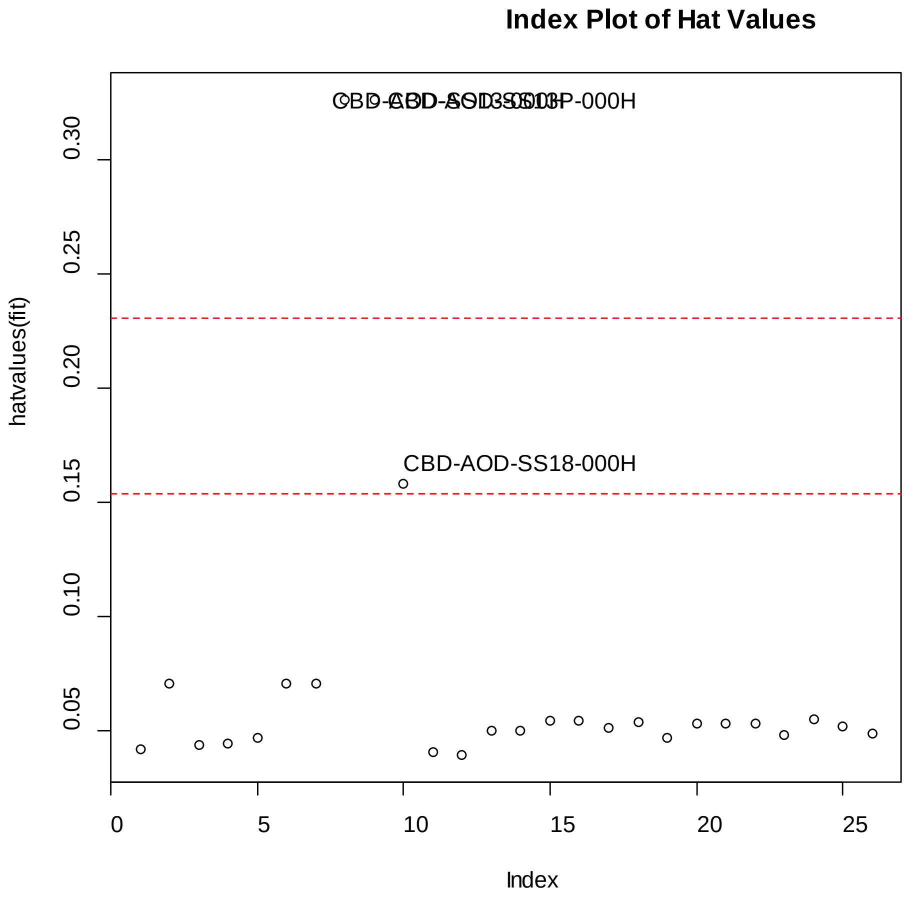

Normal Q-Q
Standardized residuals
2
1
0
-1
-2
CBD-AOD-SS18-0
CBD-AOD-SS07-000H
-2
-1
0
1
2
Theoretical Quantiles

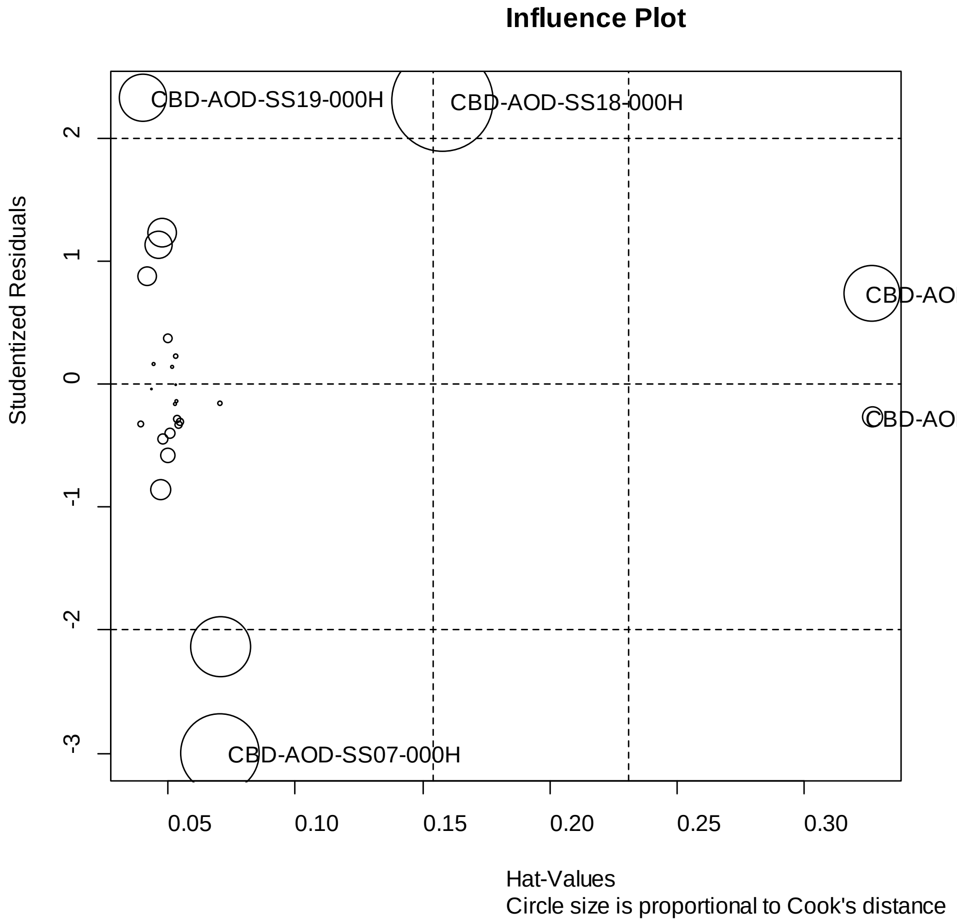

Scale-Location
√|Standardized residuals|
1.5
1.0
0.5
0.0
CBD-AOD-SS07-000H
CBD-AOD-SS19-000H
CBD-AOD-SS18-000H
0
200
400
600
800
1000
Fitted values


Residuals vs Leverage
Standardized residuals
2
1
0
-1
-2
-3
CBD-AOD-SS18-000H
CBD-AOD-SS12P-000H
CBD-AOD-SS07-000H
Cook's distance
1
0.5
0.5
1
0.00
0.10
0.20
0.30
Leverage


Q-Q Plot
Studentized Residuals(fit)
t Quantiles
-3
-2
-1
0
1
2
-2
-1
0
1
2
CBD-AOD-SS07-000H
CBD-AOI

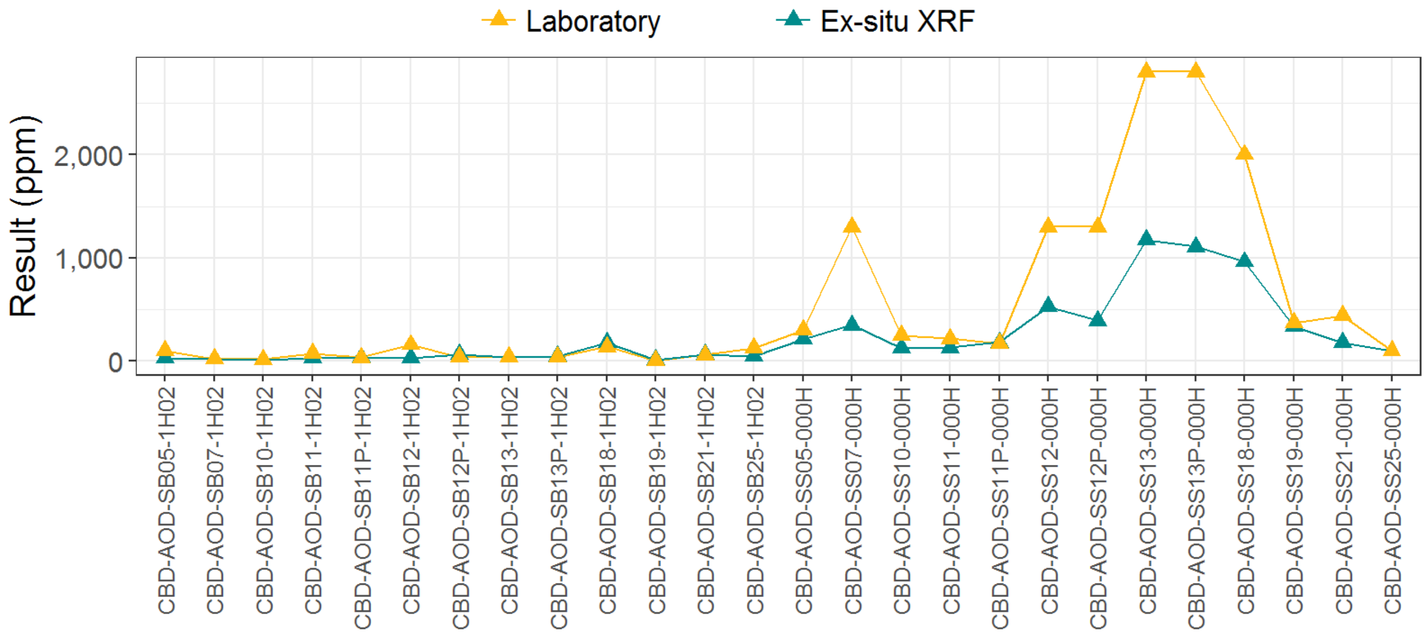

Cook's distance
Cook's distance
Obs. number
lm(XRF ~ LAB)
0.0
0.1
0.2
0.3
0.4
0
5
10
15
20
25
CBD-AOD-SS18-000H
CBD-AOD-SS07-000H
CBD-AOD-SS12P-000H


Index Plot of Hat Values
hatvalues(fit)
0.05
0.10
0.15
0.20
0.25
0.30
Index
0
5
10
15
20
25
CBD-AOD-SS18-000H

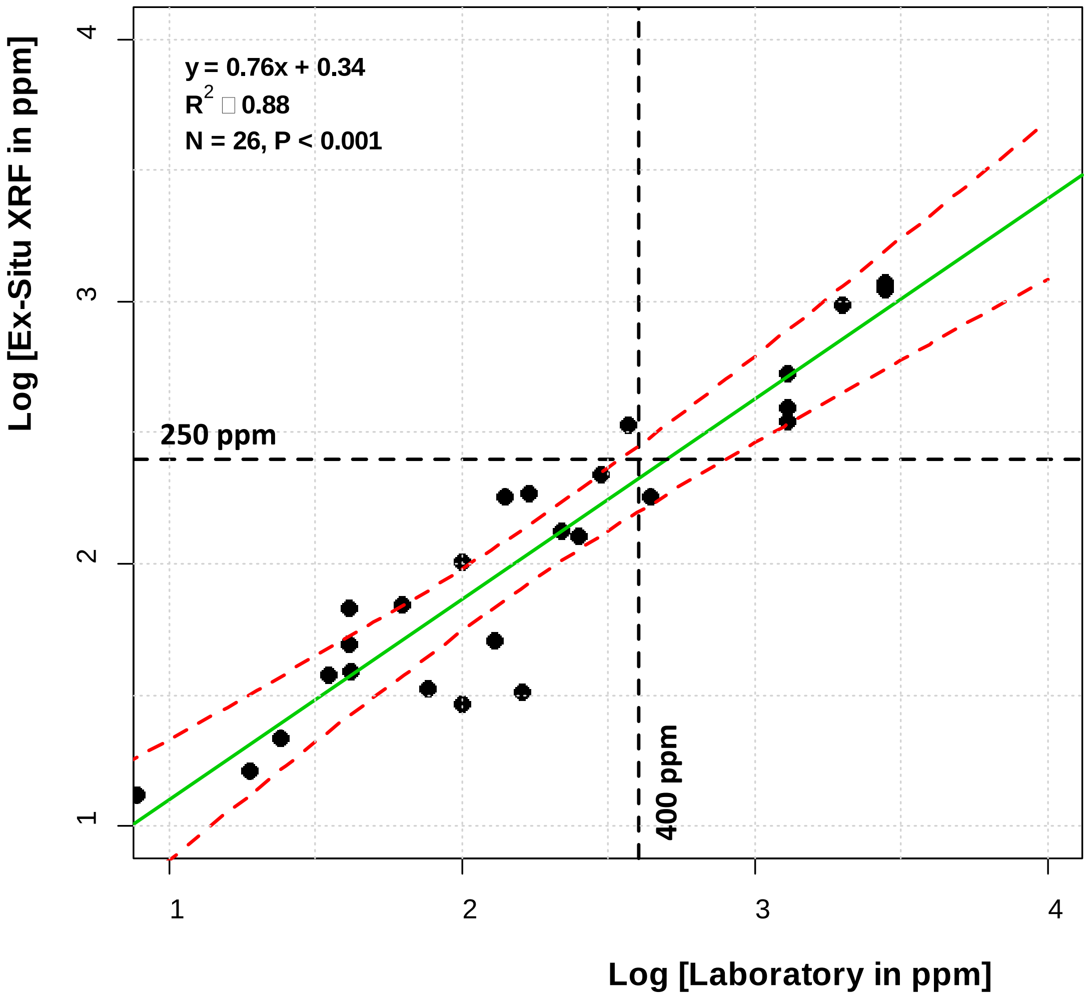

Influence Plot
Studentized Residuals
-3
-2
-1
0
1
2
0.05
0.10
0.15
0.20
0.25
0.30
Hat-Values
Circle size is proportional to Cook's distance
CBD-AOD-SS19-000H
CBD-AOD-SS18-000H
CBD-AOI
CBD-AOI
CBD-AOD-SS07-000H

# Log-Transformed Regression Analysis

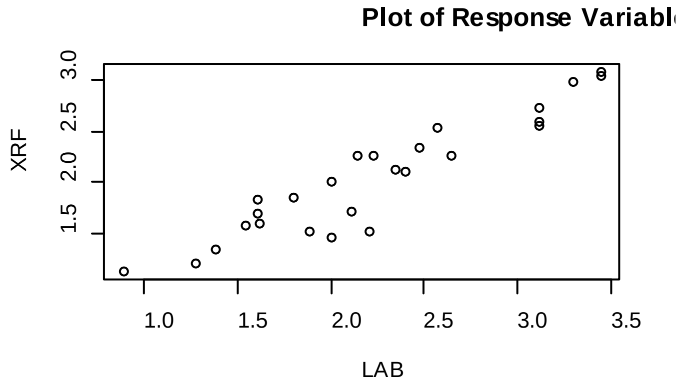
Lead Concentrations by XRF and Off-Site Laboratory



Linear Correlation Plot for Lead
Ex-situ XRF

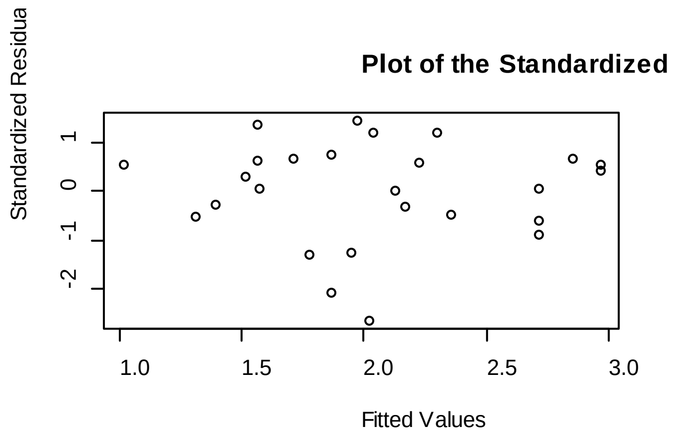


```
Call:
lm(formula = XRF ~ LAB, data = dat)

Residuals:
     Min       1Q   Median       3Q      Max 
-0.50941 -0.09994  0.03596  0.12732  0.28087 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  0.33834    0.13504   2.505   0.0194 *  
LAB          0.76233    0.05759  13.238  1.6e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2018 on 24 degrees of freedom
Multiple R-squared:  0.8795,    Adjusted R-squared:  0.8745 
F-statistic: 175.2 on 1 and 24 DF,  p-value: 1.596e-12


ASSESSMENT OF THE LINEAR MODEL ASSUMPTIONS
USING THE GLOBAL TEST ON 4 DEGREES-OF-FREEDOM:
Level of Significance =  0.05 

Call:
 gvlma(x = fit) 

                     Value p-value                Decision
Global Stat        5.65171 0.22671 Assumptions acceptable.
Skewness           2.97957 0.08432 Assumptions acceptable.
Kurtosis           0.07248 0.78776 Assumptions acceptable.
Link Function      0.71432 0.39801 Assumptions acceptable.
Heteroscedasticity 1.88534 0.16973 Assumptions acceptable.
```

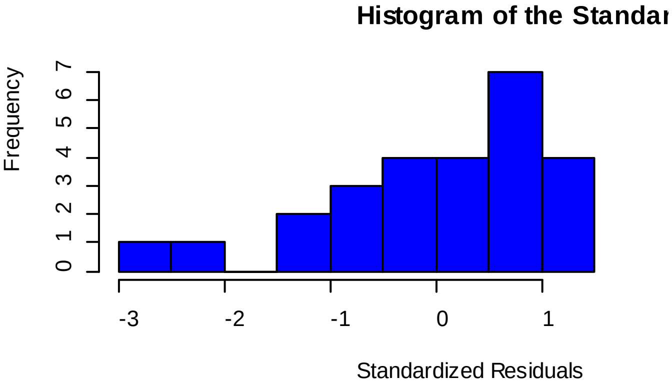


Plot of Response Variabl

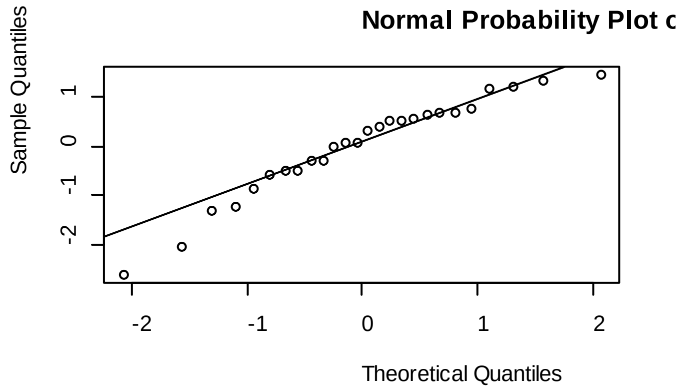
Plot of Response Variabl



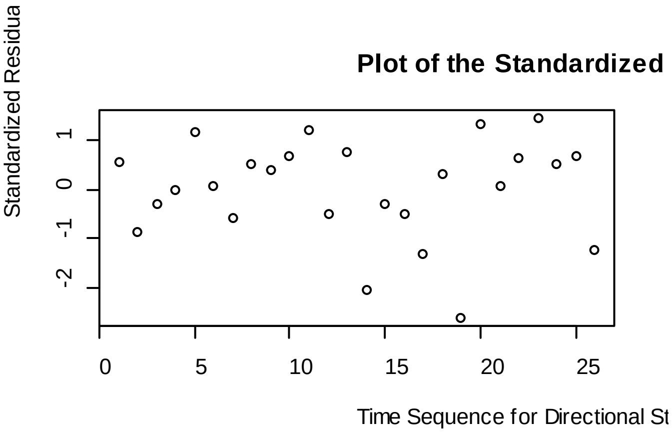
Plot of the Standardized



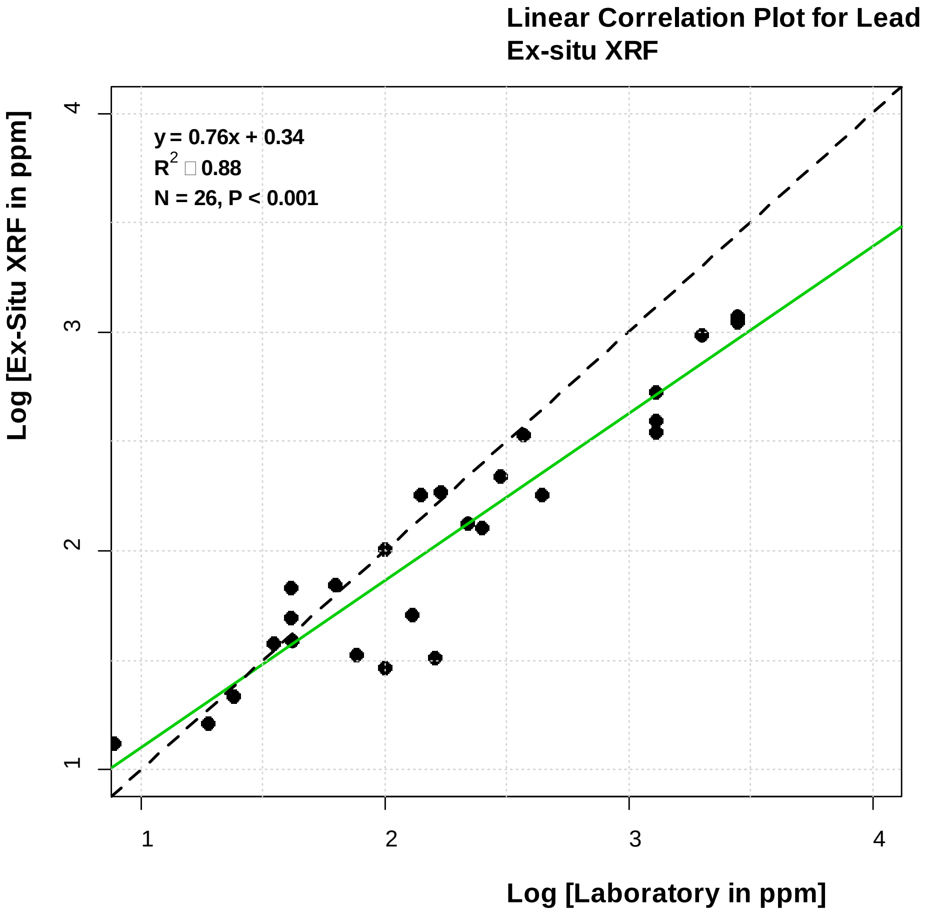
Histogram of the Standar

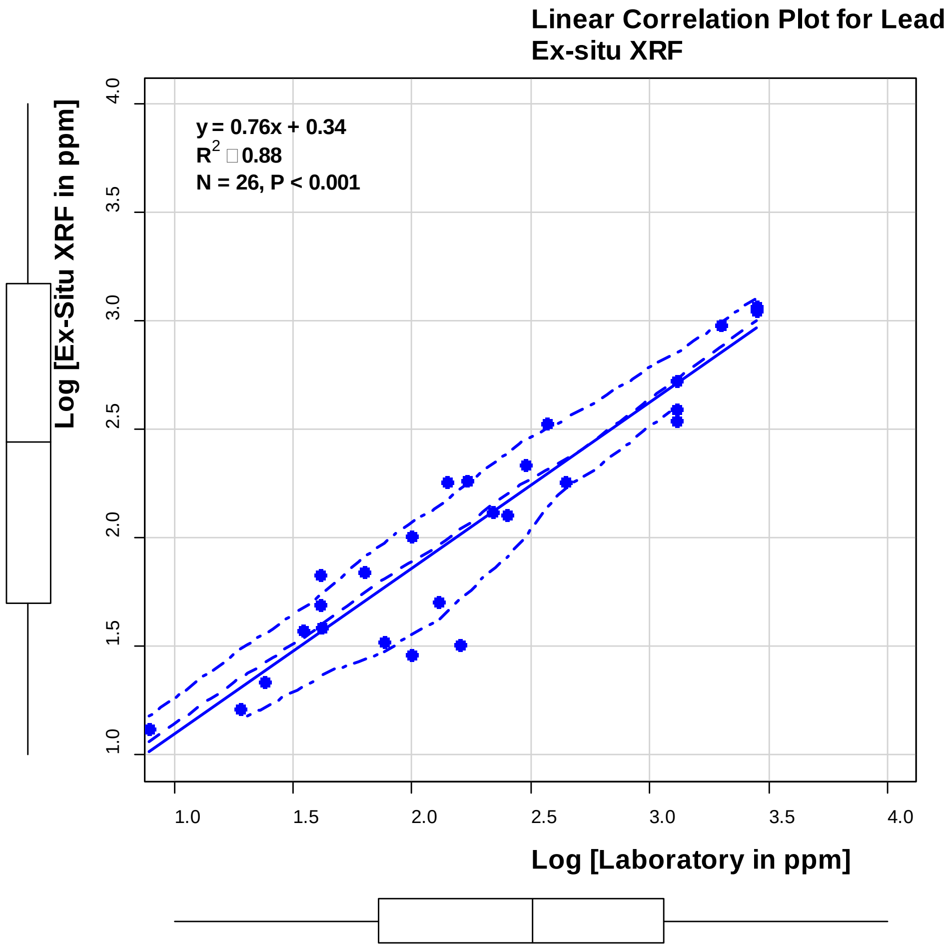


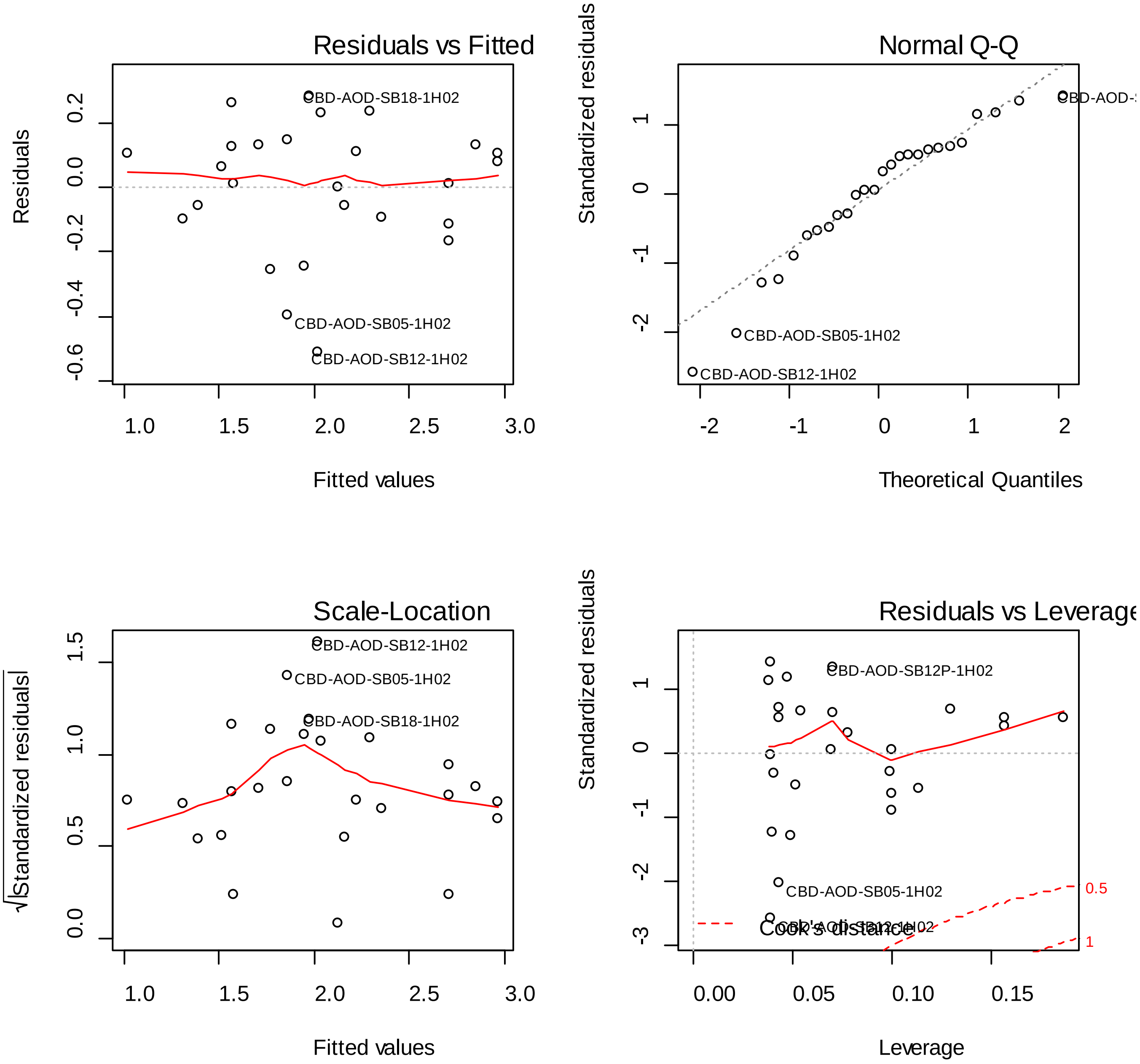
Normal Probability Plot o

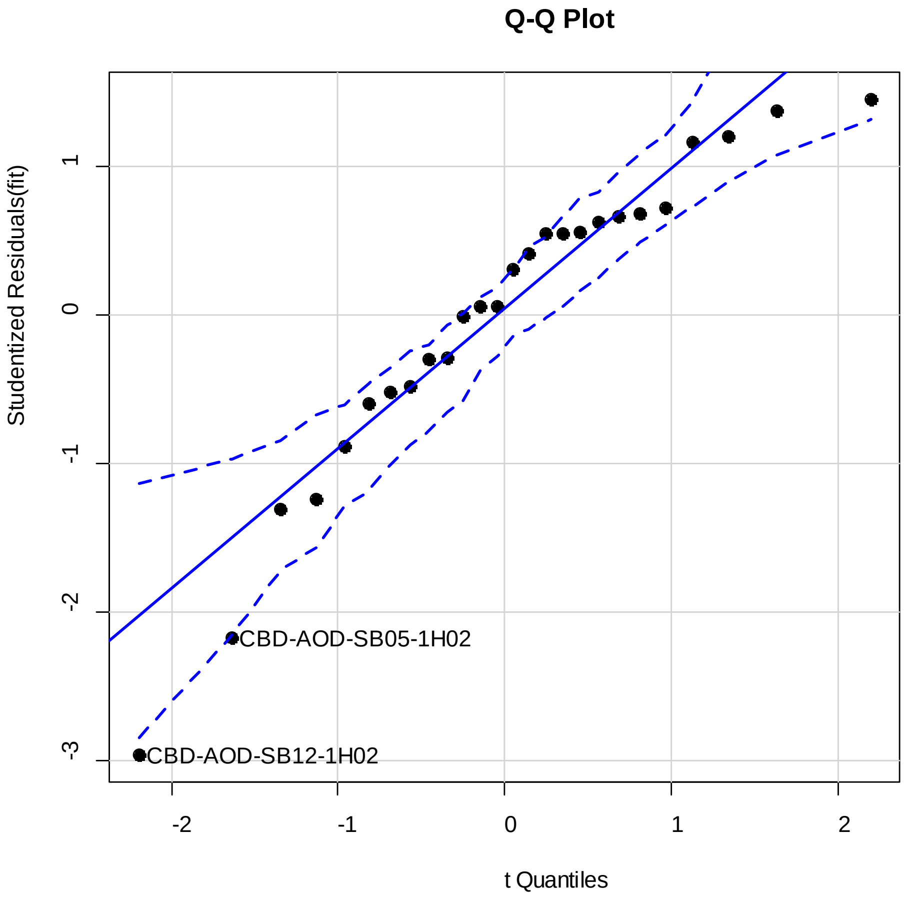


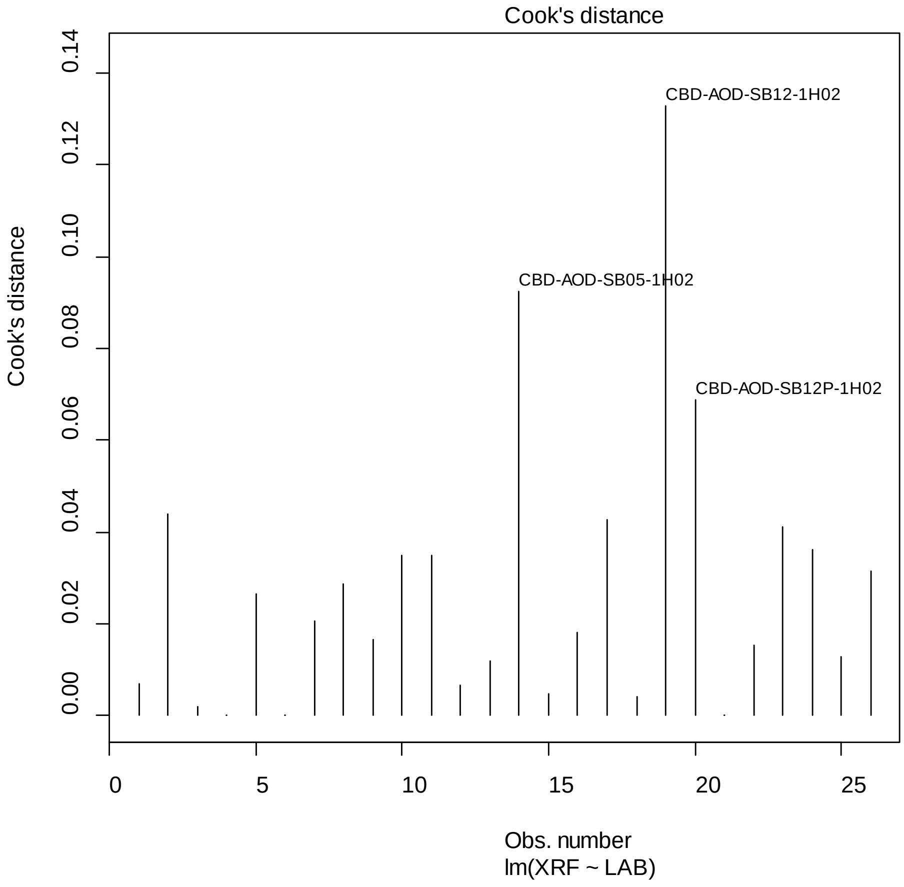
Plot of the Standardized

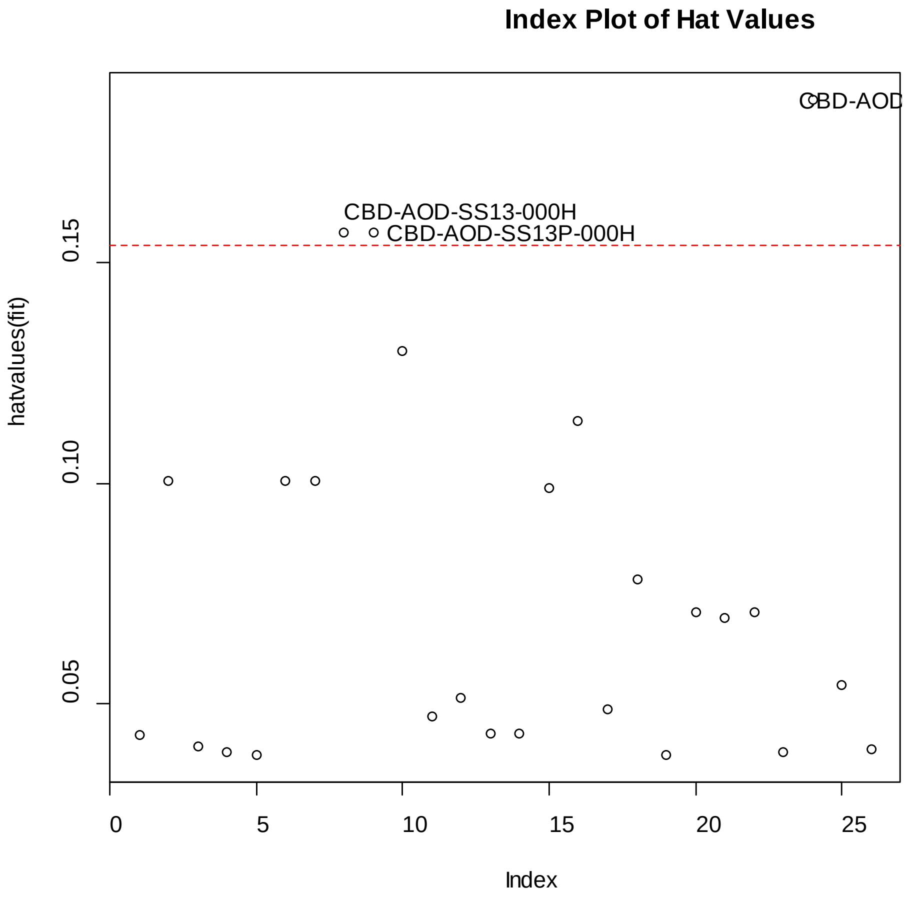

Linear Correlation Plot for Lead
Ex-situ XRF
y = 0.76x + 0.34
$R^2$ □ 0.88
N = 26, P < 0.001
Log [Ex-Situ XRF in ppm]
1
2
3
4
Log [Laboratory in ppm]

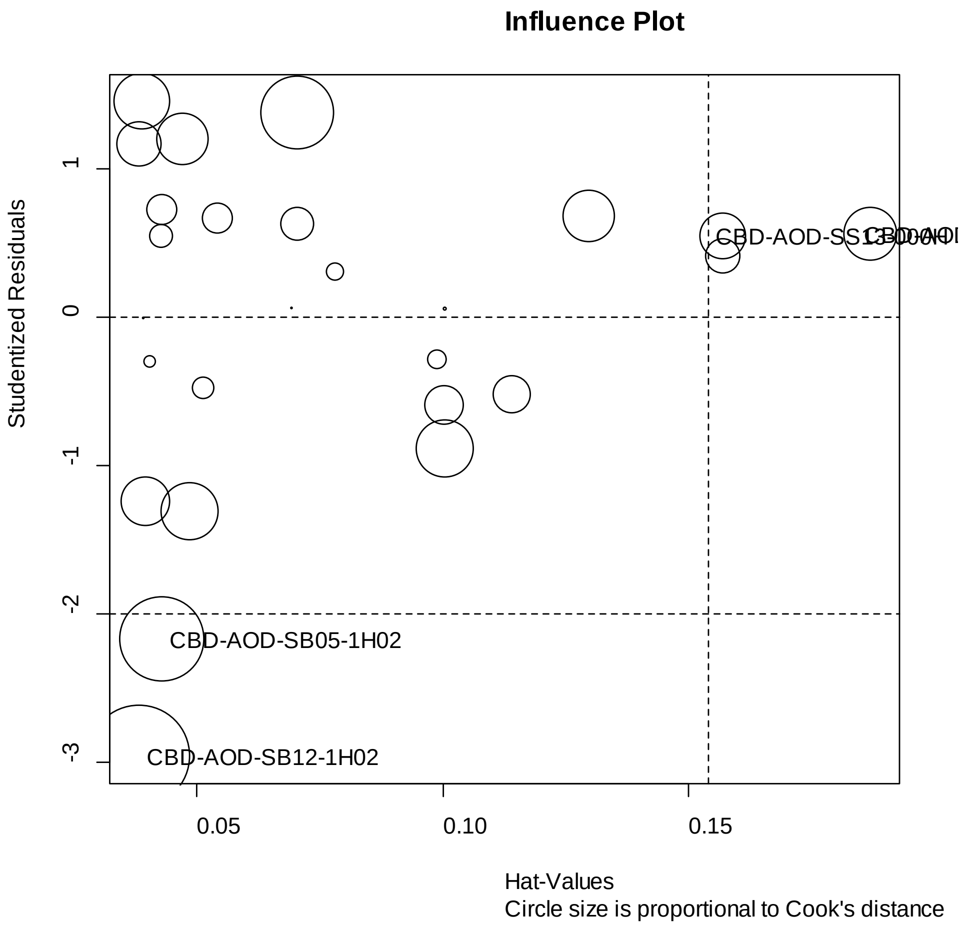

Linear Correlation Plot for Lead
Ex-situ XRF
y = 0.76x + 0.34
$R^2$ □ 0.88
N = 26, P < 0.001
Log [Ex-Situ XRF in ppm]
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Log [Laboratory in ppm]


Residuals vs Fitted
Residuals
0.2
0.0
-0.2
-0.4
-0.6
1.0
1.5
2.0
2.5
3.0
Fitted values
CBD-AOD-SB18-1H02
CBD-AOD-SB05-1H02
CBD-AOD-SB12-1H02
Normal Q-Q
Standardized residuals
1
0
-1
-2
Theoretical Quantiles
CBD-AOD-
CBD-AOD-SB05-1H02
CBD-AOD-SB12-1H02
Scale-Location
√|Standardized residuals|
1.5
1.0
0.5
0.0
Fitted values
CBD-AOD-SB12-1H02
CBD-AOD-SB05-1H02
CBD-AOD-SB18-1H02
Residuals vs Leverage
Standardized residuals
-3
0.00
0.05
0.10
0.15
Leverage
CBD-AOD-SB12P-1H02
CBD-AOD-SB05-1H02
CBD-AOD-SB12-1H02
Cook's distance
0.5
1


Q-Q Plot
Studentized Residuals(fit)
1
0
-1
-2
-3
-2
-1
0
1
2
t Quantiles
CBD-AOD-SB05-1H02
CBD-AOD-SB12-1H02


Cook's distance
Cook's distance
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0
5
10
15
20
25
Obs. number
lm(XRF ~ LAB)
CBD-AOD-SB12-1H02
CBD-AOD-SB05-1H02
CBD-AOD-SB12P-1H02


Index Plot of Hat Values
hatvalues(fit)
0.05
0.10
0.15
Index
0
5
10
15
20
25
CBD-AOD-SS13-000H
CBD-AOD-SS13P-000H
CBD-AOD


Influence Plot
Studentized Residuals
1
0
-1
-2
-3
0.05
0.10
0.15
Hat-Values
Circle size is proportional to Cook's distance
CBD-AOD-SB05-1H02
CBD-AOD-SB12-1H02
CBD-AOD-SS13-000H