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DRAFT RISK ASSESSMENT AND FEASIBILITY STUDY SITE 10 SOIL ALLEGANY BALLISTICS LABORATORY ROCKET CENTER WV (DRAFT ACTING AS FINAL)
1/1/2004
CH2M HILL

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# Risk Assessment and Feasibility Study for Site 10 Soil

# at the

# Allegany Ballistics Laboratory Rocket Center, West Virginia

**Contract Task Order 110**

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# Acronyms and Abbreviations

| | |
|---|---|
| ABL | Allegany Ballistics Laboratory |
| ATK | ATK Tactical Systems Company, LLC |
| BERA | baseline ecological risk assessment |
| CNO | Chief of Naval Operations |
| COPC | Constituent of Potential Concern |
| CSF | cancer slope factor |
| CT | central tendency |
| CTO | Contract Task Order |
| DAF | dilution attenuation factor |
| DL | detection limit |
| DoD | Department of Defense |
| DoN | Department of Navy |
| DQO | Data Quality Objectives |
| EPC | exposure point concentration |
| ERA | ecological risk assessment |
| ESADDI | estimated safe and adequate daily dietary intake |
| FFS | Focused Feasibility Study |
| GOCO | government-owned, contractor-operated |
| HEAST | Health Effects Assessment Summary Tables |
| HHRA | human health risk assessment |
| HI | hazard index |
| HQ | hazard quotient |
| IRIS | Integrated Risk Information System |
| IRP | Installation Restoration Program |
| LANTDIV | Atlantic Division |
| LMS | linearized multistage |
| LOAEL | lowest observed adverse effect level |
| MCL | Maximum Contaminant Level |
| MF | modifying factor |
| NAVFACENGCOM | Naval Facilities Engineering Command |
| NAVSEA | Naval Sea Systems Command |
| NCEA | National Center for Environmental Assessment |
| NOAEL | no observed adverse effect level |
| NPL | National Priority List |

| | |
|---|---|
| PRAP | Proposed Remedial Action Plan |
| PWA | Production Well "A" |
| RA | risk assessment |
| RAGS | Risk Assessment Guidance for Superfund |
| RBC | risk-based concentration |
| RDA | Recommended Dietary Allowance |
| RfD | reference dose |
| RME | reasonable maximum exposure |
| ROD | Record of Decision |
| SERA | screening ecological risk assessment |
| SF | slope factor |
| SMDP | Scientific Management Decision Point |
| SQL | sample quantitation limit |
| SSL | soil screening level |
| SVOC | semivolatile organic compound |
| TCE | trichloroethene |
| TOC | total organic carbon |
| VOC | volatile organic compound |
| UCL | upper confidence limit |
| UF | uncertainty factor |
| USEPA | United States Environmental Protection Agency |

SECTION 1

# Introduction

This risk assessment and feasibility study report is intended to summarize the human and ecological risk assessments and present sufficient information to support an informed risk management decision regarding the need for further action for Site 10 soil at the Allegany Ballistics Laboratory (ABL) in Mineral County, Rocket Center, West Virginia.

This document is organized in seven sections. Section 1 presents this introduction. Section 2 presents facility and site background information. Section 3 discusses the nature and extent of soil contamination. Sections 4 and 5 present the human health and ecological risk assessment results, respectively. Section 6 summarizes the feasibility study for the site. Section 7 lists the references used to prepare this report.

This report also contains three appendices. Tabulated results of raw analytical data for soil samples collected during the RI and Phase II RI and for the Site 10 surface and subsurface soil used in the human health and ecological risk assessments are presented in Appendix A. Appendix B summarizes the statistical comparison of Site 10 soil data to facility soil background concentrations. Appendix C contains human health risk assessment tables.

SECTION 2

# Facility and Site Background

## 2.1 Facility Background

ABL is a government-owned (Navy), contractor-operated [ATK Tactical Systems Company LLC[1] (ATK)], research, development, testing, and production facility for solid propellants and motors used for ammunition, rockets, and armaments.

The facility is located in Mineral County, in the northeastern part of West Virginia, approximately 10 miles southwest of Cumberland, Maryland, along the West Virginia and Maryland border. The facility lies between the North Branch Potomac River, to the north and west, and Knobly Mountain, to the south and east. Several small towns are located near the facility, including Short Gap, West Virginia to the southeast, and Pinto, Maryland to the north. The land surrounding the ABL facility is primarily rural agricultural and forest.

ABL consists of about 1,634 acres of land with about 350 buildings. The facility is divided into two distinct operating plants, Plant 1 and Plant 2. Plant 1 is the government-owned, contractor-operated (GOCO) facility owned by the Navy and leased to ATK, by the Naval Sea Systems Command (NAVSEA) through a Facilities Use Contract. It occupies about 1,577 acres in area (including a large undeveloped area). Plant 2, owned and operated by ATK, occupies the remaining 57 acres.

The Navy and Hercules[2] performed previous environmental investigations at ABL under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and under the Navy's IRP.

Twelve present and former IRP sites were identified at Plant 1 of ABL. Eight IRP sites are located within the developed area of Plant 1, and three remaining sites within the undeveloped area. On May 31, 1994, ABL Plant 1 was added to the National Priorities List (NPL). Plant 2 is not on the NPL. Figure 2-1 shows the relative locations of the two plants and active IRP Sites.

## 2.2 Site Background

Site 10 is located in the south-central portion of Plant 1 and consists of the area around Building 157. Site 10 was initially defined as Site PWA because contamination had been detected in Production Well A (PWA), which was used in the past to supply potable, boiler, and fire-fighting water to the plant. Because volatile organic compounds (VOCs) were detected in PWA as early as 1980, its use as a water source was discontinued. Site 10 has been part of a number of investigations conducted at ABL in the 1980s and early-1990s and was part of a supplemental soil investigation in June 2000.

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[1] All site work through the Phase II RI was performed when Hercules Aerospace Company (Hercules) operated the facility. Since 1995, ATK has been the operator.

[2] The RI was conducted for Hercules. All Installation Restoration work conducted since the RI (e.g., Phase II RI and Focused RI) have been conducted for the Navy.

Below is a list of each of the investigations that has been conducted at Site 10 in chronological order. Information gathered during these investigations indicates that limited VOC soil contamination exists in the vicinity of the former TCE still, and that VOC contamination (predominantly TCE) is located primarily in the alluvial aquifer and to a smaller extent the bedrock aquifer (Figure 2-2). More detailed descriptions of these investigations and their findings can be found in the documents referenced.

- *Interim Remedial Investigation for Allegany Ballistics Laboratory* (Roy F. Weston, Inc., October 1989)
- *Remedial Investigation of the Allegany Ballistics Laboratory* (CH2M HILL, January 1996)
- *Phase II Remedial Investigation at Allegany Ballistics Laboratory* (CH2M HILL, August 1996)
- *Phase I Aquifer Testing at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, December 1998).
- *Phase II Aquifer Testing at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, September 1999).
- *Focused Feasibility Study for Site 10 Groundwater at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, March 1998).
- *Phase III Aquifer Testing at Site 1 and Site 10 of Allegany Ballistics Laboratory Superfund Site Report* (CH2M HILL, March 2002).
- *Technical Memorandum Soil and Groundwater Sampling and Well Installation Activities at Site 4B and Site 10 at Allegany Ballistics Laboratory* (CH2M HILL, January 15, 2000).

A Proposed Remedial Action Plan (PRAP) for groundwater at Site 10 was issued in March 1998 and a Record of Decision (ROD) was signed in August 1998. The selected remedy, intended to contain and remove the was most highly contaminated portion of the alluvial aquifer (i.e., TCE contamination greater than 100 µg/L), was implemented in February 1999 but was considered an interim action because it did not address the full extent of alluvial and bedrock aquifer contamination.

Since that time, one additional alluvial and four additional bedrock extraction wells have been added to the extraction system at Site 10 to achieve capture of the area of groundwater contamination above the trichloroethene (TCE) maximum contaminant level (MCL) of 5 µg/l. The Navy issued the final PRAP for groundwater at Site 10 in January 2002 and a final ROD has been prepared and is currently being evaluated by the authorizing signatories.

The soil at Site 10, which is the focus of this report, was first investigated during the Remedial Investigation (RI) (CH2M HILL, January 1996) when soil samples were collected around seven buildings where VOCs were thought have been used or stored in the vicinity of PWA. Those samples collected adjacent to Building 157 and the former TCE still are shown in Figure 2-3. Soil samples were analyzed for VOCs at an onsite mobile laboratory, and a subset of samples was sent to an offsite laboratory for confirmatory analysis. TCE was detected in all eight soil samples collected southwest of Building 157 where the former TCE still operated during 1959 and the early-1960s. Only one of these samples was sent offsite for

analysis (HCS-PWA-13). The results of the RI confirmed that the groundwater contamination in PWA likely originated from the former TCE still at Building 157.

Additional soil samples were collected during the Phase II RI (Figure 2-3) for a wider range of constituents than had been evaluated during the RI. The majority of soil samples were analyzed by an onsite laboratory for VOCs only to determine appropriate locations for monitoring well installation activities. Two soil samples, one surface (HCS-PWA-29S) and one subsurface (HCS-PWA-29), collected in the vicinity of Building 157 were also sent to an offsite laboratory for SVOCs and metals analysis (CH2M HILL, August 1996). The results of the Phase II RI confirmed that VOCs were the primary constituents of concern at Site 10 and supported the conclusion that the former TCE still was the likely source of contamination.

The analytical data for all soil samples collected for Site PWA (Site 10) during the RI and Phase II RI are provided in Appendix A. The RI and Phase II RI sample locations not collected at Building 157 were in the vicinity of solid waste management units (SWMUs) or areas of concern (AOCs) identified during the Phase II RCRA Facility Assessment (RFA) (Kearney, March 1983). These units are or have been the subject of other investigations, removal action, and/or closeout under the Federal Facility Agreement (FFA) and are no longer considered to be part of Site 10. Therefore, because the source area for Site 10 groundwater contamination is believed to have been the former TCE still at Building 157, only the soil samples collected in the immediate vicinity of Building 157 during the RI and Phase II RI (HCS-PWA-13, HCS-PWA-29S, HCS-PWA-29) are included in the risk assessment dataset.

Subsequent to the Phase II RI, the ABL Partnering Team determined there were not sufficient data to adequately assess potential risks associated with exposure to soil at Site 10. Therefore, a supplemental soil investigation was conducted at Site 10 in the summer of 2000. During this investigation, 12 soil samples (6 surface and 6 subsurface samples) were collected from six locations in the vicinity of a former TCE still. These samples were analyzed for Target Compound List (TCL) VOCs and Target Analyte List (TAL) metals.

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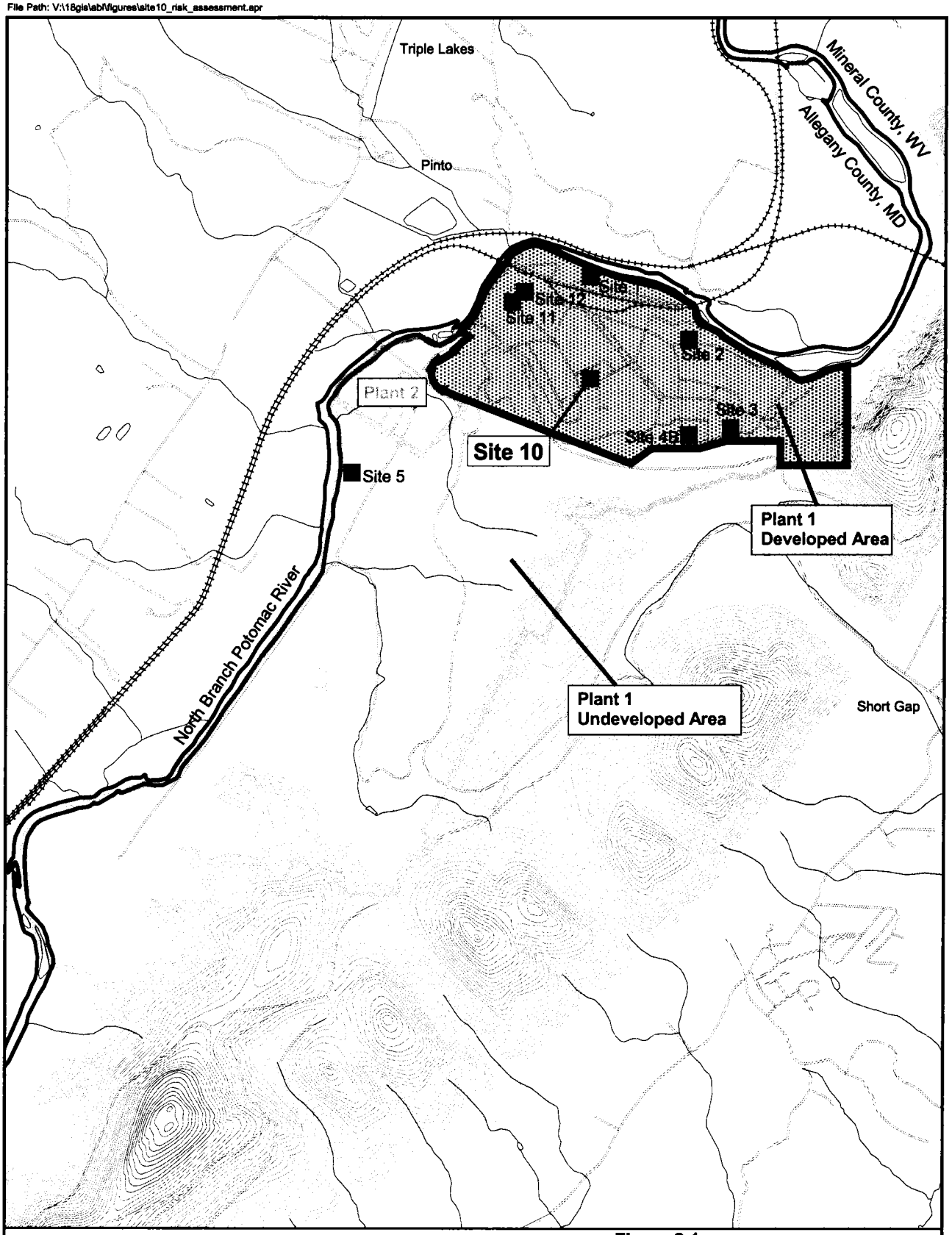


**LEGEND**

- IRP Sites
- Railroads
- River Bank
- Roads
- Plant 1
- Plant 2
- Plant 1 - Undeveloped Area

N

1200 0 1200 2400 Feet

**Figure 2-1**
Facility and Site Location Map
Risk Assessment Report for Site 10 Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia

**CH2MHILL**

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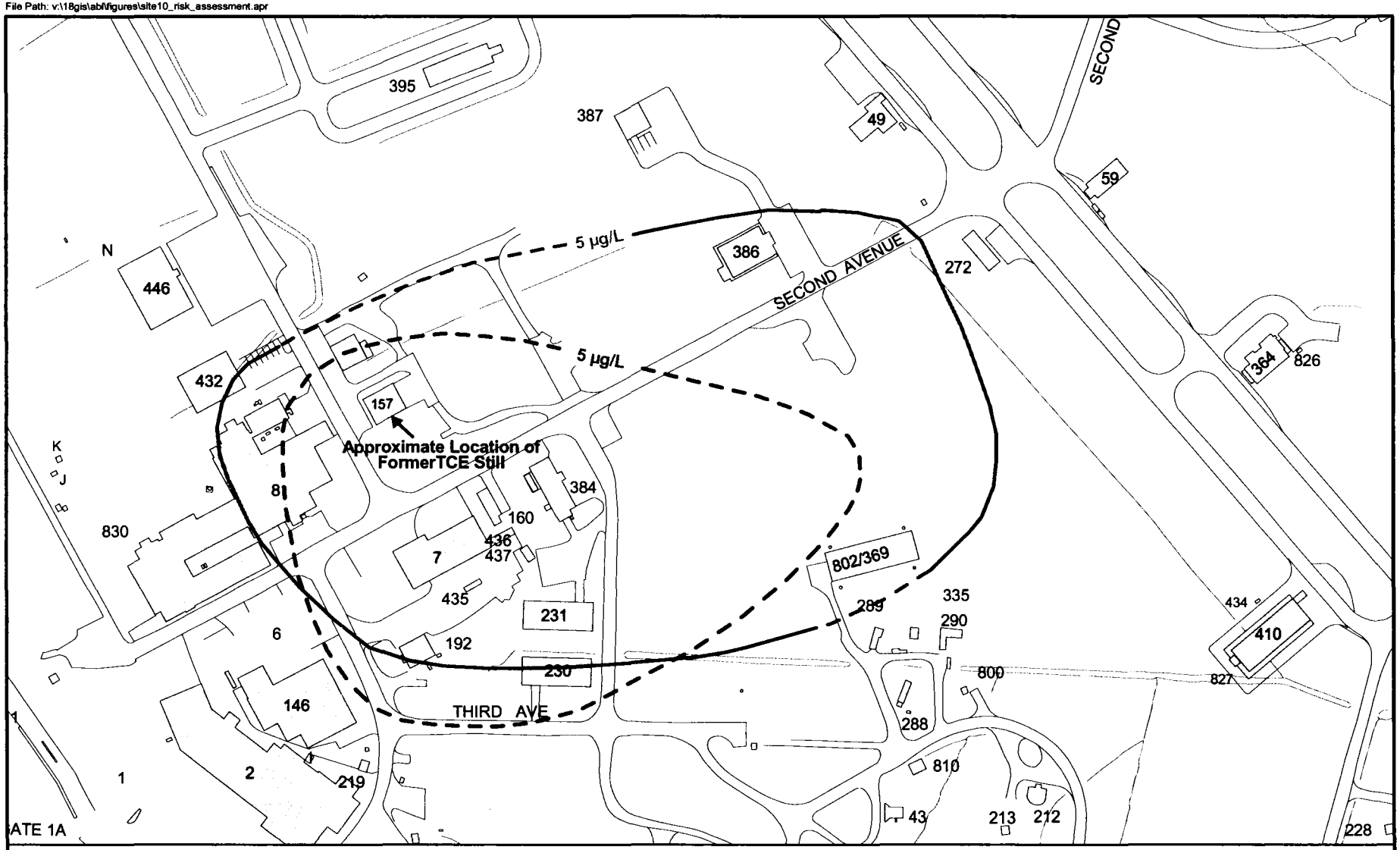


**LEGEND**

- 5 µg/l TCE Area in Alluvial Aquifer (dashed where inferred)
- 5 µg/l TCE Area in Bedrock Aquifer (dashed where inferred)
- Building
- Edge of Pavement
- Water Bodies

N

0 100 200 300 Feet

**Figure 2-2**
Site 10 Features and Location
Risk Assessment Report for Site 10 Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia

**CH2M**HILL

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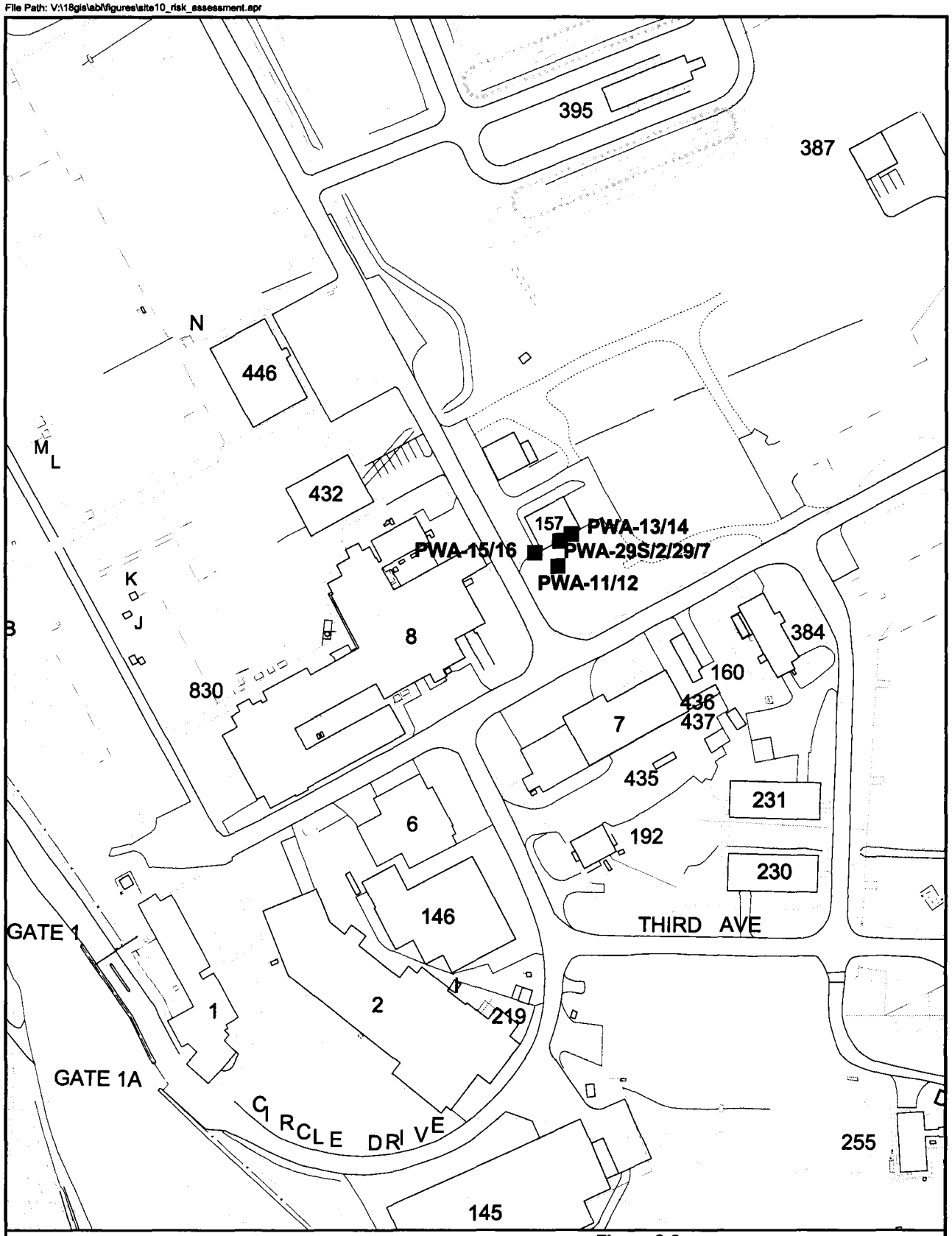


**LEGEND**

■ RI and Phase II RI Soil Sample Locations

N

0 75 150 225 Feet

**Figure 2-3**
RI and Phase II RI Soil Sample Locations
Collected Adjacent to Building 157
Risk Assessment Report for Site 10 Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia

**CH2MHILL**

SECTION 3

# Nature and Extent of Contamination

This section describes the nature and extent of Site 10 soil contamination. The constituents detected in the surface and subsurface soil samples collected at Site 10 and analyzed at an offsite analytical laboratory (see Section 2) are summarized in tables 3-1 and 3-2, respectively. Raw analytical results for these samples can be found in Appendix A.

The discussion below focuses on the organic constituents detected (due to the nature of historical activity at the site), the constituents of potential concern (COPCs) (i.e., aluminum, arsenic, iron, and manganese) identified during the human health risk assessment (HHRA), and the constituents of concern (COCs) (i.e., aluminum, arsenic, chromium, iron, manganese, vanadium and zinc) identified during the ecological risk assessment (ERA) (Sections 4 and 5, respectively). It is important to note that the human health COPCs and ecological COCs are utilized in this section for descriptive purposes and do not reflect the risk assessment conclusions. The human health risk assessment did not identify any COCs for Site 10 soil (see Section 4). Further, potential risks associated with the ecological COCs identified were determined to be negligible (see Section 5).

Figures 3-1 and 3-2 show the surface and subsurface soil samples, respectively, collected in the vicinity of the suspected contamination source at Site 10 (i.e., the former TCE still) and the VOC and COPC/COC concentrations detected at each location.

## 3.1 Surface Soil

No organic constituents were identified as surface soil COPCs or COCs in the risk assessments (see sections 4 and 5). In fact, only two VOCs (i.e., m- & p- xylene and TCE) were detected in the surface soil, and both were detected at estimated concentrations below the laboratory quantitation limits. TCE was detected in only two of the six samples for which it was analyzed, both at estimated concentrations (AS10-SB03 at 2.3 µg/kg and AS10-SB05 at 3.1 µg/kg). m- and p- Xylene were detected at estimated concentrations ranging from 1.9 to 5.7 µg/kg in five of the six surface soil samples.

Nineteen inorganic constituents (hereafter referred to as metals) were detected in one or more surface soil samples, as shown in Table 3-1. Four metals (i.e., aluminum, arsenic, iron, and manganese) were identified as COPCs for surface soil during the HHRA (see Section 4), based on comparison with adjusted residential risk-based concentrations (RBCs). Seven constituents (i.e., aluminum, arsenic, chromium, iron, manganese, vanadium and zinc) were identified as COCs during the ERA (see Section 5). All of these constituents were detected in all of the surface soil samples. Aluminum concentrations ranged from 5,900 mg/kg to 9,830 mg/kg. Arsenic concentrations ranged from 4.4 mg/kg to 7.8 mg/kg. Chromium concentrations ranged from 10.7 mg/kg to 14.7 mg/kg. Iron concentrations ranged from 19,100 mg/kg to 27,200 mg/kg. Manganese concentrations ranged from 751 mg/kg to 1,140 mg/kg. Vanadium concentrations ranged from 17.1 mg/kg to 24.5 mg/kg and zinc concentrations ranged from 52.5 mg/kg to 130 mg/kg.

## 3.2 Subsurface Soil

No organic constituents were identified as subsurface soil COPCs or COCs in the risk assessments (see sections 4 and 5). Three VOCs (i.e., m- & p- xylene, tetrachloroethene [PCE], and TCE) were detected in the subsurface soil (Table 3-2 and Figure 3-2). TCE was detected in all six subsurface soil samples at concentrations ranging from 1.7 to 34 µg/kg. PCE was detected in only one sample (i.e., HCS-PWA-13) at an estimated concentration of 4 µg/kg. m- and p- xylene were detected below the laboratory quantitation limit in four of the six subsurface soil samples.

Twenty-one metals were detected in one or more subsurface soil samples, as shown in Table 3-2. Four of these constituents (i.e., aluminum, arsenic, iron, and manganese) were identified as COPCs for combined surface and subsurface soil during the HHRA. All four of these constituents were detected in all seven subsurface soil samples. Although no ecological COCs were identified for the subsurface soil because there is no available exposure pathway, the concentrations of chromium, vanadium and zinc detected in Site 10 subsurface soil are provided on Figure 3-2 for reference purposes.

Aluminum was detected in subsurface soil at concentrations ranging from 6,890 mg/kg to 9,650 mg/kg; arsenic from 6.4 mg/kg to 13.2 mg/kg; iron from 28,300 mg/kg to 40,500 mg/kg; and manganese from 461 mg/kg to 1,990 mg/kg.

In general, the concentrations of TCE were higher in the subsurface soil samples than in corresponding surface soil samples. However, there was not a significant difference between metals concentrations detected in the surface soil versus the subsurface soil except at locations AS10-SB01 and AS01-SB05. At these locations, the concentrations of metals were higher in the subsurface soil than in the surface soil.

## 3.3 Background Soil Comparison

Comparisons of central tendency were performed to help determine if the concentrations of the soil COPCs and COCs at Site 10 are statistically different from facility background concentrations (CH2M HILL, August 21, 2003). A brief description of the statistical methodology used for the comparison is provided in Appendix B of this document. The results of the comparison for surface and subsurface soil are presented in tables 3-3 and 3-4, respectively. The comparison for combined surface and subsurface soil is presented in Table 3-5.

As shown in Table 3-3, the results of the statistical comparison indicate that there is no statistical difference between facility background concentrations and Site 10 surface soil data for three of the COPCs/COCs identified (i.e., arsenic, iron, and manganese). Aluminum was the only COPC identified during the HHRA detected in the surface soil statistically above background (see Section 4). Four COCs identified during the ERA (i.e., aluminum, chromium, vanadium and zinc) were also detected in the surface soil statistically above background (see Section 5).

The results of the statistical comparison for subsurface soil (Table 3-4) and for surface and subsurface soil data combined (Table 3-5) indicate that there is a statistically significant difference between facility background and the Site 10 subsurface soil concentrations for each of the four COPCs identified.

Table 3-1
Detects Data for Surface Soil
Site 10 - Former TCE Still at Building 157
Risk Assessment and Feasibility Study for Site 10 Soil
Allegany Ballsitics Laboratory, Rcoket Center, West Virginia

| Station ID | AS10-SB01 | AS10-SB02 | AS10-SB03 | | AS10-SB04 | AS10-SB05 | AS10-SB06 | PWA-29S/2/29/7 |
|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SS01-(0-0.5) | AS10-SS02-(0-0.5) | AS10-SS03-(0-0.5) | AS10-SS03P-(0-0.5) | AS10-SS04-(0-0.5) | AS10-SS05-(0-0.5) | AS10-SS06-(0-0.5) | HCS-PWA-29S |
| Sample Date | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 11/15/94 |
| **Chemical Name** | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | |
| Trichloroethene | 12 U | 13 U | 2.3 J | 13 U | 13 U | 3.1 J | 13 U | NA |
| m- and p-Xylene | 12 U | 1.9 J | 2.9 J | 5.7 J | 2.6 J | 3 J | 2.2 J | NA |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | |
| No Detections | NA | NA | NA | NA | NA | NA | NA | NA |
| **Explosives (UG/KG)** | | | | | | | | |
| No Detections | NA | NA | NA | NA | NA | NA | NA | NA |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | 6,500 | 8,430 | 9,830 | NA | 6,370 | 5,900 | 9,310 | 9,040 |
| Arsenic | 5.8 | 6.8 | 7.8 | NA | 5.1 | 4.4 | 6.9 | 6.5 J |
| Barium | 88.2 | 95.1 | 105 | NA | 90.6 | 94.3 | 131 | 120 |
| Beryllium | 0.89 J | 1 J | 1.1 J | NA | 0.98 J | 1 J | 1.3 | 1.20 |
| Calcium | 3,950 | 4,420 | 4,360 | NA | 3,900 | 4,050 | 7,140 | 5,380 |
| Chromium | 10.7 | 13.3 | 14.7 | NA | 10.9 | 10.8 | 14.7 | 13.4 |
| Cobalt | 10.4 J | 11.2 J | 11.8 J | NA | 10.5 J | 11.3 J | 12.8 J | 12.9 |
| Copper | 12.8 | 13.7 | 14.1 | NA | 12.9 | 13.4 | 16.8 | 18.1 |
| Iron | 19,100 | 21,900 | 25,300 | NA | 19,700 | 19,600 | 26,800 | 27,200 |
| Lead | 19.5 | 23.4 | 20.3 | NA | 19.6 | 17.7 | 21.6 | 22 |
| Magnesium | 1,120 J | 1,660 | 1,510 | NA | 1,180 J | 1,150 J | 1,820 | 1,560 |
| Manganese | 751 | 865 | 898 | NA | 854 | 752 | 1,140 | 1,070 |
| Mercury | 0.08 | 0.13 | 0.06 U | NA | 0.11 J | 0.12 J | 0.13 | 0.0600 U |
| Nickel | 12.8 | 16.1 | 16.9 | NA | 13.3 | 14.7 | 18.7 | 16.4 |
| Potassium | 1,220 | 1,390 | 1,780 | NA | 1,050 J | 952 J | 1,440 | 1,090 B |
| Selenium | 0.4 U | 1 J | 0.42 U | NA | 0.43 U | 0.42 U | 0.44 U | 0.860 B |
| Sodium | 93.9 U | 100 U | 99.1 U | NA | 137 J | 99.5 U | 117 J | 25.6 U |
| Vanadium | 19.4 | 21.4 | 24.4 | NA | 18.8 | 17.1 | 24.5 | 23.9 |
| Zinc | 98.8 | 130 | 65.7 | NA | 68.7 | 52.5 | 78 | 62.2 J |
| **Wet Chemistry (MG/KG)** | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | 28,000 |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
U - Analyte not detected

Table 3-2
Detects Data for Subsurface Soil
Site 10 - Former TCE Still at Building 157
Risk Assessment and Feasibility Study for Site 10 Soil
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | AS10-SB02 | AS10-SB03 | AS10-SB04 | AS10-SB05 | AS10-SB06 | PWA-13/14 | PWA-29S/2/29/7 |
|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SB01-(2-4) | AS10-SB02-(2-4) | AS10-SB03-(2-4) | AS10-SB04-(2-4) | AS10-SB05-(2-4) | AS10-SB06-(2-4) | HCS-PWA-13 | HCS-PWA-29 |
| Sample Date | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 07/21/92 | 11/15/94 |
| **Chemical Name** | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | |
| Tetrachloroethene | 13 U | 12 U | 13 U | 13 U | 13 U | 13 U | 4 J | NA |
| Trichloroethene | 3.2 J | 1.7 J | 6.6 J | 4.1 J | 26 | 18 | 34 | NA |
| m- and p-Xylene | 3.1 J | 12 U | 2.3 J | 13 U | 3.1 J | 2.4 J | NA | NA |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | |
| No Detections | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | |
| No Detections | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | 8,450 | 8,970 | 9,040 | 6,890 | 9,650 | 8,800 | NA | 8,540 |
| Arsenic | 10 | 6.4 | 7.6 | 8.7 | 12.3 | 13.2 | NA | 13.1 J |
| Barium | 128 | 112 | 137 | 174 | 193 | 132 | NA | 159 |
| Beryllium | 1.4 | 1.3 | 1.3 | 1.3 | 1.5 | 1.5 | NA | 1.30 |
| Cadmium | 0.05 U | 0.05 U | 0.05 U | 0.05 U | 0.05 U | 0.05 U | NA | 2.30 J |
| Calcium | 3,440 | 2,950 | 3,660 | 3,760 | 4,380 | 3,920 | NA | 2,990 |
| Chromium | 15.9 | 15.6 | 16.4 | 13.2 | 17.1 | 16.4 | NA | 12.3 |
| Cobalt | 12.7 | 13.2 | 15.5 | 22.8 | 20 | 13.7 | NA | 15.3 |
| Copper | 19.5 | 21.5 | 18.8 | 20.3 | 20.3 | 20.6 | NA | 22.3 |
| Iron | 36,100 | 28,300 | 34,600 | 30,400 | 38,500 | 40,500 | NA | 41,300 |
| Lead | 19.7 | 19.5 | 18.5 | 19.6 | 19.6 | 20.4 | NA | 18.8 |
| Magnesium | 1,320 | 1,270 | 1,670 | 1,420 | 1,590 | 1,500 | NA | 1,610 |
| Manganese | 461 | 638 | 981 | 1,910 | 1,990 | 669 | NA | 1,200 |
| Mercury | 1.2 | 0.06 U | 0.24 | 0.09 J | 0.13 | 0.13 | NA | 0.100 B |
| Nickel | 17.5 | 22.8 | 24.2 | 27.3 | 29.3 | 22.4 | NA | 26.3 |
| Potassium | 869 J | 1,010 J | 1,010 J | 640 J | 871 J | 846 J | NA | 908 B |
| Selenium | 0.42 U | 0.4 U | 0.43 U | 0.42 U | 0.43 U | 0.64 J | NA | 0.440 U |
| Silver | 0.45 B | 0.45 B | 0.52 B | 0.6 B | 1.3 B | 0.68 B | NA | 2.10 J |
| Sodium | 132 J | 116 J | 119 J | 151 J | 100 U | 149 J | NA | 46.6 U |
| Vanadium | 25.2 | 24.2 | 23.7 | 20.9 | 26.2 | 27.5 | NA | 26.3 |
| Zinc | 127 | 192 | 77.6 | 91.2 | 76.4 | 88.2 | NA | 87 J |
| **Wet Chemistry (MG/KG)** | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | 6,550 |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate

Table 3-3
Summary of Background Comparison Results for Surface Soil
Site 10 - Former TCE Still at Building 157
Risk Assessment and Feasibility Study for Site 10 Soil
Allegany Ballistics Laboratory,
Rocket Center, West Virginia

| Matrix | Parameter | Assumed Distribution for Comparison | Probability that the Observed Differences Would Occur Purely by Chance | Is there a significant difference between these two groups? | Bkgd Detection Frequency | Site 10 Detection Frequency |
|---|---|---|---|---|---|---|
| SS | Aluminum | Nonparametric | 0.001 | Yes | 30/30 | 7/7 |
| SS | Arsenic | Nonparametric | 0.155 | No | 30/30 | 7/7 |
| SS | Barium | Nonparametric | 0.018 | Yes | 30/30 | 7/7 |
| SS | Beryllium | Nonparametric | 0.002 | Yes | 23/30 | 7/7 |
| SS | Calcium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SS | Chromium | Nonparametric | 0.003 | Yes | 30/30 | 7/7 |
| SS | Cobalt | Nonparametric | 0.126 | No | 30/30 | 7/7 |
| SS | Copper | Nonparametric | 0.343 | No | 30/30 | 7/7 |
| SS | Iron | Nonparametric | 0.210 | No | 30/30 | 7/7 |
| SS | Lead | Nonparametric | 0.040 | Yes | 30/30 | 7/7 |
| SS | Magnesium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SS | Manganese | Nonparametric | 0.054 | No | 30/30 | 7/7 |
| SS | Mercury | Nonparametric | 0.007 | Yes | 11/30 | 5/7 |
| SS | Nickel | Nonparametric | 0.023 | Yes | 30/30 | 7/7 |
| SS | Potassium | Nonparametric | 0.004 | Yes | 30/30 | 6/7 |
| SS | Selenium | Nonparametric | 0.915 | No | 21/30 | 1/7 |
| SS | Sodium | Nonparametric | 0.000 | Yes | 0/28 | 2/7 |
| SS | Vanadium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SS | Zinc | Nonparametric | 0.027 | Yes | 21/30 | 7/7 |

Table 3-4
Summary of Background Comparison Results for Subsurface Soil
Site 10 - Former TCE Still at Building 157
Risk Assessment and Feasibility Study for Site 10 Soil
Allegany Ballistics Laboratory,
Rocket Center, West Virginia

| Matrix | Parameter | Assumed Distribution for Comparison | Probability that the Observed Differences Would Occur Purely by Chance | Is there a significant difference between these two groups? | Bkgd Detection Frequency | Site 10 Detection Frequency |
|---|---|---|---|---|---|---|
| SB | Aluminum | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Arsenic | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Barium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Beryllium | Nonparametric | 0.000 | Yes | 14/30 | 7/7 |
| SB | Cadmium | Nonparametric | 0.983 | No | 27/30 | 1/7 |
| SB | Calcium | Nonparametric | 0.000 | Yes | 29/29 | 7/7 |
| SB | Chromium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Cobalt | Nonparametric | 0.002 | Yes | 30/30 | 7/7 |
| SB | Copper | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Iron | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Lead | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Magnesium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Manganese | Nonparametric | 0.009 | Yes | 30/30 | 7/7 |
| SB | Mercury | Nonparametric | 0.000 | Yes | 6/30 | 5/7 |
| SB | Nickel | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Potassium | Nonparametric | 0.147 | No | 30/30 | 6/7 |
| SB | Selenium | Nonparametric | 0.997 | No | 26/30 | 1/7 |
| SB | Silver | Nonparametric | 0.000 | Yes | 0/30 | 1/7 |
| SB | Sodium | Nonparametric | 0.000 | Yes | 0/30 | 5/7 |
| SB | Vanadium | Nonparametric | 0.000 | Yes | 30/30 | 7/7 |
| SB | Zinc | Nonparametric | 0.000 | Yes | 19/30 | 7/7 |

Table 3-5
Summary of Background Comparison Results for Surface and Subsurface Soil
Site 10 - Former TCE Still at Building 157
Risk Assessment and Feasibility Study for Site 10 Soil
Allegany Ballistics Laboratory,
Rocket Center, West Virginia

| Matrix | Parameter | Assumed Distribution for Comparison | Probability that the Observed Differences Would Occur Purely by Chance | Is there a significant difference between these two groups? * | Bkgd Detection Frequency | Site 10 Detection Frequency |
|---|---|---|---|---|---|---|
| SO | Aluminum | Nonparametric | 0.000 | Yes | 60/60 | 14/14 |
| SO | Arsenic | Nonparametric | 0.000 | Yes | 60/60 | 14/14 |
| SO | Chromium | Nonparametric | 0.000 | Yes | 60/60 | 14/14 |
| SO | Cobalt | Nonparametric | 0.007 | Yes | 60/60 | 14/14 |
| SO | Copper | Nonparametric | 0.002 | Yes | 60/60 | 14/14 |
| SO | Magnesium | Nonparametric | 0.000 | Yes | 60/60 | 14/14 |
| SO | Mercury | Nonparametric | 0.000 | Yes | 17/60 | 10/14 |
| SO | Potassium | Normal | 0.020 | Yes | 60/60 | 12/14 |
| SO | Selenium | Nonparametric | 0.998 | No | 47/60 | 2/14 |
| SO | Silver | Nonparametric | 0.000 | Yes | 0/60 | 1/7 |
| SO | Sodium | Nonparametric | 0.000 | Yes | 0/58 | 7/14 |
| SO | Vanadium | Normal | 0.000 | Yes | 60/60 | 14/14 |

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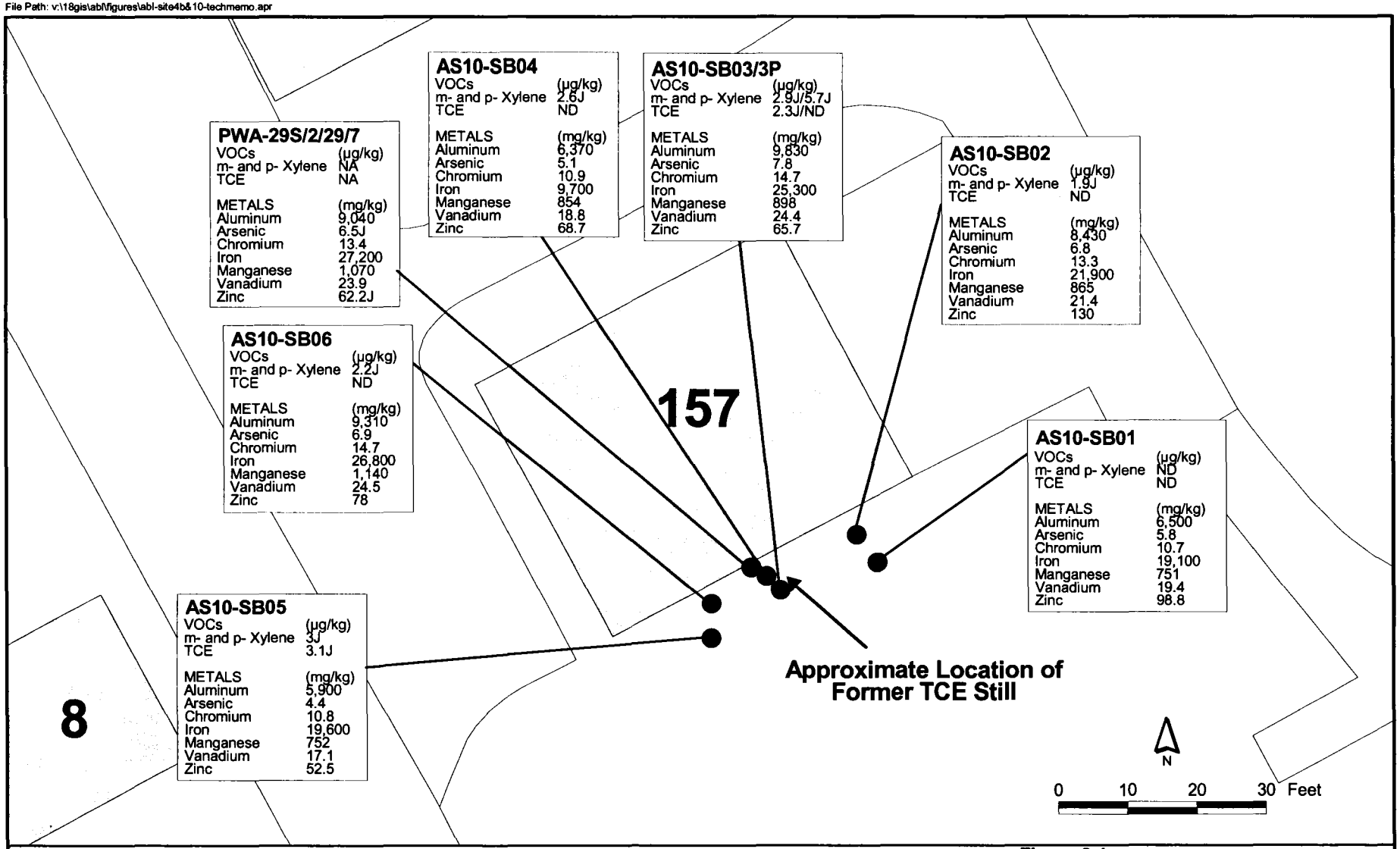


**LEGEND**

- ● Surface Soil Samples at Site 10
- ▭ Building
- ⟋ Edge of Pavement

Qualifiers:
J - Estimated
NA - Not Analyzed
ND - Not Detected
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

**Figure 3-1**
Organic Constituents and COPCs detected in Surface Soil Site 10
Risk Assessment Report for Site 10 Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia

CH2MHILL

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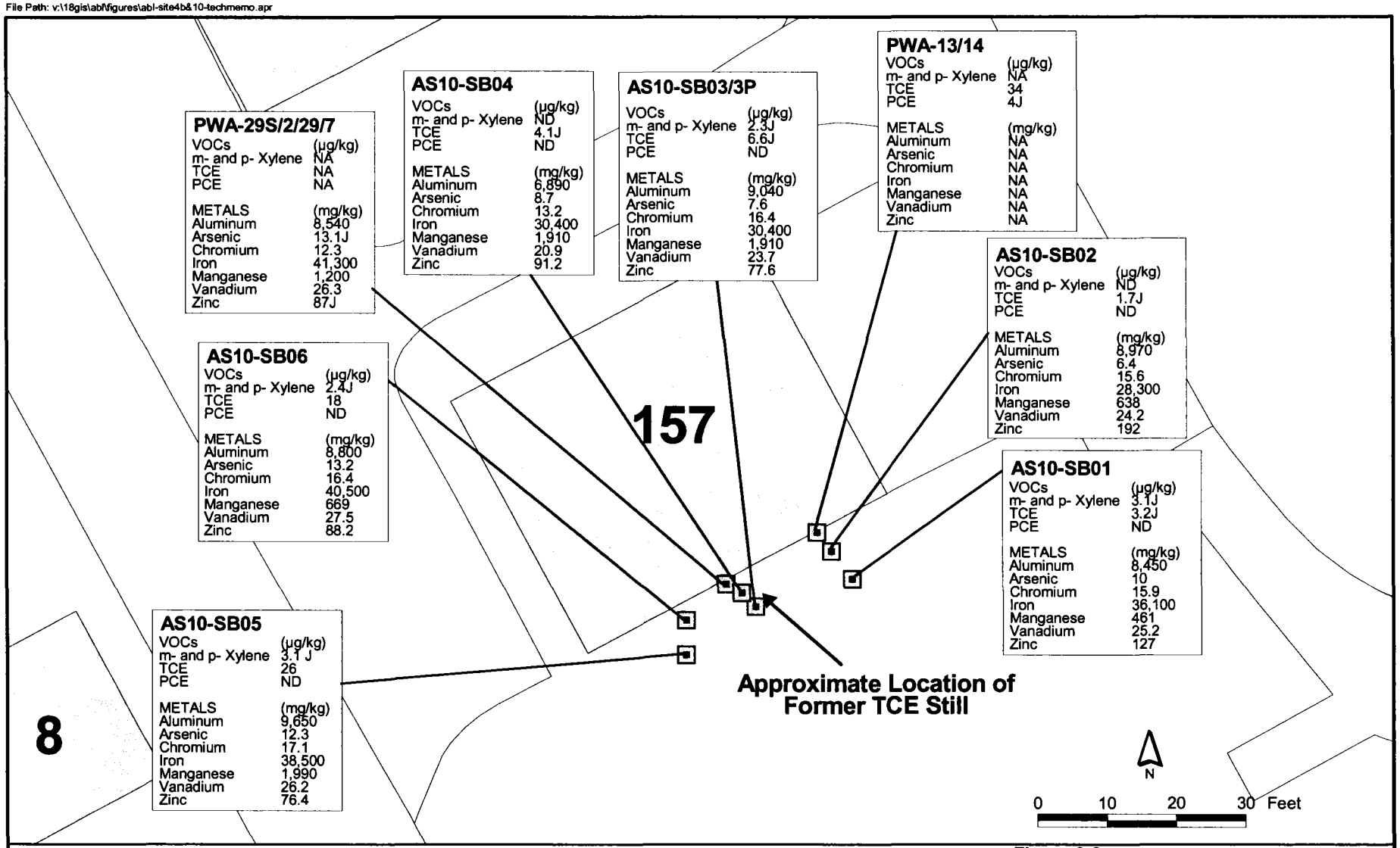


**LEGEND**

- Subsurface Soil Samples at Site 10
- Building
- Edge of Pavement

Qualifiers:
J - Estimated
NA - Not Anlayzed
ND - Not Detected
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

**Figure 3-2**
Organic Constituents and COPCs Detected in Subsurface Soil Site 10
Risk Assessment Report for Site 10 Soil
Allegany Ballistics Laboratory
Rocket Center, West Virginia

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SECTION 4

# Human Health Risk Assessment

## 4.1 Introduction

This baseline risk assessment was conducted to assess the potential human health impacts from exposure to surface soil and subsurface soil at Site 10, as well as to determine if any further actions are needed to be sufficiently protective of human health. This risk assessment has been prepared utilizing conservative assumptions, and considering the feasible exposure pathways based on current site conditions and potential future site use. The risk assessment incorporates the general methodology described in the *Revised Proposed Methods for Preparing the Human Health Risk Assessment – Sites 2, 3, and 10 (soil), Allegany Ballistics Laboratory* (CH2M HILL, October 2001) and the *Interim Deliverable 2, Human Health Risk Assessment, Allegany Ballistics Laboratory Sites 2, 3 and 10* (CH2M HILL, April 2002) and in the *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A* (USEPA, December 1989), *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part D* (USEPA, December 1997), and USEPA Region 3 Technical Guidance Manuals for Risk Assessment.

### 4.1.1 Site Overview

A brief description of the site can be found in Section 2 of this document and in various documents cited in Section 2.

### 4.1.2 Scope of Risk Assessment

The human health risk assessment for Site 10 soil comprises the following components:

- **Identification of COPCs** - Identifies and characterizes the distribution of COPCs found on the site. COPCs identified in this screening are the focus of the subsequent evaluation in the risk assessment.
- **Exposure Assessment** - Identifies potential pathways by which exposure could occur; characterizes the potentially exposed populations (e.g., industrial workers, construction workers, residents); and estimates the magnitude, frequency, and duration of potential exposures.
- **Toxicity Assessment** - Identifies the types of adverse health effects associated with exposure to COPCs, lists available toxicity factors (e.g., cancer slope factors and reference dose values), and summarizes the relationship between magnitude of exposure and potential occurrence of adverse health effects. It also identifies related uncertainties (such as the weight-of-evidence for carcinogenicity of a particular constituent in humans) associated with these values.
- **Risk Characterization** - Integrates the results of the exposure assessment and toxicity assessment to estimate the potential risks to human health. Both cancer and noncancer

human health effects are evaluated. Pathways that pose an unacceptable risk based on quantitative risk characterization are identified.

- **Uncertainty Assessment** - Identifies sources of uncertainty associated with the data, methodology, and the values used in the risk assessment estimation.

These components are described briefly in the following sections. Spreadsheets prepared in accordance with USEPA RAGS Part D were used to screen for COPCs, and to calculate estimated exposures and health risks associated with the COPCs. These spreadsheets are presented in Appendix C, Tables 1 through 10.2.CT.

## 4.2 Identification of Constituents of Potential Concern

The identification of COPCs includes data collection, data evaluation, and data screening steps. The data collection and evaluation steps involve gathering and reviewing the available site data and identifying a set of data that is of acceptable quality for the risk assessment. This data set is then further screened against concentrations that are protective of human health to reduce the data set to those constituents and media of potential concern. The data used for the quantitative risk analysis were all validated and met Data Quality Objectives (DQOs) prior to use in the risk assessment.

Sections 4.2.1 and 4.2.2 discuss the selection of samples used for the quantitative risk assessment. Section 4.2.3 discusses the methodology used to further reduce the risk assessment data set to the constituents and media which are of primary concern to human health. Section. 4.2.4 identifies the COPCs that were quantitatively assessed in the risk assessment.

### 4.2.1 Data Evaluation and Selection

Several remedial investigation and remedial action activities within the CERCLA and IRP processes have been conducted at Site 10, as described in Section 2. A subset of the historic surface and subsurface soil data, primarily those samples collected in the immediately area of the former Building 157 TCE still, were evaluated quantitatively in the risk assessment. In addition, it should be noted that none of the soil samples analyzed by an onsite analytical laboratory were utilized in the risk assessment as they did not meet data quality objectives. Table 4-1 summarizes the samples that were used to estimate potential exposures and risks in each medium.

Data selected for evaluation in the human health risk assessment were reviewed to determine their reliability for the quantitative risk assessment. A review of the data and discussions with USEPA and the Navy identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as unqualified detected concentrations and were included in the calculation of summary statistics without modification.
- Data qualified with an R (rejected) were not used in the risk assessment.
- Data qualified with a B (blank contamination) were used in the risk assessment as if they were non-detects, with the blank-related concentrations of each constituent used as the

sample quantitation limit (SQL). One-half of the blank-related concentrations were used to calculate exposure point concentrations in the risk assessment if the constituent was detected in other samples within the data grouping.

- One-half of the SQL or sample detection limit (DL) was used in the risk assessment for cases where no detectable constituent quantities were found in that sample, but the constituent was detected in other samples from a medium.
- For duplicate samples, the maximum concentration of the primary and duplicate samples was used as the sample concentration. In calculating the frequency of detection and the 95 percent upper confidence limit (UCL), the duplicates were counted as a single sample.

## 4.2.2 Data Summary

All of the data used in the risk assessment have been fully validated and are assumed to represent current conditions. For each medium (surface soil and subsurface soil), constituent-specific summary statistics are presented in Appendix C for the data sets used for the risk calculations. These summary statistics include frequency of detection, minimum and maximum detected values, normal and lognormal arithmetic mean, normal and lognormal standard deviation, results of W-test, and 95 percent UCL for normal and lognormal distribution. Methods for calculating exposure point concentrations, including the 95 percent UCL values, are discussed in Section 4.3.3.1.

### 4.2.2.1 Surface and Subsurface Soil

One surface soil sample collected in 1995 along with six surface soil samples from 2000 were evaluated in the risk assessment. One subsurface soil sample collected in 1992, one collected in 1994, and six collected in 2000 were also evaluated in the risk assessment. Table 4-1 summarizes each sample and the corresponding analyses. A statistical summary of constituents detected in the soil samples is presented in Appendix C.

## 4.2.3 Selection of COPCs

All of the detected constituents were screened in accordance with USEPA Region 3 guidelines (USEPA, January 1993), using the steps described below. The COPC selection process was conservative to ensure selection of the constituents comprising the majority of the potential risk associated with the site. The maximum detected concentration of each constituent in each medium was compared to a screening value (typically a risk-based concentration) to select the COPCs. If the maximum concentration of a constituent exceeded the screening value, the constituent was selected as a COPC and retained for the risk evaluation.

- **Comparison with Health-based Criteria for Surface Soil and Soil (combined surface and subsurface soil):** The maximum detected constituent concentrations in surface soil and combined surface and subsurface soil were compared with USEPA Region 3 residential soil RBCs (USEPA, April 2003). Residential soil RBCs that are based on noncarcinogenic effects were divided by ten to account for exposure to multiple constituents. RBCs based on carcinogenic effects were used as presented in the RBC Table. Constituents with maximum detected concentrations below the RBCs were not

retained as COPCs. Lead concentrations in soil were compared to the USEPA residential child soil screening value of 400 mg/kg (OSWER Directive 9355.4-12, issued on July 14).

- **Comparison with Soil Screening Levels based on Soil to Air Transport for Surface Soil and Soil (combined surface and subsurface soil):** Volatile and particulate carcinogen and noncarcinogen SSLs were calculated to screen the individual constituents detected in soil for inhalation of volatiles and inhalation of fugitive dusts from soil using the methodology presented in EPA's *Soil Screening Guidance* (USEPA, April 1996). The maximum detected soil concentrations were compared to the calculated volatile and particulate carcinogen and noncarcinogen SSLs and also to the EPA Region 3 residential soil ingestion RBCs, as discussed in the first bullet item. Noncarcinogenic SSLs were based on a hazard index of 0.1 and carcinogenic SSLs were based on a carcinogenic risk of $10^{-6}$. Any constituent whose maximum detected concentration was below the lowest screening value (SSL based on particulate emissions, SSL based on volatile emissions, or residential soil RBC) was not retained as a COPC for the soil to air pathway.
- **Comparison with Soil Screening Levels based on Soil to Groundwater Transport for Soil (combined surface and subsurface soil):** The maximum detected soil concentrations (combined surface and subsurface soil) were compared to the current USEPA Region 3 Soil Screening Levels (SSLs), based on a Dilution and Attenuation Factor (DAF) of 20, to determine if soil is a potential concern based on the transport of constituents from soil to groundwater (USEPA, September 2001). SSLs that are based on noncarcinogenic effects were divided by 10 to account for exposure to multiple constituents. Any constituent whose maximum detected concentration was greater than the SSL is identified as a COPC for the transport from soil to groundwater pathway, but not for the direct contact with soil pathway. Exposure to COPCs selected for this pathway was not quantified in the risk assessment. Human health risks associated with groundwater are addressed in the Site 10 groundwater ROD.
- **Comparison with Recommended Dietary Allowances (RDAs):** Constituents which are human nutrients, present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and toxic only at very high doses were eliminated from the quantitative risk analysis. These constituents are calcium, magnesium, potassium, and sodium.

### 4.2.4 Constituents of Potential Concern

Table 4-2 identifies the constituents that were selected as COPCs based on the above screening methodology for surface soil and subsurface soil. The COPC screening for each media is presented in Tables 2.1 through 2.11 in Appendix C. As shown in Table 4-2, all of the COPCs retained for Site 10 media are metals.

## 4.3 Exposure Assessment

Exposure refers to the potential contact of an individual with a COPC. The exposure assessment identifies pathways and routes by which an individual may be exposed to the COPCs and estimates the magnitude, frequency, and duration of potential exposure. The magnitude of exposure is determined by estimating the amount of a constituent available at

the exchange boundaries (i.e., the lungs, gastrointestinal tract, and skin). Constituent intakes and associated health risks are only quantified for complete exposure pathways.

A conceptual exposure model showing potential exposure scenarios identified under current and potential future conditions is presented in Figure 4-1. The following subsections discuss the three components of exposure assessment:

- Characterization of exposure setting
- Identification of exposure pathways
- Quantification of exposure

## 4.3.1 Characterization of Exposure Setting

Characterizing an exposure setting consists of two parts: (1) presenting the physical characteristics of the site as they relate to exposure, and (2) characterizing human populations on or near the site.

### 4.3.1.1 Physical Characteristics

Basic site characteristics are discussed in Section 2 and the documents referenced therein.

### 4.3.1.2 Potentially Exposed Populations

Potentially exposed populations are identified based on their locations relative to the site, their activity patterns, and the presence of potential sensitive subpopulations. Table 4-3 summarizes the potentially exposed populations evaluated in this risk assessment.

**Current Land Use.** Site 10 lies within Plant 1, an industrial section of ABL. The current and planned use of this area is industrial. Therefore, based on current land use, an industrial worker may be exposed to surface soil. Additionally, adolescent trespassers/visitors may potentially be exposed to surface soil. These receptors may be exposed to the surface soil through incidental ingestion, dermal contact, and inhalation of fugitive emissions from the soil. There were no COPCs retained for volatile emissions from subsurface soil; therefore, this is not a complete exposure pathway for current industrial workers or trespassers/visitors.

**Potential Future Uses.** Site 10 is anticipated to remain an industrial area in the future. Therefore, the current exposure pathways are also applicable for potential future site uses. Additionally, it is assumed that if any construction activities occur at Site 10, a future construction worker could be exposed to the combined surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions from soil.

Although unlikely, future residential exposure to soil (combined surface and subsurface soil) is evaluated in the Site 10 risk assessment as a worst case scenario. It assumes that the subsurface soil may be placed on the surface if the site is converted for residential use or during future construction/excavation activities. The residents could be exposed to the combined surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of particulate emissions from soil.

### 4.3.2 Identification of Exposure Pathways

An exposure pathway can be described as a mechanism that moves a COPC from its source to an exposed population or individual, referred to as a receptor. An exposure pathway must be complete or exposure cannot occur. A complete exposure pathway has five elements:

- A source (e.g., chemical residues in soil)
- A mechanism for release and migration of constituents (e.g., leaching)
- An environmental transport medium (e.g., soil, groundwater)
- An exposure point, which is a point or site of potential human contact (e.g., contact with soil, drinking water)
- A route of intake (e.g., incidental ingestion of soil, ingestion of groundwater used as a drinking water source)

All five elements must be present for a pathway to be considered complete. If one or more elements are not present, then the pathway is incomplete and there is no possibility of exposure. The following subsections discuss the elements as they pertain to Site 10.

#### 4.3.2.1 Contaminant Sources

The contaminant source at Site 10 is the former TCE still that was located adjacent to Building 157.

#### 4.3.2.2 Release and Transport Mechanisms

The primary transport mechanisms of constituents in soil are leaching to groundwater and fugitive emissions and transport by wind. There are no topographic or surface drainage features at the site where runoff would create a problem. Leaching to groundwater, and the risks associated with exposure to groundwater are not evaluated in this risk assessment because they have already been addressed in the Site 10 groundwater ROD.

#### 4.3.2.3 Potential Exposure Points and Exposure Routes

Exposure points are locations where humans could come in contact with contamination. On-site exposure points comprise surface soil and subsurface soil.

Potential exposure routes are evaluated for current and potential future site use. Existing and potential future exposure pathways are illustrated in the conceptual exposure model (Figure 4-1). Exposure scenarios and potentially complete pathways of exposure evaluated in this risk assessment are presented in Table 4-3.

**Current Exposure Routes.** The only contaminated medium currently accessible at the site is surface soil, because no construction is occurring at Site 10. Based on current site use, potential receptors at Site 10 are industrial workers and adolescent trespasser/visitors.

In summary, the current land use exposure routes comprise:

- Industrial Worker (adult): incidental ingestion of and dermal contact with surface soil along with incidental inhalation of dust particles from surface soil.

- Trespasser/Visitor (adolescent): incidental ingestion of and dermal contact with surface soil along with incidental inhalation of dust particles from surface soil.

**Future Exposure Routes.** Based on potential future site use, potential receptors at the Site 10 comprise the current receptors, identified as industrial workers and adolescent trespasser/visitors, adult and child residents, and construction workers.

In summary, the future land use exposure routes include the current routes and the following:

- Adolescent Trespasser/Visitor: inhalation of airborne particulates from combined soil, and incidental ingestion and dermal contact with combined soil.
- Residents (adult): inhalation of airborne particulates from combined soil, incidental ingestion of combined soil, and dermal contact with combined soil.
- Residents (child): inhalation of airborne particulates from combined soil, incidental ingestion of combined soil, and dermal contact with combined soil.
- Construction Worker: inhalation of airborne particulates from combined soil, and incidental ingestion and dermal contact with combined soil.

The exposure pathways listed above were selected in consultation with USEPA Region 3 and the Navy. All of these pathways were quantified for potential exposure.

## 4.3.3 Quantification of Exposure

Exposure is quantified by estimating the exposure point concentrations (EPCs) and constituent intakes by the receptors for both the reasonable maximum exposure (RME) and central tendency (CT) scenarios.

### 4.3.3.1 Exposure Point Concentrations

EPCs are estimated constituent concentrations that a receptor may contact and are specific to each exposure medium. EPCs may be directly monitored or estimated using environmental fate and transport models. For this assessment, no fate and transport modeling was needed to estimate EPCs.

The EPC for the RME scenario and the CT scenario is based on the 95 percent upper confidence limit of the mean (95 percent UCL) for a medium in which five or more samples were collected. The maximum detected concentration was used in place of the 95 percent UCL when the calculated 95 percent UCL was greater than the maximum detected value. The Shapiro-Wilks W-test using an alpha value of one percent was used to determine if the data fit a lognormal or normal distribution. If the W-test was inconclusive, the 95 percent UCL that best fit the data as indicated by the higher W-test value was used.

The 95 percent UCL for a lognormal distribution was calculated as follows:

$$95\%\ UCL = \exp(TM + 0.5 \times s^2 + (s \times H/(n-1)^{0.5}))$$

Where:

exp = natural log
TM = transformed mean

s= standard deviation of the transformed data
H= H-statistic
n= sample size

The 95 percent UCL for a normal distribution was calculated as follows:

$$95\% \text{ UCL} = NM+(t \times s/(n)^{0.5})$$

Where:
NM= normal arithmetic mean
t= t-statistic
s= standard deviation
n= sample size

The 95 percent UCL concentrations are included in Appendix C, Tables 3.1 through 3.11.

#### 4.3.3.2 Estimation of Constituent Intakes for Individual Pathways

Constituent intake is the amount of the constituent entering the receptor's body. Constituent intakes are generally expressed as follows:

$$I = \frac{C \times CR \times EF \times ED}{BW \times AT} = (mg/kg/day)$$

Where:

I = intake (mg/kg-day)

C = constituent concentration at exposure point (mg/L, mg/kg, mg/m$^3$)

CR= contact rate, or amount of contaminated medium contacted per unit time or event (L/day, mg/event, m$^3$/day)

EF= exposure frequency (days/year)

ED= exposure duration (years)

BW= body weight of exposed individual (kg)

AT= averaging time, or period over which exposure is averaged (days)

The intake equation requires specific exposure parameters for each exposure pathway. Exposure parameters are often assumed values, and their magnitude influences the estimates of potential exposure (and risk). The reliability of the values chosen can also contribute substantially to the uncertainty of the resulting risk estimates. Many of the exposure parameters have default values, which were used for this assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and duration are provided by USEPA guidance. Other assumptions (e.g., exposure duration for the construction worker) required consideration of location-specific information and were determined using professional judgment. Appendix C, Tables 4.1 through 4.21 present the exposure factors used for different scenarios at the site. Both RME and CT intakes were included in this evaluation. CT intakes were calculated for exposure scenarios with RME cumulative cancer risks greater than $1 \times 10^{-4}$ or cumulative noncancer hazards greater than 1.

For residential exposure to groundwater, lifetime age-adjusted intakes were calculated for carcinogenic constituents. This involved determining age-adjusted factors for each exposure pathway.

## 4.4 Toxicity Assessment

Toxicity assessment defines the relationship between the magnitude of exposure and possible severity of adverse effects, and weighs the quality of available toxicological evidence. Toxicity assessment generally consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining the potential adverse effects from exposure to the constituent along with the type of health effect involved. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the constituent administered or received and the incidence of adverse health effects in the exposed population. Toxicity criteria (e.g., reference doses and slope factors) are derived from the dose-response relationship. USEPA has performed the toxicity assessment step for many constituents and has published the results in the Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST) databases.

Health effects are divided into two broad groups: noncarcinogenic and carcinogenic effects. This division is based on the different mechanisms of action currently associated with each category. Constituents causing noncarcinogenic health effects are evaluated independently from those having carcinogenic effects. Some constituents may produce both noncarcinogenic and carcinogenic effects, and are therefore evaluated in both groups. This section discusses noncarcinogenic and carcinogenic effects separately, and concludes with a brief discussion of the toxicological properties of selected COPCs.

The primary source of toxicity values is the USEPA's IRIS database, which contains up-to-date health risk and USEPA regulatory information. IRIS includes only reference doses (RfDs) and slope factors (SFs) that have been verified by USEPA work-groups. The IRIS database is the USEPA's preferred source of toxicity information. The HEAST tables, which are issued by USEPA's Office of Solid Waste and Emergency Response, were consulted when data were not available in IRIS. If data were not available from either of these sources, toxicity values provided in USEPA's *Risk-Based Concentration Table* (USEPA, April 2003) were used.

### 4.4.1 Toxicity Information for Noncarcinogenic Effects

Noncarcinogenic health effects include a variety of toxic effects on body systems, such as renal toxicity (toxicity to the kidneys) to central nervous system disorders. Noncarcinogenic health effects can be grouped into two basic categories: acute toxicity and chronic toxicity. Acute toxicity can occur after a single exposure (usually at high doses), and the effect is most often seen immediately. Chronic toxicity generally occurs after repeated exposure (usually at low doses) and is seen months or years after the initial exposure. The toxicity of a constituent is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations of exposed human populations, typically in the workplace.

USEPA (USEPA, December 1989) defines the chronic RfD as a dose which is likely to be without appreciable risk of deleterious effects during a lifetime of exposure. Chronic RfDs are specifically developed to be protective for long-term exposure to a constituent (for example, 7 years to a lifetime), and consider uncertainty in the toxicological data base and sensitive receptors. Chronic RfDs may be overly protective if used to evaluate the potential for adverse health effects resulting from short-term exposure. USEPA's National Center for Environmental Assessment (NCEA) develops subchronic RfDs for short-term exposure (2 weeks to 7 years). Chronic and subchronic RfDs are developed for both the inhalation and oral exposures. Subchronic RfDs were used for the construction worker scenario because the exposure duration is 1 year.

In the development of RfDs, all available studies examining the toxicity of a constituent following exposure are considered based on their scientific merit. The lowest dose level at which an observed toxic effect is observed is identified as the "lowest-observed-adverse-effect-level" (LOAEL) and the dose at which no effect is observed is identified as the "no-observed-adverse-effect-level" (NOAEL). Several uncertainty factors (UFs) may be applied to account for uncertainty. UFs account for uncertain data quality, extrapolation of data from animal studies to human exposures, or the use of subchronic studies to develop chronic criteria. These UFs range between 10 and 10,000, and reflect the varying degrees of uncertainty in the toxicity criteria.

USEPA-derived oral and inhalation chronic RfDs, and associated UF and modifying factor (MF) values, available for the COPCs at Site 10 are listed in Tables 5.1 and 5.2 in Appendix C.

Per USEPA guidance, oral RfD values were adjusted from administered dose to absorbed dose for evaluating dermal toxicity. The RfD was adjusted using oral absorption factors from USEPA (USEPA, September 2001). If oral absorption factors were not available from USEPA (September 2001), values from USEPA Region 3 (USEPA, April 1999) were used. The adjusted dermal RfDs are summarized in Table 5.1 in Appendix C.

### 4.4.2 Toxicity Information for Carcinogenic Effects

Potential carcinogenic effects are quantified as oral cancer slope factors, inhalation slope factors, or unit risk factors that convert estimated exposures directly to incremental lifetime cancer risks. Cancer slope factors (CSFs) are expressed in units of risk per milligram per kilogram of body weight per day $(mg/kg\text{-}day)^{-1}$, and unit risk factors are expressed in units of risk per micrograms per cubic meter $(\mu g/m^3)^{-1}$.

CSFs may be derived from the results of chronic animal bioassays, human epidemiological studies, or both. Animal bioassays are usually conducted at dose levels that are much higher than are likely to be encountered in the environment. This design detects possible adverse effects in the relatively small test populations used in the studies. A number of mathematical models and procedures have been developed to extrapolate from the high doses used in the studies to the low doses typically associated with environmental exposures.

The USEPA-preferred linearized multistage (LMS) model is usually used to estimate the largest linear slope (within the upper 95 percent UCL) at low extrapolated doses that is consistent with the data. The 95 percent UCL slope of the dose-response curve is subjected to various adjustments, and an inter-species scaling factor is usually applied to derive a CSF

or inhalation unit risk factor for humans. It is assumed that if a cancer response occurs at the dose level in the study, there is some probability that a response will occur at all lower exposure levels (i.e., a dose-response relationship with no threshold is assumed). Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an *ad hoc* basis. In both types of analyses, conservative (e.g., health protective) assumptions are applied and the models are believed to provide rough estimates of the upper limits on potential lifetime risk.

USEPA-derived oral and inhalation cancer slope factors are listed in Tables 6.1 and 6.2 in Appendix C, respectively. Per USEPA guidance, oral CSF values were adjusted from administered dose to absorbed dose for evaluating dermal toxicity. The CSF was adjusted using oral absorption factors from USEPA (USEPA, September 2001). If oral absorption factors were not available from USEPA (September 2001), values from USEPA Region 3 (USEPA, April 1999) were used. The adjusted dermal RfDs are summarized in Table 6.1 in Appendix C.

In addition to deriving a quantitative estimate of cancer potency, USEPA also assigns weight-of-evidence classifications to potential carcinogens. Constituents are classified as Group A, Group B1, Group B2, Group C, Group D, or Group E carcinogens.

- Group A carcinogens (known human carcinogens) are constituents for which there is sufficient evidence to support the causal association between exposure to the constituents in humans and cancer.
- Group B1 carcinogens (probable human carcinogens) are constituents for which there is limited evidence of possible carcinogenicity in humans with sufficient evidence of carcinogenicity in laboratory animals.
- Group B2 carcinogens (probable human carcinogens) are constituents for which there is sufficient evidence of carcinogenicity in animals but inadequate evidence in humans.
- Group C carcinogens (possible human carcinogens) are constituents for which there is limited evidence of carcinogenicity in animals and inadequate or a lack of human data.
- Group D carcinogens (not classifiable as to human carcinogenicity) are constituents with inadequate human and animal evidence of carcinogenicity or for which no data are available.
- Group E carcinogens (evidence of noncarcinogenicity in humans) are constituents for which there is no evidence of carcinogenicity from human or animal studies, or both.

### 4.4.3 Constituents for Which no USEPA Toxicity Values Are Available

Most of the constituents detected at the site have toxicity factors or appropriate surrogate constituents whose RBCs were used in the COPC screening in Appendix C, Table 2s. In this assessment, lead is the only constituent that does not have available published toxicity factors or an appropriate surrogate constituent. Lead is regulated by USEPA based on blood-lead uptake using a physiologically-based pharmakokinetic model referred to as the IEUBK model. As a screening tool, lead is screened at 400 mg/kg in soil. The maximum

detected concentrations of lead in the surface and subsurface soil are below this screening level.

## 4.5 Risk Characterization

Risk characterization is the process of integrating the previous elements of the risk assessment into quantitative and semi-quantitative expressions of risk. The quantification of risk is then used as an integral component in remedial decision-making and selection of potential remedies or actions.

### 4.5.1 Noncarcinogenic and Carcinogenic Risk Estimation Methods

Potential human health risks are discussed independently for carcinogenic and noncarcinogenic constituents because of the different toxicological endpoints, relevant exposure duration, and methods used to characterize risk. The noncarcinogenic health impacts from carcinogens are also assessed.

#### 4.5.1.1 Noncarcinogenic Risk Estimation

Noncarcinogenic health risks are estimated by comparing actual or expected exposure levels to threshold concentrations (or RfDs). The expected intake divided by the RfD is equal to the hazard quotient (HQ):

Hazard Quotient (HQ) = Intake / RfD

The intake and RfD are expressed in the same units and represent the same exposure period (i.e., chronic or subchronic). The intake and RfD also represent the same exposure route, (e.g., oral intakes are divided by the oral RfD). When HQ exceeds unity (i.e., exposure exceeds the RfD), a certain degree of health risk is indicated. To assess the potential for noncarcinogenic health effects posed by exposure to multiple constituents, a "hazard index" approach is used (USEPA, December 1989). This approach assumes that noncarcinogenic hazards associated with exposure to more than one constituent are additive. Synergistic or antagonistic interactions between constituents are not accounted for. The hazard index (HI) may exceed unity even if all of the individual HQs are less than one. The constituents may then be segregated by similar mechanisms of toxicity and toxicological effects, and separate HIs derived based on mechanism and target organs affected. Hazards were also added across the pathways (i.e., ingestion or dermal), if an individual would be exposed through multiple pathways.

#### 4.5.1.2 Carcinogenic Risk Estimation

The potential for carcinogenic effects due to exposure to site-related contamination is evaluated by estimating excess lifetime cancer risk. Excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer during one's lifetime in addition to the background probability of developing cancer. The background probability of developing cancer, from all known causes, is about one in two for men and one in three for women (American Cancer Society, 2002). Therefore, a $2x10^{-6}$ excess lifetime carcinogenic risk means that an individual's probability of developing cancer in his or her lifetime changes from approximately 0.500000 to 0.500002. Or, expressed another way, for every 1 million

people exposed to the carcinogen throughout their lifetime, the incidence of cancer *may* increase by two cases.

Potential carcinogenic risks associated with exposure to individual carcinogens were calculated using the CSFs from IRIS and HEAST presented in Section 8.4, the Toxicity Assessment, and the intakes calculated in Section 8.3, the Exposure Assessment. Risk is calculated by multiplying the intake by the CSF.

$$\text{Risk} = \text{Intake} \times \text{CSF}$$

The combined risk from exposure to multiple constituents at a site was evaluated by adding the risks from individual constituents. Risks were also added across the pathways, if an individual would be exposed through multiple pathways. For example, a person contacting the surface soil could be exposed by both the oral and dermal pathways.

When a cumulative carcinogenic risk to an individual receptor under the assumed RME exposure conditions at the site exceeds 100 in a million ($10^{-4}$ excess cancer risk), CERCLA generally requires remedial action to reduce risks at the site (USEPA, March 1991). If the cumulative risk is less than $10^{-4}$, action generally is not required. However, if there is a non-carcinogenic hazard to a receptor which exceeds 1, remedial action may be required.

### 4.5.2 Risk Assessment Results

The results of the risk characterization are presented below. A summary of the results is shown in Table 4-4 for the RME risk estimates and Table 4-5 for the CT risk estimates. The CT values were calculated only when the cumulative RME hazards exceeded 1 or the cumulative cancer risks exceeded $10^{-4}$.

**Surface Soil Exposure.** The RME risk estimates for exposure to surface soil were calculated for an industrial worker and adolescent trespasser/visitor under current/future site use (Appendix C, Tables 7.1.RME through 7.4.RME, and 8.1.RME through 8.4.RME). These risks are summarized in Table 4-4. It was assumed these receptors would be exposed to surface soil through incidental ingestion, dermal contact, and inhalation of particulates.

***Industrial Worker.*** The noncarcinogenic hazard associated with exposure to an industrial worker (0.32) is below USEPA's target hazard index of 1.0 (Appendix C, Table 9.1.RME). The carcinogenic risk associated with exposure to the surface soil by an industrial worker ($4.6 \times 10^{-6}$) is within the USEPA's target risk range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ (Appendix C, Table 9.1.RME).

***Trespasser/Visitor Adolescent.*** The noncarcinogenic hazard associated with exposure to an adolescent trespasser/visitor (0.085) is below USEPA's target hazard index of 1.0 (Appendix C, Table 9.2.RME). The carcinogenic risk associated with exposure to the surface soil by an adolescent trespasser/visitor ($7.6 \times 10^{-7}$) is below the USEPA's target risk range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ (Appendix C, Section Table 8.2.RME).

**Combined Soil Exposure.** Exposure to combined surface and subsurface soil were calculated for an adult, child, and lifetime resident, construction worker, and an adolescent trespasser/visitor under future site use (Appendix C, Tables 7.5.RME through 7.12.RME, and 8.5.RME through 8.10.RME). These risks are summarized in Table 4-4. It was assumed

these receptors would be exposed to combined soil through incidental ingestion, dermal contact, and inhalation of particulate emissions.

***Residential.*** The noncarcinogenic hazard is above USEPA's benchmark HI of 1.0 for the potential future child resident (Appendix C, Table 9.4.RME). The noncarcinogenic hazards to a child and adult resident are 3.1 and 0.4, respectively. The hazard for the child is primarily associated with ingestion of iron and manganese, both of which contribute HI's above 1.0.

The carcinogenic risk for combined soil for the resident is presented as a lifetime age-adjusted risk. The RME carcinogenic risk associated with exposure to the combined soil ($2.3x10^{-5}$) is within the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ (Appendix C, Table 9.5.RME).

The CT risk estimates are summarized in Table 4-5 (and calculated in Appendix C, Tables 7.13.CT and 7.14.CT). The CT noncarcinogenic hazard for a child resident (.39) is less than USEPA's target HI. The CT carcinogenic risk for a lifetime age-adjusted resident ($2.8x10^{-6}$) is within the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$.

***Construction Worker.*** The noncarcinogenic hazard associated with exposure to the construction worker (1.1) is above USEPA's target hazard index of 1.0 (Appendix C, Table 9.6.RME). The hazard is primarily associated with the ingestion of iron. The carcinogenic risk associated with exposure to the soil by the construction worker ($1.0x10^{-6}$) is within the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ (Appendix C, Table 9.6.RME).

The CT risk estimates are summarized in Table 4-5 (and calculated in Appendix C, Table 7.14.CT). The calculated CT noncarcinogenic hazard for a construction worker (.92) is below USEPA's target HI.

***Trespasser/Visitor Adolescent.*** The noncarcinogenic hazard associated with exposure to the soil by an adolescent trespasser/visitor (0.11) is below USEPA's target hazard index of 1.0 (Appendix C, Table 9.7.RME). The carcinogenic risk associated with exposure to the soil by an adolescent trespasser/visitor ($6.5x10^{-7}$) is also below the USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ (Appendix C, Table 9.7.RME).

## 4.6 Uncertainty Associated with Human Health Assessment

The risk measures used in risk assessments are not fully probabilistic estimates of risk but are conditional estimates given that a set of assumptions about exposure and toxicity are realized. Thus, it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective.

### 4.6.1 General Uncertainty in COPC Selection

The uncertainty in sampling and possibility of missing a contaminated location is expected to be minimal at this site because of the number of investigations conducted at the site, the amount of sampling data available, the known location of the contamination source, and its relatively small area. The quantitative uncertainty associated with the data quality is also minimal because the data have been fully validated prior to use in the risk assessment. The

general assumptions used in the COPC selection are conservative to ensure the estimation of highest possible risk.

A comparison of site data to background data was not used to select the COPCs. This may result in including background risks in the total risks calculated for the site and an overestimation of potential site-related risks.

### 4.6.2 Uncertainty Associated with Exposure Assessment

Most of the exposure pathways analyzed are assumed, and exposure factors used for quantitation of exposure are conservative and reflect worst-case or upper-bound assumptions on the exposure.

### 4.6.3 Uncertainty Associated with Toxicity Assessment

Uncertainties associated with the noncarcinogenic toxicity factors are included in Appendix C, Tables 5.1 and 5.2. The uncertainty associated with CSFs is mostly associated with the low dose extrapolation where carcinogenicity at low doses is assumed to be straight line responses. This is a conservative assumption, which introduces a high uncertainty into slope factors that are from this extrapolated area of the dose-response curve. However, most of the experimental studies indicate existence of a threshold for carcinogenicity.

Carcinogenic slope factors developed by the USEPA represent upper bound estimates. Any carcinogenic risks generated in this assessment should be regarded as an upper bound estimate on the potential carcinogenic risks rather than an accurate representation of carcinogenic risk. The true carcinogenic risk is likely to be less than the predicted value.

Additional uncertainty is in the prediction of relative sensitivities of different species of animals and the applicability of animal data to humans.

Use of provisional toxicity factors increases the degree of uncertainty associated with the risk assessment. A provisional RfD for iron was used in this assessment. Iron is an essential human nutrient, which complicates the derivation of an RfD (USEPA, January 1999). The future child resident was the only receptor that had an estimated HQ above 1 from exposure to iron. However, the estimated RME intake of iron via incidental ingestion of soil (0.33 mg/kg-day; Appendix C, Table 7.2) is below the recommended dietary allowance (RDA) range for children ages 6 months to 10 years (0.36 - 1.11 mg/kg-day) (USEPA, January 1999). Therefore, exposure to iron in soil by child residents should not be considered a health concern.

Although the oral RfD for manganese is not provisional (that is, the RfD has been approved by a USEPA workgroup), the derivation of toxicity factors for essential nutrients is complicated and therefore warrants further discussion. Manganese is an essential human nutrient responsible for activating several enzymes (USEPA, September 2003). Exposure to manganese in subsurface soil resulted in HQs above 0.5 for several receptors. However, the National Research Council has determined an "estimated safe and adequate daily dietary intake" (ESADDI) of manganese to be 2 to 5 mg/day for adults (USEPA, September 2003). This would correlate to 0.029 mg/kg-day to 0.071 mg/kg-day for a 70 kg adult. The range of the ESADDI includes an "extra margin of safety" from the level of 10 mg/day (0.14 mg/kg-

day for a 70 kg adult), which the NRC considered to be safe for an occasional intake (USEPA, September 2003). The estimated intakes for receptors typically were within these ESADDI doses.

### 4.6.4 Uncertainty in Risk Characterization

The uncertainties identified in each component of risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and constituents contributes to uncertainty based on the interaction of constituents such as additivity, synergism, potentiation, susceptibility of exposed receptors, etc.

Two essential nutrients, iron and manganese, were identified as the primary contributors to noncarcinogenic hazard for two receptors (child resident - iron and manganese, and construction worker - iron) evaluated in the risk assessment. However, the receptor-specific intakes were consistent with established safe or recommended daily doses. Therefore the RME risk characterization for these constituents should be reviewed in conjunction with important toxicological information regarding daily intakes estimated to prevent conditions related to deficiencies of these constituents.

## 4.7 Human Health Risk Assessment Conclusions

This baseline risk assessment was conducted to evaluate the potential human-health risks associated with exposure to site-related:

- surface soil and combined surface and subsurface soil

Potential risks were calculated for current/future industrial worker and current/future adolescent trespasser/visitor exposure to surface soil. In addition, potential risks were calculated for future adult resident, future child resident, future lifetime resident, future construction worker, and future adolescent trespasser/visitor to combined surface and subsurface soil. Tables 4-4 and 4-5 summarize the risks and hazards across media for the RME and CT scenarios, respectively. The risks calculated for current site use (industrial worker and adolescent trespasser/visitor exposed to surface soil) were all within USEPA target levels.

The following receptors had total RME noncarcinogenic hazards or carcinogenic risks that exceeded USEPA's target levels:

- Future child resident, exposure to combined surface and subsurface soil
- Future construction worker, exposure to combined surface and subsurface soil

Future exposure to combined surface and subsurface soil by a child resident may result in a noncarcinogenic hazard above USEPA's target hazard index of one primarily due to ingestion of iron and manganese. The CT noncarcinogenic hazard is below USEPA's target HI. The RME noncarcinogenic hazard for the construction worker is slightly above USEPA's target HI primarily due to the ingestion of iron. None of the individual constituents contribute hazards above EPA's target level alone. The CT noncarcinogenic hazard is below USEPA's target HI. Noncarcinogenic and carcinogenic risks associated with exposure to the combined surface and subsurface soil by all other potential future receptors are below or within USEPA's target levels.

The primary contributors to the noncarcinogenic hazard for the combined soil (surface and subsurface soil) at Site 10 are:

- iron
- manganese

Although the hazards are associated with naturally occurring constituents, the concentrations of iron and manganese detected in Site 10 subsurface soil are greater than the concentrations of these constituents in the background data (see Section 3.3).

Both of the contributors to the noncarcinogenic hazard are metals. Iron is an essential human nutrient, which complicates the derivation of an RfD (USEPA, January 1999). The future child resident had an estimated HQ from exposure to iron above 1. However, the estimated RME intake of iron via incidental ingestion of soil (0.39 mg/kg-day; Appendix C, Table 7.6) is within the RDA range for children ages 6 months to 10 years (0.36 to 1.11 mg/kg-day) (RDA,2003). Therefore, exposure to iron in soil by child residents should not be considered a health concern. The estimated RME intake of iron via incidental ingestion of soil (0.16 mg/kg-day; Appendix C, Table 7.7) is within the RDA range for male adults ages 11 years to 51+ years (0.130 to .266 mg/kg-day) and for female adults ages 11 years to 51+ years (0.154 to 0.326 mg/kg-day) (RDA, 2003). Therefore, exposure to iron in soil by adult construction workers should not be considered a health concern.

Manganese is also an essential human nutrient responsible for activating several enzymes (IRIS, 2003). Exposure to manganese in the combined soil resulted in HQs above 1 for the future child resident. However, the National Research Council has determined an ESADDI of manganese to be 2 to 5 mg/day for adults (IRIS, 2003). This would correlate to 0.029 mg/kg-day to 0.071 mg/kg-day for a 70 kg adult. The range of the ESADDI includes an "extra margin of safety" from the level of 10 mg/day (0.14 mg/kg-day for a 70 kg adult), which the NRC considered to be safe for an occasional intake (IRIS, 2003). The estimated intakes for receptors (child resident) were within these ESADDI doses. Therefore, exposure to manganese in soil by child and adult residents should not be considered a health concern.

The results of the human health risk assessment for Site 10 soil, and the previous discussions, indicate no further action is necessary for Site 10 soil to protect potential human receptors.

**Table 4-1**
**Summary of Data Quantitatively Used in Risk Assessment**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
**Allegany Ballistics Laboratory, Rocket Center, West Virginia**

| Medium | Date of Sampling | Sample Location | Sample | Parameters |
|---|---|---|---|---|
| **Surface Soil** | | | | |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SS01-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB02 | AS10-SS02-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03P-(0-0.5)[1] | VOCs |
| | 06/07/00 | AS10-SB04 | AS10-SS04-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SS05-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SS06-(0-0.5) | VOCs, Total Metals |
| | 10/28/1995 | PWA-29S/2/29/7 | HCS-PWA-29S | VOCs (select), SVOCs, EXPLO (select), Total Metals |
| **Soil*** | | | | |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SS01-(0-0.5) | VOCs, Total Metals |
| Surface Soil | 06/07/00 | AS10-SB02 | AS10-SS02-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03P-(0-0.5)[1] | VOCs |
| | 06/07/00 | AS10-SB04 | AS10-SS04-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SS05-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SS06-(0-0.5) | VOCs, Total Metals |
| | 10/28/1995 | PWA-29S/2/29/7 | HCS-PWA-29S | VOCs (select), SVOCs, EXPLO (select), Total Metals |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SB01-(2-4) | VOCs, Total Metals |
| Subsurface Soil | 06/07/00 | AS10-SB02 | AS10-SB02-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SB03-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB04 | AS10-SB04-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SB05-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SB06-(2-4) | VOCs, Total Metals |
| | 07/21/92 | PWA-13/14 | HCS-PWA-13 | VOCs |
| | 11/15/94 | PWA-13/14 | HCS-PWA-29 | 1,2,4-Trichlorobenzene, (1,2-, 1,3-, 1,4-)Dichlorobenzene, SVOCs, EXPLO (select), Total Metals |

1 Duplicate of sample AS10-SS03-(0-0.5)
Soil* - Surface and subsurface soil combined.

**Table 4- 2**
**Summary of Chemicals of Potential Concern for the HHRA**
**Site 10 - Former TCR Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
**Allegany Ballistics Laboratory, Rocket Center, West Virginia**

| Surface Soil | Soil* |
|---|---|
| *Ingestion, Dermal, and Inhalation of Airborne Particulates* | *Ingestion, Dermal, and Inhalation of Airborne Particulates* |
| Aluminum | Aluminum |
| Arsenic | Arsenic |
| Iron | Iron |
| Manganese | Manganese |

* Surface and subsurface soil combined.

**Table 4-3**
**Exposure Pathways**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
**Allegany Ballistics Laboratory, Rocket Center, West Virginia**

| Media | Exposure Route | Current/Future | | Future | | | |
|---|---|---|---|---|---|---|---|
| | | Industrial Worker | Trespasser/Visitor Adolescent | Trespasser/Visitor Adolescent | Construction Worker | Resident | |
| | | | | | | Adult | Child |
| Surface Soil (Site 10) | Ingestion | X | X | | | | |
| | Dermal | X | X | | | | |
| | Inhalation | X | X | | | | |
| Soil* (Site 10) | Ingestion | | | X | X | X | X |
| | Dermal | | | X | X | X | X |
| | Inhalation | | | X | X | X | X |

X Quantitative evaluation.

* Surface and subsurface soil combined.

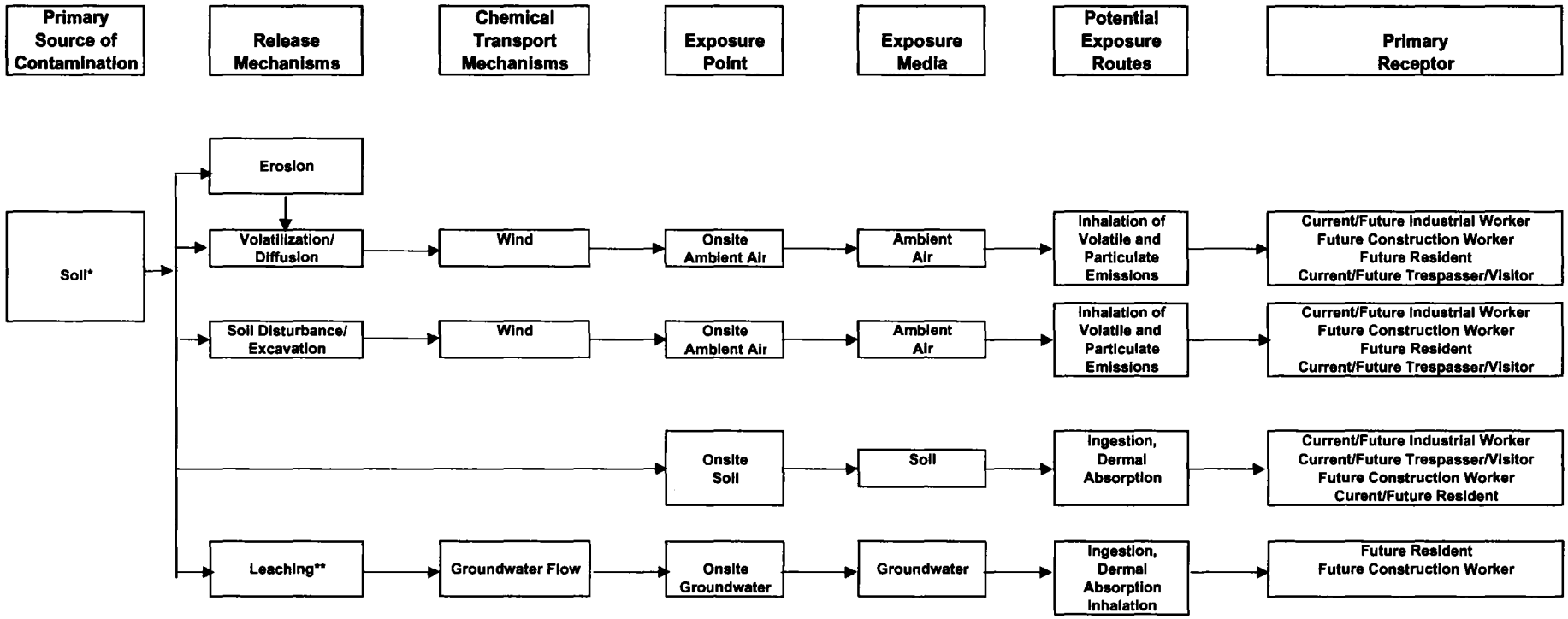
**Table 4-4**
**Summary of RME Cancer Risks and Hazard Indices**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
**Allegany Ballistics Laboratory, Rocket Center, West Virginia**

| Receptor | Media | Exposure Route | Cancer Risk | Chemicals with Cancer Risks $>10^{-4}$ | Chemicals with Cancer Risks $>10^{-5}$ and $<10^{-4}$ | Chemicals with Cancer Risks $>10^{-6}$ and $<10^{-5}$ | Hazard Index | Chemicals with HI>1 |
|---|---|---|---|---|---|---|---|---|
| Current/Future Industrial Worker | Surface Soil - Site 10 | Ingestion | 3.7E-06 | | | Arsenic | 0.2 | |
| | | Dermal Contact | 9.4E-07 | | | | 0.2 | |
| | | Inhalation | 3.3E-09 | | | | 0.007 | |
| | | Total | 4.6E-06 | | | | 0.3 | |
| | All Media | Total | 4.6E-06 | | | | 0.3 | |
| Current/Future Adolescent Trespasser/Visitor | Surface Soil - Site 10 | Ingestion | 3.8E-07 | | | | 0.05 | |
| | | Dermal Contact | 8.4E-08 | | | | 0.04 | |
| | | Inhalation | 4.3E-11 | | | | 0.0003 | |
| | | Total | 4.6E-07 | | | | 0.09 | |
| | All Media | Total | 4.6E-07 | | | | 0.09 | |
| Future Adult Resident | Soil* - Site 10 | Ingestion | NA | | | | 0.3 | |
| | | Dermal Contact | NA | | | | 0.1 | |
| | | Inhalation | NA | | | | 0.02 | |
| | | Total | NA | | | | 0.4 | |
| | All Media | Total | NA | | | | 0.4 | |
| Future Child Resident | Soil* - Site 10 | Ingestion | NA | | | | 2.5 | Iron |
| | | Dermal Contact | NA | | | | 0.6 | |
| | | Inhalation | NA | | | | 0.06 | |
| | | Total | NA | | | | 3.2 | Iron, Manganese |
| | All Media | Total | NA | | | | 3.2 | |
| Future Child/Adult Resident | Soil* - Site 10 | Ingestion | 2.2E-05 | | Arsenic | | NA | |
| | | Dermal Contact | 1.7E-06 | | | Arsenic | NA | |
| | | Inhalation | 1.8E-08 | | | | NA | |
| | | Total | 2.3E-05 | | | | NA | |
| | All Media | Total | 2.3E-05 | | | | NA | |
| Future Construction Worker | Soil* - Site 10 | Ingestion | 9.9E-07 | | | | 1.0 | |
| | | Dermal Contact | 2.0E-08 | | | | 0.07 | |
| | | Inhalation | 4.1E-10 | | | | 0.02 | |
| | | Total | 1.0E-06 | | | | 1.1 | |
| | All Media | Total | 1.0E-06 | | | | 1.1 | |
| Future Adolescent Trespasser/Visitor | Soil* - Site 10 | Ingestion | 5.3E-07 | | | | 0.06 | |
| | | Dermal Contact | 1.2E-07 | | | | 0.05 | |
| | | Inhalation | 6.0E-11 | | | | 0.001 | |
| | | Total | 6.5E-07 | | | | 0.1 | |
| | All Media | Total | 6.5E-07 | | | | 0.1 | |

* Surface and subsurface soil combined.

**Table 4-5**
**Summary of CT Cancer Risks and Hazard Indices**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
**Allegany Ballistics Laboratory, Rocket Center, West Virginia**

| Receptor | Media | Exposure Route | Cancer Risk | Chemicals with Cancer Risks $>10^{-4}$ | Chemicals with Cancer Risks $>10^{-5}$ and $<10^{-4}$ | Chemicals with Cancer Risks $>10^{-6}$ and $<10^{-5}$ | Hazard Index | Chemicals with HI>1 |
|---|---|---|---|---|---|---|---|---|
| Future Child Resident | Soil* - Site 10 | Ingestion | NA | | | | 0.3 | |
| | | Dermal Contact | NA | | | | 0.1 | |
| | | Inhalation | NA | | | | NA | |
| | | Total | NA | | | | 0.4 | |
| | All Media | Total | NA | | | | 0.4 | |
| Future Construction Worker | Soil* - Site 10 | Ingestion | NA | | | | 0.9 | |
| | | Dermal Contact | NA | | | | 0.02 | |
| | | Inhalation | NA | | | | NA | |
| | | Total | NA | | | | 0.9 | |
| | All Media | Total | NA | | | | 0.9 | |




* Current scenarios are for exposure to surface soil, future scenarios are for exposure to combined surface and subsurface soil.
** Risk associated with groundwater are addressed in the Site 10 groundwater ROD and are not evaluated in this risk assessment.

**Figure 4-1**
Conceptual Site Model for Potential Human Exposures
Site 10 - Former TCE Still at Building 157
*Allegany Ballistics Laboratory, Rocket Center, West Virgnina*

SECTION 5

# Ecological Risk Assessment

This section contains a screening ecological risk assessment (Steps 1 and 2 of the ecological risk assessment process) and the first step (Step 3) of a baseline ecological risk assessment for Site 10 (former TCE still at Building 157) at ABL in Rocket Center, West Virginia. The location of Site 10 is shown in Figure 2-1.

## 5.1 Introduction

This ecological risk assessment was conducted in accordance with the *Navy Policy for Conducting Ecological Risk Assessments* (Chief of Naval Operations [CNO], 1999), the Navy guidance for implementing the CNO ERA policy (NAVFAC, February 2001), and the Navy/ Tier II ERA approach developed for USEPA, Region 3. The CNO ERA policy and guidance, which describe a process consisting of eight steps organized into three tiers, are conceptually similar to the eight-step ERA process outlined in USEPA ERA guidance for the Superfund program (USEPA, 1997a). The major differences between the Navy ERA policy/ guidance and the USEPA ERA guidance are: (1) the Navy policy and guidance provide clearly defined criteria for exiting the ERA process at specific points, (2) the Navy policy and guidance divide Step 3 (the first step of the baseline ERA) into two distinct sub-steps (Steps 3A and 3B), with a potential exit point after Step 3A, and (3) the Navy policy and guidance incorporate risk management considerations throughout all tiers of the ERA process.

Steps 1 and 2 of the ERA process constitute the screening ERA (SERA), which is conducted using intentionally conservative assumptions. If complete exposure pathways exist at a site and the results of the SERA indicate that risks are possible, the site normally continues on to Step 3, the first step in the baseline ERA (BERA). As indicated above, Step 3 is divided into two distinct sub-steps in Navy ERA guidance.

Step 3 of the USEPA ERA guidance consists of the following activities (USEPA, 1997a):

1. Refinement of the preliminary COPCs from the SERA.
2. Further characterizing the potential ecological effects of contaminants.
3. Refining information on contaminant fate and transport, complete exposure pathways, and receptors potentially at risk.
4. Selecting assessment endpoints.
5. Refining the conceptual model and risk hypotheses from the SERA.

Step 3A of the Navy policy/guidance (refinement of conservative exposure assumptions) corresponds to the first activity listed above for the USEPA ERA guidance. In Step 3A, a refined evaluation of exposure estimates is conducted using more realistic assumptions and additional methodologies relative to those used in the SERA, which is intended to be a very conservative assessment. Examples of more realistic exposure assumptions include using

central tendency (e.g., arithmetic mean) estimates (rather than maximums) for media concentrations, bioaccumulation factors, and exposure parameters. Examples of additional methodologies include consideration of background concentrations, detection frequency, and bioavailability (CNO, 1999; NAVFAC, 2001).

If risk estimates (and their associated uncertainty) are acceptable following Step 3A, the site will meet the conditions of the exit criterion specified in the Navy guidance. This possible exit point is not present in the USEPA ERA guidance. If the Step 3A evaluation does not support an acceptable risk determination, the site continues to Step 3B.

Step 3B of the Navy policy/guidance (problem formulation) corresponds conceptually to the last four activities listed above for the USEPA ERA guidance. In Step 3B, the preliminary conceptual model presented in the SERA is refined based on the results of the Step 3A evaluation to develop a revised list of key receptors, complete and significant exposure pathways, COPCs, assessment endpoints, measurement endpoints, and risk hypotheses. Based upon the revised conceptual model, the lines of evidence to be used in characterizing risk are determined. Agreement on the revised conceptual model, COPCs, exposure pathways, endpoints, and risk hypotheses constitutes the Scientific Management Decision Point (SMDP) at the end of Step 3 in both Navy and USEPA ERA guidance.

### 5.1.1 Objectives

The objectives of the SERA are to:

- Determine if potential risks to ecological receptors warrant either: (1) additional assessment beyond the conservative screening steps of the ERA process (unacceptable ecological risks are possible), or (2) the removal of the site from further ecological consideration (no unacceptable ecological risks likely).
- Identify any data gaps or areas of unacceptable uncertainty that may require the collection of additional data to support ERA evaluations beyond the screening level.

If the site is not screened out in the SERA, the evaluation continues to Step 3. The general objectives of the Step 3 ERA are to:

- Refine the risk estimates from the SERA to determine if risks to ecological receptors from site-related constituents are likely to occur based on realistic exposure scenarios.
- Focus subsequent data collection activities if potential risks are indicated, uncertainties are unacceptably high, and/or data gaps are identified.

At the conclusion of Step 3, there are three possible decision points:

- **No further action is warranted.** This decision is appropriate if the evaluation indicates that sufficient data are available on which to base a conclusion of no unacceptable risk within acceptable uncertainty.
- **Further data are required.** This decision is appropriate if the evaluation indicates that the potential for unacceptable risk exists and additional data to refine these estimates (e.g., additional analytical data, measures of bioavailability) are needed. In this case, the site continues to Step 4 of the ERA process.

- **Take remedial action.** This decision may be appropriate for circumstances in which the potential for unacceptable risks is identified but these potential risks could best be addressed through remedial action (e.g., presumptive remedy) rather than additional study.

## 5.2 Screening Ecological Risk Assessment

As discussed in Section 5.1, Steps 1 and 2 of the ERA process constitute the SERA, which is conducted using intentionally conservative assumptions. The principal components of the SERA are problem formulation, exposure estimation, effects evaluation, and risk calculation. Each of these components is discussed below.

### 5.2.1 Screening Problem Formulation

Problem formulation establishes the goals, scope, and focus of the ERA. As part of problem formulation, the environmental setting of Site 10 is characterized in terms of the habitats and biota known or likely to be present. The types and concentrations of constituents that are present in ecologically relevant media are also described. A preliminary conceptual model is developed for Site 10 that describes potential sources, potential transport pathways, potential exposure pathways and routes, and potential receptors. Assessment endpoints, measurement endpoints, and risk hypotheses are then selected to evaluate those receptors for which complete and potentially significant exposure pathways are likely to exist. The fate, transport, and toxicological properties of the constituents present at Site 10, particularly the potential for bioaccumulation, are also considered during this process.

#### 5.2.1.1 Site Description and History

A brief description of the site can be found in Section 2 and the documents referenced therein. Available habitats and biota at Site 10 are summarized below.

**Habitats and Biota.** There are no wetland or aquatic habitats located on or near Site 10. The terrestrial portion of Site 10 consists of a periodically mowed open field containing grasses and other herbaceous plants immediately adjacent to Building 157 (Figure 2-2; the shaded areas on this figure indicates the alluvial and bedrock groundwater plumes). There are no areas of bare soil present. The quality of the available habitat is very low due to the mowing, the homogeneity of the vegetative community, and the developed nature of the surrounding landscape. The site is accessible to wildlife species and may be used by species such as white-tailed deer (*Odocoileus virginianus*), woodchuck (*Marmota monax*), eastern cottontail rabbit (*Sylvilagus floridana*), and a variety of songbirds. Small mammal species, such as voles, and soil invertebrates may occur at Site 10 on a more regular basis.

The North Branch Potomac River is located about 2,000 feet north-northeast of Site 10. The site is relatively flat and there are no surface water conveyances (such as drainage ditches) in the former location of the TCE still. The nearest drainage ditch is approximately 100 feet north of the site on the other side of Building 157 (Figure 2-2). The underground portion of the facility's storm sewer system passes south of Building 157 (Figure 3-1) but there appear to be no access points (e.g., catch basins) to this system on or near the site. Groundwater flow at the site is northeast at an average velocity of 5 feet per year (CH2M HILL, 1996).

#### 5.2.1.2 Summary of Available Analytical Data

One surface soil sample was collected in November 1994 as part of the Phase II Remedial Investigation (CH2M HILL, 1996) and six surface soil samples were collected in June 2000 as part of a supplemental sampling event for risk assessment purposes. All surface soil samples were taken at a depth of 0 to 6 inches from close proximity to the former TCE still.

A statistical summary of the surface soil data used in the ERA are presented in Table 5-1. Sampling locations are shown on Figure 3-1. The raw analytical data are provided in Appendix A.

#### 5.2.1.3 Preliminary Conceptual Model

Information on the habitat features at the site and on the fate and transport of the constituents detected at the site were used to build the preliminary conceptual model (Figure 5-1). Key components of the preliminary conceptual model include the identification of potential source areas, transport pathways, exposure media, potential exposure routes, and potential receptor groups.

**Source Areas.** The source area at Site 10 is the former TCE still near Building 157 (Figure 2-2).

**Transport Pathways and Exposure Media.** A transport pathway describes the mechanisms whereby constituents may be transported from a source of contamination to ecologically relevant media. These transport pathways are shown on Figure 5-1 for Site 10 soil. Potential complete contaminant transport pathways that may exist at Site 10 are:

- Uptake by biota from surface soil and trophic transfer to upper trophic level receptors via the food web.

**Exposure Pathways and Routes.** An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure routes. Exposure, and thus potential risk, can only occur if complete exposure pathways exist. Figure 5-1 shows the potentially complete exposure pathways to ecological receptors at Site 10.

Potentially complete exposure pathways to terrestrial receptors utilizing Site 10 (grassy area) do exist but are likely to be limited. The site, located in a developed area close to Building 157, is very small and has low habitat quality and diversity, consisting entirely of periodically mowed grass and other herbaceous plants.

There are currently no complete pathways to aquatic receptors. The current limit of the TCE groundwater plume (depicted on Figure 3-1) is approximately 2,000 feet from the North Branch Potomac River, traveling at an average velocity of 5 feet per year (CH2M HILL, 1996) under natural conditions. In addition, the existing groundwater plume is being contained, extracted, and treated via a network of alluvial and bedrock extraction wells.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a constituent present in an environmental medium. Terrestrial plants may be exposed through their root surfaces during water and nutrient uptake to constituents present in surface soils. Animals may be exposed to constituents through: (1) direct inhalation of gaseous constituents or of constituents adhered to particulate matter; (2) incidental ingestion

of contaminated soil during feeding activities; (3) the ingestion of contaminated plant and/or animal tissues for constituents that have entered food webs; and/or (4) dermal contact with contaminated soil. These routes, where applicable to Site 10, are depicted on Figure 5-1.

Based on the general fate properties (e.g., relatively high adsorption to solids) of the constituents commonly present on Site 10 (mostly metals) and the protection offered by hair or feathers, dermal and inhalation exposures for upper trophic level receptor species are not considered significant relative to ingestion exposures and are therefore not evaluated in the ERA. Upper trophic-level receptors considered in the ERA would not likely be exposed to significant airborne sources of constituents because the site is vegetated and little wind erosion of the soils would be expected. Furthermore, the primary constituents present on the site (metals) typically adsorb to soil suggesting the potential for volatilization and thus exposure via inhalation is limited. Incidental ingestion of soil during feeding, preening, or grooming activities is, however, considered in the risk estimates. Direct contact is considered for lower trophic level receptors (e.g., invertebrates). Drinking water exposures are not considered because there is no permanent source of fresh water to ecological receptors at Site 10.

**Receptors.** Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present at a site. Therefore, specific receptor species or species groups (e.g., red fox) are often selected as surrogates to evaluate potential risks to larger portions of the ecological community (guilds; e.g., carnivorous mammals) used to represent the assessment endpoints (e.g., survival and reproduction of carnivorous mammals). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site.
- Have a particular ecological, economic, or aesthetic value.
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist.
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations at the site.

The following upper trophic level receptor species have been chosen for exposure modeling based on the criteria listed above:

- Meadow vole (*Microtus pennsylvanicus*) – terrestrial mammalian herbivore.
- Short-tailed shrew (*Blarina brevicauda*) – terrestrial mammalian insectivore.
- Red fox (*Vulpes vulpes*) - terrestrial mammalian carnivore.
- American robin (*Turdus migratorius*) - terrestrial avian omnivore.
- American kestrel (*Falco sparverius*) - terrestrial avian carnivore.

Upper trophic level receptor species quantitatively evaluated in the ERA were limited to birds and mammals, the taxonomic groups with the most available information regarding

exposure and toxicological effects. Because of the limited amount of toxicological data available for reptiles and amphibians, exposures via the food web for these taxonomic groups were evaluated using bird and mammal receptor species as surrogates.

Lower trophic level receptor species were evaluated in the ERA based on those taxonomic groupings for which screening values have been developed; these groupings and screening values are typically used in most ERAs. As such, specific species of terrestrial plants or soil invertebrates (earthworms are the standard surrogate) were not chosen as receptors; terrestrial organisms were evaluated on a community level via a comparison of surface soil concentrations to surface soil screening values developed specifically for these groups.

**Endpoints and Risk Hypotheses.** The conclusion of the screening problem formulation includes the selection of ecological endpoints and risk hypotheses, which are based on the preliminary conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process (USEPA, 1997a). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1997a) and discussed in detail in Suter (1989, 1990, 1993). Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses when exposed to contaminants.

Endpoints define ecological attributes that are to be protected (assessment endpoints) and measurable characteristics of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by constituents attributable to the site (USEPA, 1997a). Assessment endpoints contain an entity (e.g., red fox population) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself. Effects on individual organisms are important for some receptors, such as rare and endangered species; population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of constituent exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level.

Table 5-2 shows the preliminary assessment endpoints, risk hypotheses, and measurement endpoints used in the screening portion (Steps 1 and 2) of the ERA. Table 5-2 also shows the receptors associated with each endpoint.

### 5.2.2 Screening Exposure Estimation

Maximum concentrations in surface soil were used in the screening portion of the ERA to conservatively estimate potential constituent exposures for the ecological receptors selected to represent the assessment endpoints at Site 10. Food web exposures for upper trophic level receptor species were determined by estimating the constituent-specific concentrations in each dietary component using uptake and food web models. Incidental ingestion of soil was also included when calculating the total level of exposure. Maximum surface soil concentrations were used in all screening food web calculations to provide a conservative assessment.

For conservatism, the maximum reporting limit for constituents that were analyzed for but not detected was also compared to medium-specific screening values and (where applicable) used for food web exposure modeling. This was done to determine if detection limits were less than or equal to constituent concentrations at which potential adverse effects to ecological receptors may occur.

#### 5.2.2.1 Selection Criteria for Analytical Data

Available analytical data were selected for use in the ERA based on the following:

- Data must have been validated by a qualified data validator using acceptable data validation methods. Data with rejected (R) values were not used in the risk assessment. Unqualified data and data qualified as J, L, or K were treated as detected. Data qualified as U or B were treated as non-detected.
- For samples with duplicate analyses, the higher of the two concentrations was used when both values were detects or when both values were non-detects. In cases where one result was a detection and the other a non-detect, the detected value was used in the assessment.
- For soil, samples collected from depths of 0 to 6 inches were used because this depth range represents the most realistic potential exposures for most of the ecological receptors evaluated in terrestrial habitats.

#### 5.2.2.2 Exposure Estimation

Upper trophic level receptor exposures to constituents in surface soil were determined by estimating the concentration of each constituent in each relevant dietary component. Incidental ingestion of soil was included when calculating the total exposure. Exposure via drinking water was not included because Site 10 lacks a permanent fresh water drinking source for ecological receptors.

Soil-associated constituents with the potential to bioaccumulate were evaluated for exposures via food webs. This list of bioaccumulating constituents is provided in Table 5-3 and is based on the list provided in Table 4-2 of USEPA *Bioaccumulation Testing and Interpretation for the purpose of sediment quality Assessment* (2000).

Dietary items for which tissue concentrations were modeled were terrestrial plants, soil invertebrates, and small mammals. The methodologies used for these tissue calculations are outlined below. For the screening portion of the ERA, the uptake of constituents from the

abiotic media into these food items was based on conservative (e.g., maximum or 90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature. Default factors of 1.0 were used only where data were unavailable for a constituent in the literature.

**Screening Exposure Point Concentrations.** Maximum surface soil concentrations were used as exposure point concentrations for exposure estimation and food web modeling in the screening portion of the ERA. Exposure point concentrations (concentrations in plant, soil invertebrate, and small mammal prey items) for terrestrial predators are estimated using bioaccumulation models and maximum measured media concentrations. The methodology and models used to derive these estimates are described below.

**Terrestrial Plants.** Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated by multiplying the maximum surface soil concentration for each constituent by constituent-specific soil-to-plant BCFs obtained from the literature. The BCF values used were based on root uptake from soil and on the ratio between dry-weight soil and dry-weight plant tissue. Literature values based on the ratio between dry-weight soil and wet-weight plant tissue were converted to a dry-weight basis by dividing the wet-weight BCF by the estimated solids content for plants (15 percent [0.15]; Sample et al. 1997).

For metals without literature based BCFs, a soil-to-plant BCF of 1.0 was assumed. For organic constituents without literature based BCFs, soil-to-plant BCFs were estimated using the algorithm provided in Travis and Arms (1988):

$$\log B_v = 1.588 - (0.578)(\log K_{ow})$$

where: $B_v$ = Soil-to-plant BCF (unitless; dry-weight basis)
$K_{ow}$ = Octanol-water partitioning coefficient (unitless)

The log $K_{ow}$ values used in the calculations were obtained mostly from USEPA (1995b, 1996) and are listed in Table 5-3. The soil-to-plant BCFs used in the screening portion of the ERA are shown in Table 5-4.

**Earthworms.** Tissue concentrations in soil invertebrates (earthworms) were estimated by multiplying the maximum surface soil concentration for each constituent by constituent-specific BCFs or BAFs obtained from the literature. BCFs are calculated by dividing the concentration of a constituent in the tissues of an organism by the concentration of that same constituent in the surrounding environmental medium (in this case, soil) without accounting for uptake via the diet. BAFs consider both direct exposure to soil and exposure via the diet. Because earthworms consume soil, BAFs are more appropriate values and are used in the food web models when available. BAFs based on depurated analyses (soil was purged from the gut of the earthworm prior to analysis) are given preference over undepurated analyses when selecting BAF values because direct ingestion of soil is accounted for separately in the food web model.

The BCF/BAF values used were based on the ratio between dry-weight soil and dry-weight earthworm tissue. Literature values based on the ratio between dry-weight soil and wet-weight earthworm tissue were converted to a dry-weight basis by dividing the wet-weight BCF/BAF by the estimated solids content for earthworms (16 percent [0.16]; USEPA, 1993). For constituents without available measured BAFs or BCFs, an earthworm BAF of 1.0 was

assumed. The soil-to-earthworm BCFs/BAFs used in the screening portion of the ERA are shown in Table 5-4.

**Small Mammals.** Whole-body tissue concentrations in small mammals (shrews, voles, and/or mice) were estimated using one of two methodologies. For constituents with literature-based soil-to-small mammal BAFs, the small mammal tissue concentration was calculated by multiplying the measured or estimated surface soil concentration for each constituent by a constituent-specific soil-to-small mammal BAF obtained from the literature. The BAF values used were based on the ratio between dry-weight soil and whole-body dry-weight tissue. Literature values based on the ratio between dry-weight soil and wet-weight tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for small mammals (32 percent [0.32]; USEPA, 1993). BAFs for shrews are those reported in Sample et al. (1998b) for insectivores (or for general small mammals if insectivore values were unavailable), for voles are those reported for herbivores, and for mice are those reported for omnivores. The soil-to-small mammal BAFs are shown in Table 5-5.

For constituents without soil-to-small mammal BAF values, an alternate approach was used to estimate whole-body tissue concentrations. Because most constituent exposure for these small mammals is via the diet, it was assumed that the concentration of each constituent in the small mammal's tissues is equal to the constituent concentration in its diet; that is, a diet to whole-body BAF (wet-weight basis) of 1.0 was assumed. The use of a diet to whole-body BAF of 1.0 is likely to result in a conservative estimate of concentrations for constituents that are not known to biomagnify in terrestrial food webs (e.g., PAHs) based on reported literature values for constituents that are known to biomagnify in food webs. For example, a maximum BAF (wet weight) value of 1.0 was reported by Simmons and McKee (1992) for PCBs based on laboratory studies with white-footed mice. Menzie et al. (1992) reported BAF values (wet-weight) for DDT of 0.3 for voles and 0.2 for short-tailed shrews. Reported BAF (wet-weight) values for dioxin were only slightly above one (1.4) for the deer mouse (USEPA, 1990). Resulting tissue concentrations (wet-weight) were converted to a dry-weight basis using an estimated solids content of 32 percent (see above).

**Dietary Intakes.** Dietary intakes for each receptor species were calculated using the following formula (modified from USEPA [1993]):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

where:

| | | |
|---|---|---|
| $DI_x$ | = | Dietary intake for constituent x (mg constituent/kg body weight/day) |
| FIR | = | Food ingestion rate (kg/day, dry-weight) |
| $FC_{xi}$ | = | Concentration of constituent x in food item i (mg/kg, dry-weight) |
| $PDF_i$ | = | Proportion of diet composed of food item i (dry-weight basis) |
| $SC_x$ | = | Concentration of constituent x in soil/sediment (mg/kg, dry-weight) |
| PDS | = | Proportion of diet composed of soil/sediment (dry-weight basis) |
| WIR | = | Water ingestion rate (L/day) |
| $WC_x$ | = | Concentration of constituent x in water (mg/L) |

BW = Body weight (kg, wet weight)

Receptor-specific values used as inputs to this equation for the screening portion of the ERA are provided in Table 5-6. Consistent with the conservative approach used for a SERA, the minimum body weight and maximum food ingestion rate from the scientific literature were used for each receptor (the water ingestion rate was set to zero because the site lacks a permanent freshwater drinking source for ecological receptors). It was assumed that constituents were 100 percent bioavailable to the receptor and it was also assumed that each receptor spent 100 percent of its time on the site (i.e., an area use factor [AUF] of 1.0 was assumed).

### 5.2.3 Screening Effects Evaluation

The purpose of the screening effects evaluation is to establish constituent exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. One set of screening values is typically developed for each selected assessment endpoint. Two types of screening values, medium-specific and ingestion, were established.

#### 5.2.3.1 Surface Soil Screening Values

Surface soil screening values were established at Site 10 because the preliminary conceptual model (Figure 5-1) indicated that direct exposure to surface soil was a potentially complete pathway. The screening values used in the ERA were based on Region 3 BTAG screening values (USEPA, August 1995) and additional screening values available in the literature. Where more than one screening value was available for soil (i.e., soil fauna and soil flora), the lowest value was selected for use in the screening portion of the ERA. Surface soil screening values based on Dutch soil standards for certain organic constituents were adjusted based on a total organic carbon (TOC) value of 2 percent. This 2-percent value represents the default minimum adjustment value and was used because only one site-specific TOC sample was available (value of 2.8 percent). The screening values used in this ERA are summarized in Table 5-7.

#### 5.2.3.2 Ingestion Screening Values

Ingestion screening values for dietary exposures were derived for each mammalian and avian receptor species and constituent evaluated in the ERA. Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary. The ingestion screening values are expressed as milligrams of the constituent per kilogram body weight of the receptor per day (mg/kg-BW/day).

Growth and reproduction were emphasized as assessment endpoints because they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicity studies were available from the literature, the most appropriate study was selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. NOAELs based on growth and reproduction were utilized, where available, as the primary screening values. When chronic NOAEL values were unavailable, estimates were extrapolated from chronic LOAELs using a safety

factor of 10. Ingestion screening values for mammals and birds are summarized in Tables 5-8 and 5-9, respectively.

### 5.2.4 Screening Risk Calculation

The screening risk calculation is the final step in a SERA. In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper trophic level receptor species) are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of COPCs for each media-pathway-receptor combination evaluated or a conclusion of acceptable risk.

COPCs are selected using the hazard quotient (HQ) method. HQs are calculated by dividing the constituent concentration in the medium being evaluated by the corresponding medium-specific screening value or by dividing the exposure dose by the corresponding ingestion screening value. Constituents with HQs greater than or equal to one are considered COPCs in the SERA.

HQs exceeding one indicate that the potential for risk exists because the constituent concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to one do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies constituent-pathway-receptor combinations requiring further evaluation. HQs that are less than one indicate that risks are very unlikely to exist, enabling a conclusion of no unacceptable risk to be reached with high confidence.

Two sets of risk calculations were performed for terrestrial habitats, direct exposure (lower trophic level receptors) and food web exposure (upper trophic level receptors). Each of these is described below.

#### 5.2.4.1 Direct Exposure for Terrestrial Receptors

Maximum surface soil concentrations are compared to screening values in Table 5-10. Based on this comparison, eight metals (aluminum, antimony, chromium, iron, manganese, mercury, vanadium, and zinc) had HQs equaling or exceeding one and were identified as COPCs. The exceedance for antimony was based on the maximum reporting limit because all results were "non-detect."

Twenty semivolatile organic compounds (SVOCs) and one VOC had HQs equaling or exceeding one based on maximum reporting limits (Table 5-10). All 21 of these constituents were retained as COPCs.

#### 5.2.4.2 Food Web Exposure for Terrestrial Receptors

Maximum exposure doses for each upper trophic level receptor species are compared to ingestion screening values in Table 5-11. Based on a comparison to NOAELs, seven metals (arsenic, cadmium, chromium, lead, mercury, selenium, and zinc) had HQs greater than or equal to 1.0 for one or more receptors. The exceedance for cadmium was based on the maximum reporting limit because all results were "non-detect." Ingestion screening values were not available for three SVOCs (4-bromophenyl-phenylether, 4-chlorophenyl-phenylether, and hexachloroethane; Table 5-11).

### 5.2.5 Screening Risk Conclusions

COPCs were identified in each of the media evaluated via direct exposure and/or food web exposure scenarios. These COPCs are summarized in Table 5-12. Based on the results of the SERA, the evaluation continued to Step 3 (see below).

## 5.3 Baseline Ecological Risk Assessment (Step 3)

The SERA resulted in a set of COPCs being identified for surface soil at Site 10. This set of COPCs comprises constituents with HQs greater than or equal to 1.0 (based on maximum exposures) and constituents for which assessment data were not available.

### 5.3.1 Refinement of Conservative Screening Assumptions

According to Superfund guidance (USEPA, 1997a), Step 3 initiates the problem formulation phase of the BERA. Under Navy policy/guidance (CNO, 1999; NAVFAC, 2001), the BERA begins with a preliminary step (Step 3A) in which the conservative assumptions employed in the SERA are refined and risk estimates are recalculated using the same conceptual model for the site. In addition, the re-evaluation may include consideration of other factors such as background data (CNO, 1999; NAVFAC, 2001).

The assumptions, parameter values, and methods that were modified for the Step 3A re-evaluation included:

- Risk estimates based on maximum constituent concentrations were supplemented by risk estimates based on average (arithmetic mean) constituent concentrations. In addition, BAFs and BCFs were based on, or modeled from, central tendency estimates (e.g., median or mean) from the literature as opposed to the maximum or "high-end" (e.g., 90th percentile) estimates used in the SERA for many constituents. Revised BAF/BCF values used in Step 3A are provided in Tables 5-13 and 5-14.

  In the BERA, using central tendency estimates (rather than high end or maximums) for exposure parameters such as BAFs provides a more representative estimate of potential exposures and risks to receptor populations (the focus of the assessment endpoints) of upper trophic level receptors. Because these upper trophic level species are highly mobile, they would be expected to effectively average their exposure over time as they forage within the area defining their home range (which will extend to off-site areas). Average prey concentrations at Step 3A are most appropriately estimated using central tendency estimates of media concentrations and accumulation factors. For example, the wildlife dietary exposure models contained in the Wildlife Exposure Factors Handbook (USEPA, 1993) specify the calculation of an average daily dose. Increasing the

factor of 10. Ingestion screening values for mammals and birds are summarized in Tables 5-8 and 5-9, respectively.

### 5.2.4 Screening Risk Calculation

The screening risk calculation is the final step in a SERA. In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper trophic level receptor species) are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of COPCs for each media-pathway-receptor combination evaluated or a conclusion of acceptable risk.

COPCs are selected using the hazard quotient (HQ) method. HQs are calculated by dividing the constituent concentration in the medium being evaluated by the corresponding medium-specific screening value or by dividing the exposure dose by the corresponding ingestion screening value. Constituents with HQs greater than or equal to one are considered COPCs in the SERA.

HQs exceeding one indicate that the potential for risk exists because the constituent concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to one do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies constituent-pathway-receptor combinations requiring further evaluation. HQs that are less than one indicate that risks are very unlikely to exist, enabling a conclusion of no unacceptable risk to be reached with high confidence.

Two sets of risk calculations were performed for terrestrial habitats, direct exposure (lower trophic level receptors) and food web exposure (upper trophic level receptors). Each of these is described below.

#### 5.2.4.1 Direct Exposure for Terrestrial Receptors

Maximum surface soil concentrations are compared to screening values in Table 5-10. Based on this comparison, eight metals (aluminum, antimony, chromium, iron, manganese, mercury, vanadium, and zinc) had HQs equaling or exceeding one and were identified as COPCs. The exceedance for antimony was based on the maximum reporting limit because all results were "non-detect."

Twenty semivolatile organic compounds (SVOCs) and one VOC had HQs equaling or exceeding one based on maximum reporting limits (Table 5-10). All 21 of these constituents were retained as COPCs.

#### 5.2.4.2 Food Web Exposure for Terrestrial Receptors

Maximum exposure doses for each upper trophic level receptor species are compared to ingestion screening values in Table 5-11. Based on a comparison to NOAELs, seven metals (arsenic, cadmium, chromium, lead, mercury, selenium, and zinc) had HQs greater than or equal to 1.0 for one or more receptors. The exceedance for cadmium was based on the maximum reporting limit because all results were "non-detect." Ingestion screening values were not available for three SVOCs (4-bromophenyl-phenylether, 4-chlorophenyl-phenylether, and hexachloroethane; Table 5-11).

### 5.2.5 Screening Risk Conclusions

COPCs were identified in each of the media evaluated via direct exposure and/or food web exposure scenarios. These COPCs are summarized in Table 5-12. Based on the results of the SERA, the evaluation continued to Step 3 (see below).

## 5.3 Baseline Ecological Risk Assessment (Step 3)

The SERA resulted in a set of COPCs being identified for surface soil at Site 10. This set of COPCs comprises constituents with HQs greater than or equal to 1.0 (based on maximum exposures) and constituents for which assessment data were not available.

### 5.3.1 Refinement of Conservative Screening Assumptions

According to Superfund guidance (USEPA, 1997a), Step 3 initiates the problem formulation phase of the BERA. Under Navy policy/guidance (CNO, 1999; NAVFAC, 2001), the BERA begins with a preliminary step (Step 3A) in which the conservative assumptions employed in the SERA are refined and risk estimates are recalculated using the same conceptual model for the site. In addition, the re-evaluation may include consideration of other factors such as background data (CNO, 1999; NAVFAC, 2001).

The assumptions, parameter values, and methods that were modified for the Step 3A re-evaluation included:

- Risk estimates based on maximum constituent concentrations were supplemented by risk estimates based on average (arithmetic mean) constituent concentrations. In addition, BAFs and BCFs were based on, or modeled from, central tendency estimates (e.g., median or mean) from the literature as opposed to the maximum or "high-end" (e.g., 90th percentile) estimates used in the SERA for many constituents. Revised BAF/BCF values used in Step 3A are provided in Tables 5-13 and 5-14.

  In the BERA, using central tendency estimates (rather than high end or maximums) for exposure parameters such as BAFs provides a more representative estimate of potential exposures and risks to receptor populations (the focus of the assessment endpoints) of upper trophic level receptors. Because these upper trophic level species are highly mobile, they would be expected to effectively average their exposure over time as they forage within the area defining their home range (which will extend to off-site areas). Average prey concentrations at Step 3A are most appropriately estimated using central tendency estimates of media concentrations and accumulation factors. For example, the wildlife dietary exposure models contained in the Wildlife Exposure Factors Handbook (USEPA, 1993) specify the calculation of an average daily dose. Increasing the representativeness of the exposure estimates relative to population-level effects is consistent with the intent of the Step 3A evaluation. In cases where adequate spatial sampling coverage exists, mean concentrations are also appropriate for evaluating potential risks to populations of lower trophic level receptors because the members of the population are expected to be found throughout a site (where suitable habitat is present), rather than concentrated in one particular area. While effects on individual organisms might be important for some receptors, such as rare and endangered species, population- and community-level effects are typically more relevant to ecosystems. A

discussion of the uncertainties associated with the number of available samples and their spatial distribution is contained in Section 5.4.

- Central tendency estimates (e.g., mean, median, or midpoint) for body weight and ingestion rate (Table 5-15) were used to develop exposure estimates for upper trophic level receptors, rather than the minimum body weights and maximum ingestion rates used in the SERA. Central tendency estimates for these exposure parameters are more relevant for a BERA because they better represent the characteristics of a greater proportion of the individuals in the population. Populations or communities (rather than individual organisms) were emphasized during the development of the assessment endpoints for the ERA.
- In addition to the NOAELs used in the SERA, consideration is also given to risk estimates based on LOAELs.
- Constituents that were not detected, but were retained as COPCs in the SERA because no screening value was available, were not retained as COPCs at the conclusion of Step 3. These constituents are discussed in the uncertainty section (Section 5.4). Constituents that were not detected, but were retained as COPCs in the SERA because the maximum reporting limit exceeded the respective screening value, were re-evaluated in the Step 3A portion of the ERA.
- Facility-specific background concentrations were also considered in the re-evaluation for surface soil.

Only complete and significant pathways identified in the SERA were re-evaluated in Step 3A of the ERA. Similarly, only COPCs and receptors identified in the SERA as requiring further evaluation were addressed in Step 3A. Although many aspects of the estimation of exposure were modified in Step 3A (see above), the screening values (effects) used in Step 3A were the same as the values used in the SERA. Although the same basic conceptual model from the SERA was also used in Step 3A, the endpoints and risk hypotheses from the SERA were modified slightly to better reflect the Step 3A analysis (Table 5-16).

### 5.3.2 Refined Risk Characterization (Step 3A)

Based on the results of the SERA, the assessment endpoints, measurement endpoints, and risk hypotheses were modified for the Step 3A evaluation (Table 5-16). Modifications included eliminating from further consideration those assessment endpoints for which no unacceptable risk was found during the SERA and modifying the measurement endpoints to reflect the assumptions and methods used in the Step 3A evaluation.

The refined screening for surface soil is presented in Table 5-17. Receptor species HQs associated with the Step 3A food web modeling are provided in Table 5-18.

Two sets of refined risk calculations were performed for terrestrial habitats, direct exposure (lower trophic level receptors) and food web exposure (upper trophic level exposures). The following subsections summarize the calculations and the resulting HQs.

#### 5.3.2.1 Direct Exposure for Terrestrial Receptors

Mean concentrations in surface soil are compared with soil screening values in Table 5-17. Based upon this comparison, six metals (aluminum, chromium, iron, manganese, vanadium, and zinc) had HQs equaling or exceeding 1.0 based on detected concentrations and are therefore defined as COCs.

Twenty-two constituents were retained in the SERA because maximum reporting limits exceeded screening values. Mean HQs (based on the mean of one-half of the sample reporting limits) were less than 1.0 for one of these constituents (antimony) and less than or equal to 2.0 for the remaining 21 constituents (Table 5-17). Thus, it is unlikely that these constituents are present on the site at environmentally meaningful concentrations.

#### 5.3.2.2 Food Web Exposure for Terrestrial Receptors

Mean exposure doses for each upper trophic level receptor species are compared to ingestion screening values in Table 5-18. The HQ for arsenic, based on the NOAEL, exceeded 1.0 for the short-tailed shrew (HQ of 1.55). All HQs based on the LOAEL were less than 1.0 for all receptors.

### 5.3.3 Risk Evaluation

The potential for adverse effects associated with the COCs identified in Section 5.3.2 (i.e., aluminum, arsenic, chromium, iron, manganese, vanadium, and zinc) and summarized in Table 5-19 are evaluated in this section.

The mean concentrations of six detected metals (aluminum, chromium, iron, manganese, vanadium, and zinc) exceeded surface soil screening values (mercury also exceeded based upon maximum, but not mean, concentrations). Arsenic exceeded ingestion-based screening values for the short-tailed shrew based upon the NOAEL (but not the LOAEL). However, the site surface soil concentrations of arsenic, iron, and manganese did not differ from background based upon statistical means tests (see Section 3-3) and were less than or equal to upper tolerance limits (UTLs) for facility-wide background surface soils (Table 5-20) (CH2M HILL, August 2003). Although statistically different from background based upon statistical means tests, the maximum site concentrations of mercury and zinc were less than UTLs for facility-wide background soils (Table 5-20), indicating that site soils were within the background range for these constituents. For chromium and aluminum, the maximum site concentrations are less than or equal to maximum background concentrations (Table 5-20), also indicating that site surface soils are within the background range. Vanadium exceeded background but the ratio of maximum concentrations was only 1.33 (Table 5-20). Thus, with the exception of vanadium, surface soil concentrations of the metal COCs at Site 10 are within the range of facility-specific background surface soil concentrations. Given the known site history, vanadium is not likely to be a site-related constituent. Based upon this evaluation, the small size of the site, and the limited habitat quality, risks to terrestrial receptors at Site 10 are low to negligible.

## 5.4 Uncertainties

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information. The uncertainty in this ERA is mainly attributable to the following factors:

- Detection Limits - Detection limits for some analytes exceeded applicable screening values in surface soil; these constituents were not retained as COCs unless they were detected on the site. Mean HQs (based on the mean of one-half of the sample reporting limits) exceeded 1.0 for 21 undetected organic constituents but all HQs were 2.0 or less. Thus, it is unlikely that these constituents are present on the site at environmentally meaningful concentrations.

- Selection of COCs - Constituents without available screening values for a medium were not retained as COCs unless they were detected.

- Ingestion Screening Values - Data on the toxicity of many constituents to the receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical extrapolation used in ecological risk assessments because so few wildlife species have been tested directly for most constituents. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet.

  A second uncertainty related to the derivation of ingestion screening values applies to metals. Most of the toxicological studies on which the ingestion screening values for metals were based used forms of the metal (such as salts) that have high water solubility and high bioavailability to receptors. Because the analytical samples on which site-specific exposure estimates were based measured total metal, regardless of form, and these highly bioavailable forms are expected to compose only a fraction of the total metal concentration, this is likely to result in an overestimation of potential risks for these constituents.

  A third source of uncertainty associated with the derivation of ingestion screening values concerns the use of uncertainty factors. For example, NOAELs were extrapolated to LOAELs using an uncertainty factor of ten. This approach is likely to be conservative because Dourson and Stara (1983) determined that 96 percent of the constituents included in a data review had LOAEL/NOAEL ratios of five or less. The use of an uncertainty factor of 10, although potentially conservative, also serves to counter some of the uncertainty associated with interspecies extrapolations, for which a specific uncertainty factor was not used.

- Constituent Mixtures - Information on the ecotoxicological effects of constituent interactions is generally lacking, which required (as is standard for ecological risk assessments) that the constituents be evaluated on a compound-by-compound basis during the comparison to screening values. This could result in an underestimation of

risk (if there are additive or synergistic effects among constituents) or an overestimation of risks (if there are antagonistic effects among constituents).

- Receptor Species Selection - Reptiles and amphibians were selected as receptors in the ERA, but were not evaluated quantitatively even when exposure pathways were likely to be complete. Reptiles and amphibians were evaluated using other fauna (birds and mammals) as surrogates due to the general lack of taxon-specific toxicological data.

  It was also assumed that reptiles and amphibians were not exposed to significantly higher concentrations of COPCs and were not more sensitive to COPCs than other receptor species evaluated in the risk assessment. In addition, there is some uncertainty associated with the use of specific receptor species to represent larger groups of organisms (e.g., guilds).

- Food Web Exposure Modeling - Constituent concentrations in terrestrial food items (plants, earthworms, and small mammals) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and bioaccumulation factors introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a conservative (SERA) or reasonable (Step 3A) estimate of potential food web exposure concentrations.

  Another source of uncertainty is the use of default assumptions for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for many bioaccumulative constituents were readily available from the literature and were used in the ERA, the use of a default factor of 1.0 to estimate the concentration of some constituents in receptor prey items is a source of uncertainty, the effect of which cannot be quantified.

  Area use factors were assumed to equal one. This is a conservative assumption because a significant percentage of each upper trophic level receptor species time likely is spent foraging off-site in unimpacted areas or other areas where constituent concentrations are expected to be significantly lower.

- Mean Versus Maximum Media Concentrations - As is typical in an ERA, a finite number of samples of environmental media are used to develop the exposure estimates. The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based on the mean constituent concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the Wildlife Exposure Factors Handbook (USEPA, 1993), which specify the use of average media concentrations. Given the mobility of the upper trophic level receptor species used in the ERA, the use of maximum constituent concentrations (rather than mean concentrations) in the SERA to estimate the exposure via food webs is very conservative. This conservatism was reduced to more realistic levels in the values selected for use in the Step 3A evaluation.

- Comparisons to Background - Background concentrations were used to judge the site-relatedness of individual constituents in particular media. If site constituent concentrations were consistent with background levels, it was assumed that the

concentrations were not site related. There exists the possibility that concentrations below background were indeed site related, rendering the assumption false. However the impact of this possibility is minimal because constituents at levels consistent with background should exhibit no different ecological effects than commonly occurring at areas not affected by releases, regardless of their source.

- Spatial Distribution of Samples - The number and spatial distribution of surface soil samples was sufficient to adequately estimate ecological risks. Seven surface soil samples were collected within the site boundaries, the terrestrial portion of which is less than 0.05 acres in size and uniform in habitat features.

## 5.5 Ecological Risk Assessment Conclusions

In conclusion, low to negligible risks are expected at Site 10 for both upper trophic level receptors (via food web exposure) and lower trophic level receptors (via direct exposure) based upon the following:

- The concentrations of six of the seven metals COCs exceeding direct exposure screening values were within the range of concentrations in facility-wide background soils (see Section 5.3.3). Only vanadium consistently exceeded background, although the ratio of maximum site to maximum background was only 1.33. Based upon the known site history, vanadium is not likely to be a site-related constituent.
- Estimated food web exposure doses did not exceed LOAEL-based ingestion screening values for any receptor. Although arsenic exceeded NOAEL-based ingestion screening values for one receptor, arsenic was present at background concentrations.
- The relatively small size of the site and the limited terrestrial habitat quality present at Site 10 will limit potential exposures.

**Table 5-1**
**Summary Statistics for Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean[1] | Standard Deviation of Mean |
|---|---|---|---|---|---|---|
| **Metals (MG/KG)** | | | | | | |
| Aluminum | 2.03 - 2.23 | 7 / 7 | 9,830 | AS10-SS03-(0-0.5) | 7,911 | 1,612 |
| Antimony | 0.37 - 7.60 | 0 / 7 | -- | -- | 0.72 | 1.36 |
| Arsenic | 0.35 - 0.38 | 7 / 7 | 7.80 | AS10-SS03-(0-0.5) | 6.19 | 1.16 |
| Barium | 0.02 - 0.03 | 7 / 7 | 131 | AS10-SS06-(0-0.5) | 103 | 16.3 |
| Beryllium | 0.02 - 0.03 | 7 / 7 | 1.30 | AS10-SS06-(0-0.5) | 1.07 | 0.14 |
| Cadmium | 0.05 - 2.30 | 0 / 7 | -- | -- | 0.20 | 0.42 |
| Calcium | 0.58 - 0.63 | 7 / 7 | 7,140 | AS10-SS06-(0-0.5) | 4,743 | 1,171 |
| Chromium | 0.07 - 0.08 | 7 / 7 | 14.7 | AS10-SS03-(0-0.5) | 12.6 | 1.81 |
| Cobalt | 0.07 - 0.08 | 7 / 7 | 12.9 | HCS-PWA-29S | 11.6 | 1.00 |
| Copper | 0.18 - 0.20 | 7 / 7 | 18.1 | HCS-PWA-29S | 14.5 | 2.07 |
| Iron | 7.32 - 8.03 | 7 / 7 | 27,200 | HCS-PWA-29S | 22,800 | 3,558 |
| Lead | 0.14 - 0.15 | 7 / 7 | 23.4 | AS10-SS02-(0-0.5) | 20.6 | 1.89 |
| Magnesium | 0.62 - 0.68 | 7 / 7 | 1,820 | AS10-SS06-(0-0.5) | 1,429 | 278 |
| Manganese | 0.05 - 0.05 | 7 / 7 | 1,140 | AS10-SS06-(0-0.5) | 904 | 149 |
| Mercury | 0.05 - 0.06 | 5 / 7 | 0.13 | AS10-SS02-(0-0.5) | 0.09 | 0.04 |
| Nickel | 0.09 - 0.10 | 7 / 7 | 18.7 | AS10-SS06-(0-0.5) | 15.6 | 2.09 |
| Potassium | 8.45 - 9.27 | 6 / 7 | 1,780 | AS10-SS03-(0-0.5) | 1,197 | 397 |
| Selenium | 0.40 - 0.44 | 1 / 7 | 1.00 | AS10-SS02-(0-0.5) | 0.36 | 0.30 |
| Silver | 0.05 - 0.05 | 0 / 6 | -- | -- | 0.23 | 0.08 |
| Sodium | 25.6 - 101 | 2 / 7 | 137 | AS10-SS04-(0-0.5) | 66.2 | 44.0 |
| Thallium | 0.53 - 0.71 | 0 / 7 | -- | -- | 0.89 | 0.40 |
| Vanadium | 0.07 - 0.08 | 7 / 7 | 24.5 | AS10-SS06-(0-0.5) | 21.4 | 3.00 |
| Zinc | 0.12 - 0.13 | 7 / 7 | 130 | AS10-SS02-(0-0.5) | 79.4 | 26.6 |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | |
| 2,2'-Oxybis(1-chloropropane) | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2,4,5-Trichlorophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 2,4,6-Trichlorophenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |

1 - One-half of the reporting limit was used for non-detected samples when calculating the mean

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|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2,4-Dimethylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2,4-Dinitrophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 2-Chloronaphthalene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2-Chlorophenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2-Methylnaphthalene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 2-Nitrophenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 3,3'-Dichlorobenzidine | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 3-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 4,6-Dinitro-2-methylphenol | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 4-Bromophenyl-phenylether | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 4-Chloro-3-methylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 4-Chloroaniline | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 4-Chlorophenyl-phenylether | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 4-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 4-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| 4-Nitrophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| Acenaphthene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Acenaphthylene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Benzo(a)anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Benzo(a)pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Benzo(b)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Benzo(g,h,i)perylene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Benzo(k)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Butylbenzylphthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |

1 - One-half of the reporting limit was used for non-detected samples when calculating the mean

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***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean[1] | Standard Deviation of Mean |
|---|---|---|---|---|---|---|
| Carbazole | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Chrysene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Di-n-butylphthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Di-n-octylphthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Dibenz(a,h)anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Dibenzofuran | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Diethylphthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Dimethyl phthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Fluorene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Hexachlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Hexachlorobutadiene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Hexachlorocyclopentadiene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Hexachloroethane | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Indeno(1,2,3-cd)pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Isophorone | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Naphthalene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| PAH, total | -- - -- | 0 / 1 | 3,600 | HCS-PWA-29S | 3,600 | -- |
| Pentachlorophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | -- |
| Phenanthrene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Phenol | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| bis(2-Chloroethoxy)methane | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| bis(2-Chloroethyl)ether | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| bis(2-Ethylhexyl)phthalate | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| n-Nitroso-di-n-propylamine | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| n-Nitrosodiphenylamine | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| **Explosives (UG/KG)** | | | | | | |

1 - One-half of the reporting limit was used for non-detected samples when calculating the mean

**Table 5-1**
**Summary Statistics for Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean[1] | Standard Deviation of Mean |
|---|---|---|---|---|---|---|
| 2,4-Dinitrotoluene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2,6-Dinitrotoluene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| Nitrobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| **Volatile Organic Compounds (UG/KG)** | | | | | | |
| 1,1,1-Trichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,1,2,2-Tetrachloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,1,2-Trichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,1-Dichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,1-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,2,4-Trichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 1,2-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 1,2-Dichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,2-Dichloropropane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 1,3-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 1,4-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | -- |
| 2-Butanone | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 2-Hexanone | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| 4-Methyl-2-pentanone | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Acetone | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Benzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Bromodichloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Bromoform | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Bromomethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Carbon disulfide | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Carbon tetrachloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Chlorobenzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Chloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Chloroform | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |

1 - One-half of the reporting limit was used for non-detected samples when calculating the mean

**Table 5-1**
**Summary Statistics for Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean[1] | Standard Deviation of Mean |
|---|---|---|---|---|---|---|
| Chloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Dibromochloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Ethylbenzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Methylene chloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Styrene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Tetrachloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Toluene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| Trichloroethene | 12.0 - 13.0 | 2 / 6 | 3.10 | AS10-SS05-(0-0.5) | 5.15 | 1.92 |
| Vinyl chloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| cis-1,2-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| cis-1,3-Dichloropropene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| m- and p-Xylene | 12.0 - 13.0 | 5 / 6 | 5.70 | AS10-SS03-(0-0.5) | 3.57 | 1.81 |
| o-Xylene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| trans-1,2-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| trans-1,3-Dichloropropene | 12.0 - 13.0 | 0 / 6 | -- | -- | 6.42 | 0.20 |
| **Other Parameters (MG/KG)** | | | | | | |
| Total organic carbon (TOC) | 67.7 - 67.7 | 1 / 1 | 28,000 | HCS-PWA-29S | 28,000 | -- |

1 - One-half of the reporting limit was used for non-detected samples when calculating the mean

**Table 5-2**
**Preliminary Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Assessment Endpoint | Risk Hypothesis | Measurement Endpoint | Receptor |
|---|---|---|---|
| Survival, growth, and reproduction of terrestrial soil invertebrate communities | Are site-related chemical concentrations in surface soils sufficient to adversely effect soil invertebrate communities? | Comparison of maximum chemical concentrations in surface soils with soil screening values. | Soil Invertebrates (earthworms) |
| Survival, growth, and reproduction of terrestrial plant communities | Are site-related chemical concentrations in surface soils sufficient to adversely effect terrestrial plant communities? | Comparison of maximum chemical concentrations in surface soils with soil screening values. | Terrestrial plants |
| Survival, growth, and reproduction of terrestrial mammalian herbivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species populations that may consume terrestrial plants from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations. | Meadow vole |
| Survival, growth, and reproduction of terrestrial mammalian insectivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species populations that may consume terrestrial invertebrates from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations. | Short-tailed shrew |
| Survival, growth, and reproduction of terrestrial mammalian carnivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species populations that may consume small mammals from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations. | Red fox |
| Survival, growth, and reproduction of terrestrial avian omnivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species populations that may consume terrestrial plants and invertebrates from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations. | American robin |
| Survival, growth, and reproduction of terrestrial avian carnivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species populations that may consume small mammals from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum soil concentrations. | American kestrel |

**Table 5-3**
**Bioaccumulative Chemicals List (Metals and Semivolatile Organics) and Log $K_{ow}$ Values**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Log $K_{ow}$ Range | Selected log $K_{ow}$ | Reference |
|---|---|---|---|
| **Metals** | | | |
| Arsenic | -- | -- | -- |
| Cadmium | -- | -- | -- |
| Chromium | -- | -- | -- |
| Copper | -- | -- | -- |
| Lead | -- | -- | -- |
| Mercury | -- | -- | -- |
| Nickel | -- | -- | -- |
| Selenium | -- | -- | -- |
| Silver | -- | -- | -- |
| Zinc | -- | -- | -- |
| **Semivolatile Organic Compounds** | | | |
| 1,2,4-Trichlorobenzene | 3.89 to 4.23 | 4.01 | USEPA 1995b |
| 1,2-Dichlorobenzene | 3.20 to 3.61 | 3.43 | USEPA 1995b |
| 1,3-Dichlorobenzene | Not reported | 3.50 | USEPA 1996 |
| 1,4-Dichlorobenzene | 3.26 to 3.62 | 3.42 | USEPA 1995b |
| 4-Bromophenyl-Phenylether | 4.89 to 5.24 | 5.00 | USEPA 1995b |
| 4-Chlorophenyl-Phenylether | 4.08 to 5.09 | 4.95 | USEPA 1995b |
| Acenaphthene | 3.77 to 4.49 | 3.92 | USEPA 1995b |
| Acenaphthylene | Not reported | 4.10 | USEPA 1996 |
| Anthracene | 4.40 to 4.80 | 4.55 | USEPA 1995b |
| Benzo(a)anthracene | 5.61 to 5.79 | 5.70 | USEPA 1995b |
| Benzo(a)pyrene | 5.98 to 6.34 | 6.11 | USEPA 1995b |
| Benzo(b)fluoranthene | 5.79 to 6.40 | 6.20 | USEPA 1995b |
| Benzo(g,h,i)perylene | 6.58 to 7.05 | 6.70 | USEPA 1995b |
| Benzo(k)fluoranthene | 6.12 to 6.27 | 6.20 | USEPA 1995b |
| Chrysene | 5.41 to 5.79 | 5.70 | USEPA 1995b |
| Dibenz(a,h)anthracene | 6.50 to 6.88 | 6.69 | USEPA 1995b |
| Fluoranthene | 4.84 to 5.39 | 5.12 | USEPA 1995b |
| Fluorene | 4.04 to 4.40 | 4.21 | USEPA 1995b |

**Table 5-3**
**Bioaccumulative Chemicals List (Metals and Semivolatile Organics) and Log $K_{ow}$ Values**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Log $K_{ow}$ Range | Selected log $K_{ow}$ | Reference |
|---|---|---|---|
| Hexachlorobenzene | 5.23 to 6.92 | 5.89 | USEPA 1995b |
| Hexachlorobutadiene | 4.74 to 5.16 | 4.81 | USEPA 1995b |
| Hexachlorocyclopentadiene | 5.05 to 5.51 | 5.39 | USEPA 1995b |
| Hexachloroethane | 3.82 to 4.14 | 4.00 | USEPA 1995b |
| Indeno(1,2,3-cd)pyrene | 6.58 to 6.72 | 6.65 | USEPA 1995b |
| Pentachlorophenol | 5.01 to 5.24 | 5.09 | USEPA 1995b |
| Phenanthrene | 4.37 to 4.57 | 4.55 | USEPA 1995b |
| Pyrene | 4.76 to 5.52 | 5.11 | USEPA 1995b |

**Table 5-4**
**Soil Bioconcentration and Bioaccumulation Factors Used For Plants and Soil Invertebrates - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Plant BCF (dry weight) | | Soil-Invertebrate BAF (dry weight) | |
|---|---|---|---|---|
| | Value | Reference | Value | Reference |
| **Metals** | | | | |
| Arsenic | 1.10 | Bechtel Jacobs 1998 | 0.52 | Sample et al. 1998a |
| Cadmium | 3.25 | Bechtel Jacobs 1998 | 40.7 | Sample et al. 1998a |
| Chromium | 0.008 | Baes et al. 1984 | 3.16 | Sample et al. 1998a |
| Copper | 0.63 | Bechtel Jacobs 1998 | 1.53 | Sample et al. 1998a |
| Lead | 0.47 | Bechtel Jacobs 1998 | 1.52 | Sample et al. 1998a |
| Mercury | 5.00 | Bechtel Jacobs 1998 | 20.6 | Sample et al. 1998a |
| Nickel | 1.41 | Bechtel Jacobs 1998 | 4.73 | Sample et al. 1998a |
| Selenium | 3.01 | Bechtel Jacobs 1998 | 1.34 | Sample et al. 1998a |
| Silver | 0.40 | Baes et al. 1984 | 1.00 | -- |
| Zinc | 1.82 | Bechtel Jacobs 1998 | 12.9 | Sample et al. 1998a |
| **Semivolatile Organic Compounds** | | | | |
| 1,2,4-Trichlorobenzene | 0.1863 | Travis and Arms 1988 | 0.56 | Beyer 1996 |
| 1,2-Dichlorobenzene | 0.4031 | Travis and Arms 1988 | 1.00 | -- |
| 1,3-Dichlorobenzene | 0.3673 | Travis and Arms 1988 | 1.00 | -- |
| 1,4-Dichlorobenzene | 0.4085 | Travis and Arms 1988 | 1.00 | -- |
| 4-Bromophenyl-Phenylether | 0.0499 | Travis and Arms 1988 | 1.00 | -- |
| 4-Chlorophenyl-Phenylether | 0.0533 | Travis and Arms 1988 | 1.00 | -- |
| Acenaphthene | 0.2100 | Travis and Arms 1988 | 0.30 | Beyer and Stafford 1993 |
| Acenaphthylene | 0.1653 | Travis and Arms 1988 | 0.22 | Beyer and Stafford 1993 |
| Anthracene | 0.0908 | Travis and Arms 1988 | 0.32 | Beyer and Stafford 1993 |
| Benzo(a)anthracene | 0.0197 | Travis and Arms 1988 | 0.27 | Beyer and Stafford 1993 |
| Benzo(a)pyrene | 0.0114 | Travis and Arms 1988 | 0.34 | Beyer and Stafford 1993 |
| Benzo(b)fluoranthene | 0.0101 | Travis and Arms 1988 | 0.21 | Beyer and Stafford 1993 |
| Benzo(g,h,i)perylene | 0.0052 | Travis and Arms 1988 | 0.15 | Beyer and Stafford 1993 |
| Benzo(k)fluoranthene | 0.0101 | Travis and Arms 1988 | 0.21 | Beyer and Stafford 1993 |
| Chrysene | 0.0197 | Travis and Arms 1988 | 0.44 | Beyer and Stafford 1993 |
| Dibenz(a,h)anthracene | 0.0053 | Travis and Arms 1988 | 0.49 | Beyer and Stafford 1993 |
| Fluoranthene | 0.0425 | Travis and Arms 1988 | 0.37 | Beyer and Stafford 1993 |
| Fluorene | 0.1428 | Travis and Arms 1988 | 0.20 | Beyer and Stafford 1993 |

**Table 5-4**
**Soil Bioconcentration and Bioaccumulation Factors Used For Plants and Soil Invertebrates - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Plant BCF (dry weight) | | Soil-Invertebrate BAF (dry weight) | |
|---|---|---|---|---|
| | Value | Reference | Value | Reference |
| Hexachlorobenzene | 0.0153 | Travis and Arms 1988 | 1.69 | Beyer 1996 |
| Hexachlorobutadiene | 0.0642 | Travis and Arms 1988 | 1.00 | -- |
| Hexachlorocyclopentadiene | 0.0297 | Travis and Arms 1988 | 1.00 | -- |
| Hexachloroethane | 0.1888 | Travis and Arms 1988 | 1.00 | -- |
| Indeno(1,2,3-cd)pyrene | 0.0056 | Travis and Arms 1988 | 0.41 | Beyer and Stafford 1993 |
| Pentachlorophenol | 0.0443 | Travis and Arms 1988 | 8.00 | van Gestel and Ma 1988 |
| Phenanthrene | 0.0908 | Travis and Arms 1988 | 0.28 | Beyer and Stafford 1993 |
| Pyrene | 0.0431 | Travis and Arms 1988 | 0.39 | Beyer and Stafford 1993 |

**Table 5-5**
**Soil Bioaccumulation Factors Used For Small Mammals - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Mouse BAF (dry weight) | | Soil-Vole BAF (dry weight) | | Soil-Shrew BAF (dry weight) | |
|---|---|---|---|---|---|---|
| | Value | Reference | Value | Reference | Value | Reference |
| **Metals** | | | | | | |
| Arsenic | 0.014 | Sample et al. 1998b | 0.016 | Sample et al. 1998b | 0.015 | Sample et al. 1998b |
| Cadmium | 0.462 | Sample et al. 1998b | 0.448 | Sample et al. 1998b | 7.017 | Sample et al. 1998b |
| Chromium | 0.349 | Sample et al. 1998b | 0.309 | Sample et al. 1998b | 0.333 | Sample et al. 1998b |
| Copper | 0.554 | Sample et al. 1998b | 1.290 | Sample et al. 1998b | 1.117 | Sample et al. 1998b |
| Lead | 0.286 | Sample et al. 1998b | 0.187 | Sample et al. 1998b | 0.339 | Sample et al. 1998b |
| Mercury | 0.130 | Sample et al. 1998b | 0.192 | Sample et al. 1998b | 0.192 | Sample et al. 1998b |
| Nickel | 0.589 | Sample et al. 1998b | 0.898 | Sample et al. 1998b | 0.578 | Sample et al. 1998b |
| Selenium | 1.263 | Sample et al. 1998b | 0.155 | Sample et al. 1998b | 1.187 | Sample et al. 1998b |
| Silver | -- | see text | -- | see text | -- | see text |
| Zinc | 2.782 | Sample et al. 1998b | 2.317 | Sample et al. 1998b | 2.901 | Sample et al. 1998b |
| **Semivolatile Organics** | | | | | | |
| 1,2,4-Trichlorobenzene | -- | see text | -- | see text | -- | see text |
| 1,2-Dichlorobenzene | -- | see text | -- | see text | -- | see text |
| 1,3-Dichlorobenzene | -- | see text | -- | see text | -- | see text |
| 1,4-Dichlorobenzene | -- | see text | -- | see text | -- | see text |
| 4-Bromophenyl-phenylether | -- | see text | -- | see text | -- | see text |
| 4-Chlorophenyl-phenylether | -- | see text | -- | see text | -- | see text |
| Acenaphthene | -- | see text | -- | see text | -- | see text |
| Acenaphthylene | -- | see text | -- | see text | -- | see text |
| Anthracene | -- | see text | -- | see text | -- | see text |
| Benzo(a)anthracene | -- | see text | -- | see text | -- | see text |
| Benzo(a)pyrene | -- | see text | -- | see text | -- | see text |
| Benzo(b)fluoranthene | -- | see text | -- | see text | -- | see text |
| Benzo(g,h,i)perylene | -- | see text | -- | see text | -- | see text |
| Benzo(k)fluoranthene | -- | see text | -- | see text | -- | see text |
| Chrysene | -- | see text | -- | see text | -- | see text |
| Dibenz(a,h)anthracene | -- | see text | -- | see text | -- | see text |
| Fluoranthene | -- | see text | -- | see text | -- | see text |
| Fluorene | -- | see text | -- | see text | -- | see text |

**Table 5-5**
**Soil Bioaccumulation Factors Used For Small Mammals - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Mouse BAF (dry weight) | | Soil-Vole BAF (dry weight) | | Soil-Shrew BAF (dry weight) | |
|---|---|---|---|---|---|---|
| | Value | Reference | Value | Reference | Value | Reference |
| Hexachlorobenzene | -- | see text | -- | see text | -- | see text |
| Hexachlorobutadiene | -- | see text | -- | see text | -- | see text |
| Hexachlorocyclopentadiene | -- | see text | -- | see text | -- | see text |
| Hexachloroethane | -- | see text | -- | see text | -- | see text |
| Indeno(1,2,3-cd)pyrene | -- | see text | -- | see text | -- | see text |
| Pentachlorophenol | -- | see text | -- | see text | -- | see text |
| Phenanthrene | -- | see text | -- | see text | -- | see text |
| Pyrene | -- | see text | -- | see text | -- | see text |

**Table 5-6**
**Exposure Parameters for Upper Trophic Level Ecological Receptors - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Receptor | Body Weight (kg) | | Water Ingestion Rate (L/day) | | Food Ingestion Rate (kg/day - dry) | |
|---|---|---|---|---|---|---|
| | Value | Reference | Value | Reference | Value | Reference |
| **Birds** | | | | | | |
| American kestrel | 0.0830 | Palmer 1988 | 0.01685 | allometric equation | 0.01478 | USEPA 1993 |
| American robin | 0.0635 | USEPA 1993 | 0.01287 | allometric equation | 0.00735 | Levey and Karasov 1989 |
| **Mammals** | | | | | | |
| Meadow vole | 0.0300 | Silva and Downing 1995 | 0.01334 | USEPA 1993 | 0.00310 | USEPA 1993 |
| Red fox | 3.1700 | Silva and Downing 1995 | 0.41154 | allometric equation | 0.15584 | Sample and Suter 1994 |
| Short-tailed shrew | 0.0133 | USEPA 1993 | 0.00475 | USEPA 1993 | 0.00189 | USEPA 1993 |

**Table 5-6**
**Exposure Parameters for Upper Trophic Level Ecological Receptors - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Receptor | Dietary Composition (percent) | | | | | | | Soil/ Sediment Ingestion (percent) | |
|---|---|---|---|---|---|---|---|---|---|
| | Terr. Plants | Soil Invert. | Small Mammals | Fish/ Frogs | Aquatic Plants | Aquatic Invert. | Reference | Value | Reference |
| **Birds** | | | | | | | | | |
| American kestrel | 0 | 0 | 98.0 | 0 | 0 | 0 | USEPA 1993 | 2.0 | Assumed based on diet |
| American robin | 51.6 | 43.6 | 0 | 0 | 0 | 0 | Martin et al. 1951 | 4.8 | Sample and Suter 1994 |
| **Mammals** | | | | | | | | | |
| Meadow vole | 97.6 | 0 | 0 | 0 | 0 | 0 | USEPA 1993 | 2.4 | Beyer et al. 1994 |
| Red fox | 0 | 0 | 97.2 | 0 | 0 | 0 | USEPA 1993 | 2.8 | Beyer et al. 1994 |
| Short-tailed shrew | 0 | 87.0 | 0 | 0 | 0 | 0 | USEPA 1993; Sample and Suter 1994 | 13.0 | Sample and Suter 1994 |

**Table 5-7**
**Surface Soil Screening Values Used in the ERA**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Screening Value | Units | Reference | Hardness | pH | TOC (%) |
|---|---|---|---|---|---|---|
| 1,1,1-Trichloroethane | 300 | ug/kg | USEPA 1995a | | | |
| 1,1,2,2-Tetrachloroethane | 300 | ug/kg | USEPA 1995a | | | |
| 1,1,2-Trichloroethane | 300 | ug/kg | USEPA 1995a | | | |
| 1,1-Dichloroethane | 300 | ug/kg | USEPA 1995a | | | |
| 1,2,4-Trichlorobenzene | 1,270 | ug/kg | Efroymson et al. 1997b | | | |
| 1,2-Dichlorobenzene | 100 | ug/kg | USEPA 1995a | | | |
| 1,2-Dichloroethane | 401 | ug/kg | MHSPE 1994 | | | 2 |
| 1,2-Dichloropropane | 38,800 | ug/kg | Efroymson et al. 1997b | | | |
| 1,4-Dichlorobenzene | 1,280 | ug/kg | Efroymson et al. 1997b | | | |
| 2,4,5-Trichlorophenol | 430 | ug/kg | Efroymson et al. 1997a | | | |
| 2,4,6-Trichlorophenol | 580 | ug/kg | Efroymson et al. 1997b | | | |
| 2,4-Dichlorophenol | 13,400 | ug/kg | Efroymson et al. 1997b | | | |
| 2,4-Dimethylphenol | 100 | ug/kg | USEPA 1995a | | | |
| 2,4-Dinitrophenol | 20,000 | ug/kg | Efroymson et al. 1997a | | | |
| 2-Chloronaphthalene | 1,033 | ug/kg | MHSPE 1994 | | | 2 |
| 2-Chlorophenol | 100 | ug/kg | USEPA 1995a | | | |
| 2-Methylphenol | 100 | ug/kg | USEPA 1995a | | | |
| 4-Methyl-2-pentanone | 10,000 | ug/kg | USEPA 1995a (with safety factor of 10) | | | |
| 4-Methylphenol | 100 | ug/kg | USEPA 1995a | | | |
| 4-Nitrophenol | 380 | ug/kg | Efroymson et al. 1997b | | | |
| Acenaphthene | 2,500 | ug/kg | Efroymson et al. 1997a | | | |
| Acenaphthylene | 100 | ug/kg | USEPA 1995a | | | |
| Aluminum | 50.0 | mg/kg | Efroymson et al. 1997a | | | |
| Anthracene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Antimony | 5.00 | mg/kg | Efroymson et al. 1997a | | | |
| Arsenic | 60.0 | mg/kg | Efroymson et al. 1997b | | | |
| Barium | 500 | mg/kg | Efroymson et al. 1997a | | | |
| Benzene | 105 | ug/kg | MHSPE 1994 | | | 2 |
| Benzo(a)anthracene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Benzo(a)pyrene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Benzo(b)fluoranthene | 100 | ug/kg | USEPA 1995a | | | |

**Table 5-7**
**Surface Soil Screening Values Used in the ERA**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Screening Value | Units | Reference | Hardness | pH | TOC (%) |
|---|---|---|---|---|---|---|
| Benzo(g,h,i)perylene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Benzo(k)fluoranthene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Beryllium | 10.0 | mg/kg | Efroymson et al. 1997a | | | |
| bis(2-ethylhexyl)phthalate | 10,000 | ug/kg | IPCS 1992 | | | |
| Bromodichloromethane | 45,000 | ug/kg | USEPA 1995a (with safety factor of 10) | | | |
| Bromoform (Tribromomethane) | 114,700 | ug/kg | USEPA 1995a (with safety factor of 10) | | | |
| Cadmium | 4.00 | mg/kg | Efroymson et al. 1997a | | | |
| Carbon tetrachloride | 1,000,000 | ug/kg | Efroymson et al. 1997b | | | |
| Chlorobenzene | 2,400 | ug/kg | Efroymson et al. 1997b | | | |
| Chloroform | 1,000 | ug/kg | MHSPE 1994 | | | 2 |
| Chromium | 0.40 | mg/kg | Efroymson et al. 1997b | | | |
| Chrysene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| cis-1,2-Dichloroethene | 300 | ug/kg | USEPA 1995a | | | |
| cis-1,3-Dichloropropene | 300 | ug/kg | USEPA 1995a | | | |
| Cobalt | 100 | mg/kg | USEPA 1995a | | | |
| Copper | 50.0 | mg/kg | Efroymson et al. 1997b | | | |
| Dibenz(a,h)anthracene | 100 | ug/kg | USEPA 1995a | | | |
| Diethylphthalate | 13,400 | ug/kg | Efroymson et al. 1997a | | | |
| Dimethyl phthalate | 10,640 | ug/kg | Efroymson et al. 1997b | | | |
| Di-n-butylphthalate | 200,000 | ug/kg | Efroymson et al. 1997a | | | |
| Ethylbenzene | 5,005 | ug/kg | MHSPE 1994 | | | 2 |
| Fluoranthene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Fluorene | 1,700 | ug/kg | Efroymson et al. 1997b | | | |
| Hexachlorocyclopentadiene | 1,000 | ug/kg | Efroymson et al. 1997a | | | |
| Indeno(1,2,3-cd)pyrene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Iron | 200 | mg/kg | Efroymson et al. 1997b | | | |
| Lead | 50.0 | mg/kg | Efroymson et al. 1997a | | | |
| Manganese | 500 | mg/kg | Efroymson et al. 1997a | | | |
| Mercury | 0.10 | mg/kg | Efroymson et al. 1997b | | | |
| Methylene chloride | 1,001 | ug/kg | MHSPE 1994 | | | 2 |
| Naphthalene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |

**Table 5-7**
**Surface Soil Screening Values Used in the ERA**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Screening Value | Units | Reference | Hardness | pH | TOC (%) |
|---|---|---|---|---|---|---|
| Nickel | 30.0 | mg/kg | Efroymson et al. 1997a | | | |
| Nitrobenzene | 2,260 | ug/kg | Efroymson et al. 1997b | | | |
| n-Nitrosodiphenylamine | 1,090 | ug/kg | Efroymson et al. 1997b | | | |
| PAH, total | 4,100 | ug/kg | MHSPE 1994 | | | 2 |
| Pentachlorophenol | 3,000 | ug/kg | Efroymson et al. 1997a | | | |
| Phenanthrene | see PAH, total; 100 | ug/kg | MHSPE 1994; USEPA 1995a | | | |
| Phenol | 1,880 | ug/kg | Efroymson et al. 1997b | | | |
| Pyrene | 100 | ug/kg | USEPA 1995a | | | |
| Selenium | 1.80 | mg/kg | USEPA 1995a | | | |
| Silver | 2.00 | mg/kg | Efroymson et al. 1997a | | | |
| Styrene | 10,010 | ug/kg | MHSPE 1994 | | | 2 |
| Tetrachloroethene | 401 | ug/kg | MHSPE 1994 | | | 2 |
| Thallium | 1.00 | mg/kg | Efroymson et al. 1997a | | | |
| Toluene | 13,005 | ug/kg | MHSPE 1994 | | | 2 |
| trans-1,2-Dichloroethene | 300 | ug/kg | USEPA 1995a | | | |
| trans-1,3-Dichloropropene | 300 | ug/kg | USEPA 1995a | | | |
| Trichloroethene | 6,000 | ug/kg | MHSPE 1994 | | | 2 |
| Vanadium | 2.00 | mg/kg | Efroymson et al. 1997a | | | |
| Vinyl chloride | 300 | ug/kg | USEPA 1995a | | | |
| Xylenes, total | 2,505 | ug/kg | MHSPE 1994 | | | 2 |
| Zinc | 50.0 | mg/kg | Efroymson et al. 1997a | | | |

**Table 5-8**
**Ingestion Screening Values for Mammals**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistic Laboratory, Rocket Center, West Virginia***

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | |
| Arsenic | mouse | 0.03 | 3 generations | oral in water | reproduction | 1.26 | 0.13 | Sample et al. 1996 |
| Cadmium | rat | 0.30 | 6 weeks | oral (gavage) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Cadmium | dog | 10.0 | 3 months | oral | reproduction | 7.50 | 0.75 | ATSDR 1993 |
| Chromium | rat | 0.35 | 3 months | oral in water | mortality | 131 | 13.1 | Sample et al. 1996 |
| Copper | mink | 1.00 | 357 days | oral in diet | reproduction | 15.14 | 11.7 | Sample et al. 1996 |
| Lead | rat | 0.35 | 3 generations | oral in diet | reproduction | 80.0 | 8.00 | Sample et al. 1996 |
| Mercury | rat | 0.35 | 3 generations | oral in diet | reproduction | 0.16 | 0.032 | Sample et al. 1996 |
| Mercury | mink | 1.00 | 93 days | oral in diet | mortality/weight loss | 0.25 | 0.15 | Sample et al. 1996 |
| Nickel | rat | 0.35 | 3 generations | oral in diet | reproduction | 80.0 | 40.0 | Sample et al. 1996 |
| Selenium | rat | 0.35 | 1 year | oral in water | reproduction | 0.33 | 0.20 | Sample et al. 1996 |
| Silver | rat | 0.35 | 2 weeks | oral in water | mortality | 181 | 18.1 | ATSDR 1990 |
| Zinc | rat | 0.35 | GD 1-16 | oral in diet | reproduction | 320 | 160 | Sample et al. 1996 |
| Zinc | mink | 1.00 | 25 weeks | oral | reproduction | 208 | 20.8 | ATSDR 1992 |
| **Semivolatile Organic Compounds** | | | | | | | | |
| 1,2,4-Trichlorobenzene | rat | 0.35 | 3 generations | oral in water | reproduction | 106 | 53 | Coulston and Kolbye 1994 |
| 1,2-Dichlorobenzene | rat | 0.35 | chronic | oral (gavage) | liver/kidney | 857 | 85.7 | Coulston and Kolbye 1994 |
| 1,3-Dichlorobenzene | rat | 0.35 | chronic | oral (gavage) | liver/kidney | 857 | 85.7 | Coulston and Kolbye 1994 |
| 1,4-Dichlorobenzene | rat | 0.35 | GD 6-15 | oral (gavage) | reproduction | 500 | 250 | Coulston and Kolbye 1994 |
| 4-Bromophenyl-phenylether | -- | -- | -- | -- | -- | NA | NA | -- |
| 4-Chlorophenyl-phenylether | -- | -- | -- | -- | -- | NA | NA | -- |
| Acenaphthene | mouse | 0.03 | 13 weeks | oral (gavage) | reproduction | 3,500 | 350 | ATSDR 1995 |
| Acenaphthylene | mouse | 0.03 | 13 weeks | oral (gavage) | reproduction | 3,500 | 350 | ATSDR 1995 |
| Anthracene | mouse | 0.03 | 13 weeks | oral (gavage) | reproduction | 10,000 | 1,000 | ATSDR 1995 |
| Benzo(a)anthracene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Benzo(a)pyrene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Benzo(b)fluoranthene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Benzo(g,h,i)perylene | mouse | 0.03 | 19 to 29 days | oral in diet | reproduction | 1,330 | 133 | ATSDR 1995 |
| Benzo(k)fluoranthene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Chrysene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |

**Table 5-8**
**Ingestion Screening Values for Mammals**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistic Laboratory, Rocket Center, West Virginia***

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|
| Dibenz(a,h)anthracene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Fluoranthene | mouse | 0.03 | 13 weeks | oral (gavage) | hepatic | 1,250 | 125 | ATSDR 1995 |
| Fluorene | mouse | 0.03 | 13 weeks | oral (gavage) | hematological | 1,250 | 125 | ATSDR 1995 |
| Hexachlorobenzene | rat | 0.35 | 2 years | oral | reproduction | 16.0 | 1.60 | ATSDR 1989 |
| Hexachlorobutadiene | rat | 0.35 | 90 days + | oral | reproduction | 20.0 | 2.00 | IPCS 1994 |
| Hexachlorocyclopentadiene | rat | 0.35 | GD 6-15 | oral | reproduction | 30.0 | 10.0 | USEPA 1984 |
| Hexachloroethane | -- | -- | -- | -- | -- | NA | NA | -- |
| Indeno(1,2,3-cd)pyrene | mouse | 0.03 | GD 7-16 | oral (intubation) | reproduction | 10.0 | 1.00 | Sample et al. 1996 |
| Pentachlorophenol | rat | 0.35 | up to 24 months | oral in diet | reproduction | 30.0 | 3.00 | Coulston and Kolbye 1994 |
| Phenanthrene | mouse | 0.03 | 19 to 29 days | oral in diet | reproduction | 1,330 | 133 | ATSDR 1995 |
| Pyrene | mouse | 0.03 | 19 to 29 days | oral in diet | reproduction | 1,330 | 133 | ATSDR 1995 |

**Table 5-9**
**Ingestion Screening Values for Birds**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | |
| Arsenic | brown-headed cowbird | 0.049 | 7 months | oral in diet | mortality | 7.38 | 2.46 | Sample et al. 1996 |
| Arsenic | mallard | 1.00 | 128 days | oral in diet | mortality | 12.8 | 5.14 | Sample et al. 1996 |
| Cadmium | mallard | 1.153 | 90 days | oral in diet | reproduction | 20.0 | 1.45 | Sample et al. 1996 |
| Chromium | American black duck | 1.25 | 10 months | oral in diet | reproduction | 5.00 | 1.00 | Sample et al. 1996 |
| Copper | chicks | 0.534 | 10 weeks | oral in diet | growth/mortality | 61.7 | 47.0 | Sample et al. 1996 |
| Lead | Japanese quail | 0.15 | 12 weeks | oral in diet | reproduction | 11.3 | 1.13 | Sample et al. 1996 |
| Lead | American kestrel | 0.13 | 7 months | oral in diet | reproduction | 38.5 | 3.85 | Sample et al. 1996 |
| Mercury | Japanese quail | 0.15 | 1 year | oral in diet | reproduction | 0.90 | 0.45 | Sample et al. 1996 |
| Mercury | mallard | 1.00 | 3 generations | oral in diet | reproduction | 0.078 | 0.026 | USEPA 1997b |
| Nickel | mallard | 0.782 | 90 days | oral in diet | growth/mortality | 107 | 77.4 | Sample et al. 1996 |
| Selenium | mallard | 1.00 | 100 days | oral in diet | reproduction | 0.80 | 0.40 | Sample et al. 1996 |
| Selenium | screech owl | 0.20 | 13.7 weeks | oral in diet | reproduction | 1.50 | 0.44 | Sample et al. 1996 |
| Silver | mallard | 1.00 | 14 days | oral | ? | 1,780 | 178 | USEPA 1999 |
| Zinc | chicken | 1.935 | 44 weeks | oral in diet | reproduction | 131 | 14.5 | Sample et al. 1996 |
| **Semivolatile Organic Compounds** | | | | | | | | |
| 1,2,4-Trichlorobenzene | -- | -- | -- | -- | -- | NA | NA | -- |
| 1,2-Dichlorobenzene | northern bobwhite | 0.157 | 14 days | oral (gavage) | growth/mortality | 2,500 | 250 | Grimes and Jaber 1989 |
| 1,3-Dichlorobenzene | northern bobwhite | 0.157 | 14 days | oral (gavage) | growth/mortality | 2,500 | 250 | Grimes and Jaber 1989 |
| 1,4-Dichlorobenzene | northern bobwhite | 0.157 | 14 days | oral (gavage) | growth/mortality | 2,500 | 250 | Grimes and Jaber 1989 |
| 4-Bromophenyl-Phenylether | -- | -- | -- | -- | -- | NA | NA | -- |
| 4-Chlorophenyl-Phenylether | -- | -- | -- | -- | -- | NA | NA | -- |
| Acenaphthene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Acenaphthylene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Anthracene | mallard | 1.043 | 7 months | oral in diet | hepatic | 228 | 22.8 | Patton and Dieter 1980 |
| Benzo(a)anthracene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Benzo(a)pyrene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Benzo(b)fluoranthene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Benzo(g,h,i)perylene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Benzo(k)fluoranthene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |

**Table 5-9**
**Ingestion Screening Values for Birds**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Test Organism | Body Weight (kg) | Duration | Exposure Route | Effect/Endpoint | LOAEL (mg/kg/d) | NOAEL (mg/kg/d) | Reference |
|---|---|---|---|---|---|---|---|---|
| Chrysene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Dibenz(a,h)anthracene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Fluoranthene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Fluorene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Hexachlorobenzene | Japanese quail | 0.19 | ? | oral | reproduction | 0.80 | 0.08 | Coulston and Kolbye 1994 |
| Hexachlorobutadiene | Japanese quail | 0.19 | 90 days | oral | reproduction | 8.00 | 2.50 | Coulston and Kolbye 1994; IPCS 1994 |
| Hexachlorocyclopentadiene | -- | -- | -- | -- | -- | NA | NA | -- |
| Hexachloroethane | -- | -- | -- | -- | -- | NA | NA | -- |
| Indeno(1,2,3-cd)pyrene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Pentachlorophenol | chicken | 1.50 | 8 weeks | oral | growth | 200 | 100 | Eisler 1989 |
| Phenanthrene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |
| Pyrene | chicken | 1.50 | 34 days | oral in diet | reproduction | 395 | 39.5 | Rigdon and Neal 1963a,b |

**Table 5-10**
**Step 2 Screening Statistics - Site 10 - Surface Soil**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Mineral County, WV***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Screening Value | Frequency of Exceedance | Maximum Hazard Quotient[1] | COPC? |
|---|---|---|---|---|---|---|---|---|
| **Inorganics (MG/KG)** | | | | | | | | |
| Aluminum | 2.03 - 2.23 | 7 / 7 | 9,830 | AS10-SS03-(0-0.5) | 50.0 | 7 / 7 | 197 | YES |
| Antimony | 0.37 - 7.60 | 0 / 7 | -- | -- | 5.00 | -- / -- | 1.52 | YES |
| Arsenic | 0.35 - 0.38 | 7 / 7 | 7.80 | AS10-SS03-(0-0.5) | 60.0 | 0 / 7 | 0.13 | NO |
| Barium | 0.02 - 0.03 | 7 / 7 | 131 | AS10-SS06-(0-0.5) | 500 | 0 / 7 | 0.26 | NO |
| Beryllium | 0.02 - 0.03 | 7 / 7 | 1.30 | AS10-SS06-(0-0.5) | 10.0 | 0 / 7 | 0.13 | NO |
| Cadmium | 0.05 - 2.30 | 0 / 7 | -- | -- | 4.00 | -- / -- | 0.57 | NO |
| Calcium [2] | 0.58 - 0.63 | 7 / 7 | 7,140 | AS10-SS06-(0-0.5) | NSV | -- / -- | NSV | NO |
| Chromium | 0.07 - 0.08 | 7 / 7 | 14.7 | AS10-SS03-(0-0.5) | 0.40 | 7 / 7 | 36.8 | YES |
| Cobalt | 0.07 - 0.08 | 7 / 7 | 12.9 | HCS-PWA-29S | 100 | 0 / 7 | 0.13 | NO |
| Copper | 0.18 - 0.20 | 7 / 7 | 18.1 | HCS-PWA-29S | 50.0 | 0 / 7 | 0.36 | NO |
| Iron | 7.32 - 8.03 | 7 / 7 | 27,200 | HCS-PWA-29S | 200 | 7 / 7 | 136 | YES |
| Lead | 0.14 - 0.15 | 7 / 7 | 23.4 | AS10-SS02-(0-0.5) | 50.0 | 0 / 7 | 0.47 | NO |
| Magnesium [2] | 0.62 - 0.68 | 7 / 7 | 1,820 | AS10-SS06-(0-0.5) | NSV | -- / -- | NSV | NO |
| Manganese | 0.05 - 0.05 | 7 / 7 | 1,140 | AS10-SS06-(0-0.5) | 500 | 7 / 7 | 2.28 | YES |
| Mercury | 0.05 - 0.06 | 5 / 7 | 0.13 | AS10-SS02-(0-0.5) | 0.10 | 4 / 7 | 1.30 | YES |
| Nickel | 0.09 - 0.10 | 7 / 7 | 18.7 | AS10-SS06-(0-0.5) | 30.0 | 0 / 7 | 0.62 | NO |
| Potassium [2] | 8.45 - 9.27 | 6 / 7 | 1,780 | AS10-SS03-(0-0.5) | NSV | -- / -- | NSV | NO |
| Selenium | 0.40 - 0.44 | 1 / 7 | 1.00 | AS10-SS02-(0-0.5) | 1.80 | 0 / 7 | 0.56 | NO |
| Silver | 0.05 - 0.05 | 0 / 6 | -- | -- | 2.00 | -- / -- | 0.03 | NO |
| Sodium [2] | 25.6 - 101 | 2 / 7 | 137 | AS10-SS04-(0-0.5) | NSV | -- / -- | NSV | NO |
| Thallium | 0.53 - 0.71 | 0 / 7 | -- | -- | 1.00 | -- / -- | 0.71 | NO |
| Vanadium | 0.07 - 0.08 | 7 / 7 | 24.5 | AS10-SS06-(0-0.5) | 2.00 | 7 / 7 | 12.3 | YES |
| Zinc | 0.12 - 0.13 | 7 / 7 | 130 | AS10-SS02-(0-0.5) | 50.0 | 7 / 7 | 2.60 | YES |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | |
| 2,2'-Oxybis(1-chloropropane) | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 2,4,5-Trichlorophenol | 960 - 960 | 0 / 1 | -- | -- | 430 | -- / -- | 2.23 | YES |
| 2,4,6-Trichlorophenol | 400 - 400 | 0 / 1 | -- | -- | 580 | -- / -- | 0.69 | NO |

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Macronutrient - Not considered to be a COPC

**Table 5-10**
**Step 2 Screening Statistics - Site 10 - Surface Soil**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Mineral County, WV***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Screening Value | Frequency of Exceedance | Maximum Hazard Quotient[1] | COPC? |
|---|---|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | 400 - 400 | 0 / 1 | -- | -- | 13,400 | -- / -- | 0.03 | NO |
| 2,4-Dimethylphenol | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| 2,4-Dinitrophenol | 960 - 960 | 0 / 1 | -- | -- | 20,000 | -- / -- | 0.05 | NO |
| 2-Chloronaphthalene | 400 - 400 | 0 / 1 | -- | -- | 1,033 | -- / -- | 0.39 | NO |
| 2-Chlorophenol | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| 2-Methylnaphthalene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 2-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| 2-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 2-Nitrophenol | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 3,3'-Dichlorobenzidine | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 3-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4,6-Dinitro-2-methylphenol | 960 - 960 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Bromophenyl-phenylether | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Chloro-3-methylphenol | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Chloroaniline | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Chlorophenyl-phenylether | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| 4-Nitroaniline | 960 - 960 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Nitrophenol | 960 - 960 | 0 / 1 | -- | -- | 380 | -- / -- | 2.53 | YES |
| Acenaphthene | 400 - 400 | 0 / 1 | -- | -- | 2,500 | -- / -- | 0.16 | NO |
| Acenaphthylene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Anthracene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Benzo(a)anthracene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Benzo(a)pyrene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Benzo(b)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Benzo(g,h,i)perylene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Benzo(k)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Butylbenzylphthalate | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |

NSV - No Screening Value
1 - Shaded cells indicate hazard quotient based on reporting limits
2 - Macronutrient - Not considered to be a COPC

**Table 5-10**
**Step 2 Screening Statistics - Site 10 - Surface Soil**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Mineral County, WV***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Screening Value | Frequency of Exceedance | Maximum Hazard Quotient[1] | COPC? |
|---|---|---|---|---|---|---|---|---|
| Carbazole | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Chrysene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Di-n-butylphthalate | 400 - 400 | 0 / 1 | -- | -- | 200,000 | -- / -- | 0.002 | NO |
| Di-n-octylphthalate | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Dibenz(a,h)anthracene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Dibenzofuran | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Diethylphthalate | 400 - 400 | 0 / 1 | -- | -- | 13,400 | -- / -- | 0.03 | NO |
| Dimethyl phthalate | 400 - 400 | 0 / 1 | -- | -- | 10,640 | -- / -- | 0.04 | NO |
| Fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Fluorene | 400 - 400 | 0 / 1 | -- | -- | 1,700 | -- / -- | 0.24 | NO |
| Hexachlorobenzene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Hexachlorobutadiene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Hexachlorocyclopentadiene | 400 - 400 | 0 / 1 | -- | -- | 1,000 | -- / -- | 0.40 | NO |
| Hexachloroethane | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Indeno(1,2,3-cd)pyrene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Isophorone | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Naphthalene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| PAH, total | -- - -- | 0 / 1 | 3,600 | HCS-PWA-29S | 4,100 | -- / -- | 0.88 | NO |
| Pentachlorophenol | 960 - 960 | 0 / 1 | -- | -- | 3,000 | -- / -- | 0.32 | NO |
| Phenanthrene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| Phenol | 400 - 400 | 0 / 1 | -- | -- | 1,880 | -- / -- | 0.21 | NO |
| Pyrene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| bis(2-Chloroethoxy)methane | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| bis(2-Chloroethyl)ether | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| bis(2-Ethylhexyl)phthalate | 400 - 400 | 0 / 1 | -- | -- | 10,000 | -- / -- | 0.04 | NO |
| n-Nitroso-di-n-propylamine | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| n-Nitrosodiphenylamine | 400 - 400 | 0 / 1 | -- | -- | 1,090 | -- / -- | 0.37 | NO |
| **Explosives (UG/KG)** | | | | | | | | |

NSV - No Screening Value
1 - Shaded cells indicate hazard quotient based on reporting limits
2 - Macronutrient - Not considered to be a COPC

**Table 5-10**
**Step 2 Screening Statistics - Site 10 - Surface Soil**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Mineral County, WV***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Screening Value | Frequency of Exceedance | Maximum Hazard Quotient[1] | COPC? |
|---|---|---|---|---|---|---|---|---|
| 2,4-Dinitrotoluene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 2,6-Dinitrotoluene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| Nitrobenzene | 400 - 400 | 0 / 1 | -- | -- | 2,260 | -- / -- | 0.18 | NO |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | |
| 1,1,1-Trichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| 1,1,2,2-Tetrachloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| 1,1,2-Trichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| 1,1-Dichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| 1,1-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| 1,2,4-Trichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 1,270 | -- / -- | 0.31 | NO |
| 1,2-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 100 | -- / -- | 4.00 | YES |
| 1,2-Dichloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 401 | -- / -- | 0.03 | NO |
| 1,2-Dichloropropane | 12.0 - 13.0 | 0 / 6 | -- | -- | 38,800 | -- / -- | 0.0003 | NO |
| 1,3-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | NSV | -- / -- | NSV | NO |
| 1,4-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 1,280 | -- / -- | 0.31 | NO |
| 2-Butanone | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| 2-Hexanone | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| 4-Methyl-2-pentanone | 12.0 - 13.0 | 0 / 6 | -- | -- | 10,000 | -- / -- | 0.001 | NO |
| Acetone | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Benzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 105 | -- / -- | 0.12 | NO |
| Bromodichloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | 45,000 | -- / -- | 0.0003 | NO |
| Bromoform | 12.0 - 13.0 | 0 / 6 | -- | -- | 114,700 | -- / -- | 0.0001 | NO |
| Bromomethane | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Carbon disulfide | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Carbon tetrachloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 1,000,000 | -- / -- | 0.00001 | NO |
| Chlorobenzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 2,400 | -- / -- | 0.01 | NO |
| Chloroethane | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Chloroform | 12.0 - 13.0 | 0 / 6 | -- | -- | 1,000 | -- / -- | 0.01 | NO |

NSV - No Screening Value
1 - Shaded cells indicate hazard quotient based on reporting limits
2 - Macronutrient - Not considered to be a COPC

**Table 5-10**
**Step 2 Screening Statistics - Site 10 - Surface Soil**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Mineral County, WV***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Screening Value | Frequency of Exceedance | Maximum Hazard Quotient[1] | COPC? |
|---|---|---|---|---|---|---|---|---|
| Chloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Dibromochloromethane | 12.0 - 13.0 | 0 / 6 | -- | -- | NSV | -- / -- | NSV | NO |
| Ethylbenzene | 12.0 - 13.0 | 0 / 6 | -- | -- | 5,005 | -- / -- | 0.003 | NO |
| Methylene chloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 1,001 | -- / -- | 0.01 | NO |
| Styrene | 12.0 - 13.0 | 0 / 6 | -- | -- | 10,010 | -- / -- | 0.001 | NO |
| Tetrachloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 401 | -- / -- | 0.03 | NO |
| Toluene | 12.0 - 13.0 | 0 / 6 | -- | -- | 13,005 | -- / -- | 0.001 | NO |
| Trichloroethene | 12.0 - 13.0 | 2 / 6 | 3.10 | AS10-SS05-(0-0.5) | 6,000 | 0 / 6 | 0.001 | NO |
| Vinyl chloride | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| cis-1,2-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| cis-1,3-Dichloropropene | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| m- and p-Xylene | 12.0 - 13.0 | 5 / 6 | 5.70 | AS10-SS03-(0-0.5) | 2,505 | -- / -- | 0.002 | NO |
| o-Xylene | 12.0 - 13.0 | 0 / 6 | -- | -- | 2,505 | -- / -- | 0.01 | NO |
| trans-1,2-Dichloroethene | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |
| trans-1,3-Dichloropropene | 12.0 - 13.0 | 0 / 6 | -- | -- | 300 | -- / -- | 0.04 | NO |

NSV - No Screening Value
1 - Shaded cells indicate hazard quotient based on reporting limits
2 - Macronutrient - Not considered to be a COPC

**Table 5-11**
**Summary of Hazard Quotients for Food Web Exposures - Site 10 - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Short-tailed shrew | | Meadow vole | | Red fox | | American robin | | American kestrel | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL |
| **Metals** | | | | | | | | | | |
| Arsenic | **5.15** | 0.51 | **7.03** | 0.70 | 0.13 | 0.01 | 0.31 | 0.10 | 0.02 | <0.01 |
| Cadmium | **11.6** | **1.16** | 0.76 | 0.08 | 0.55 | 0.06 | **3.57** | 0.26 | **1.04** | 0.08 |
| Chromium | 0.46 | 0.05 | <0.01 | <0.01 | 0.02 | <0.01 | **2.43** | 0.49 | 0.88 | 0.18 |
| Copper | 0.32 | 0.25 | 0.10 | 0.08 | 0.09 | 0.07 | 0.05 | 0.04 | 0.08 | 0.06 |
| Lead | 0.60 | 0.06 | 0.15 | 0.01 | 0.04 | <0.01 | **2.29** | 0.23 | 0.30 | 0.03 |
| Mercury | **10.4** | **2.09** | **2.06** | 0.41 | <0.01 | <0.01 | 0.39 | 0.19 | 0.01 | <0.01 |
| Nickel | 0.28 | 0.14 | 0.07 | 0.03 | 0.02 | <0.01 | 0.08 | 0.06 | 0.03 | 0.02 |
| Selenium | 0.92 | 0.56 | **1.53** | 0.93 | 0.17 | 0.10 | 0.58 | 0.17 | 0.27 | 0.08 |
| Silver | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Zinc | **1.31** | 0.66 | 0.15 | 0.08 | 0.79 | 0.08 | **6.86** | 0.76 | **4.11** | 0.46 |
| **Semivolatile Organic Compounds** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 1,3-Dichlorobenzene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 1,4-Dichlorobenzene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 4-Bromophenyl-Phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-Phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(a)anthracene | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(a)pyrene | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(b)fluoranthene | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(g,h,i)perylene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo(k)fluoranthene | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluorene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

**Table 5-11**
**Summary of Hazard Quotients for Food Web Exposures - Site 10 - Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Short-tailed shrew | | Meadow vole | | Red fox | | American robin | | American kestrel | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL |
| Hexachlorobenzene | 0.06 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.46 | 0.05 | 0.33 | 0.03 |
| Hexachlorobutadiene | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Hexachlorocyclopentadiene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | 0.03 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pentachlorophenol | 0.32 | 0.03 | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

**Table 5-12**
**Summary of COPCs Following Step 2 Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Surface Soil | | | Food Web Exposures | | | | |
|---|---|---|---|---|---|---|---|---|
| | MD | MRL | NSV | Short-tailed shrew | Meadow vole | Red fox | American robin | American kestrel |
| **Metals** | | | | | | | | |
| Aluminum | X | | | | | | | |
| Antimony | | X | | | | | | |
| Arsenic | | | | X | X | | | |
| Cadmium | | | | X | | | X | X |
| Chromium | X | | | | | | X | |
| Iron | X | | | | | | | |
| Lead | | | | | | | X | |
| Manganese | X | | | | | | | |
| Mercury | X | | | X | X | | | |
| Selenium | | | | | X | | | |
| Vanadium | X | | | | | | | |
| Zinc | X | | | X | | | X | X |
| **Semivolatile Organic Compounds** | | | | | | | | |
| 2,4,5-Trichlorophenol | | X | | | | | | |
| 2,4-Dimethylphenol | | X | | | | | | |
| 2-Chlorophenol | | X | | | | | | |
| 2-Methylphenol | | X | | | | | | |
| 4-Methylphenol | | X | | | | | | |
| 4-Nitrophenol | | X | | | | | | |
| Acenaphthylene | | X | | | | | | |
| Anthracene | | X | | | | | | |
| Benzo(a)anthracene | | X | | | | | | |
| Benzo(a)pyrene | | X | | | | | | |
| Benzo(b)fluoranthene | | X | | | | | | |
| Benzo(g,h,i)perylene | | X | | | | | | |
| Benzo(k)fluoranthene | | X | | | | | | |
| Chrysene | | X | | | | | | |
| Dibenz(a,h)anthracene | | X | | | | | | |

MD - Maximum Detect
MRL - Maximum Reporting Limit
NSV - No Screening Value

**Table 5-12**
**Summary of COPCs Following Step 2 Screening**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Surface Soil | | | Food Web Exposures | | | | |
|---|---|---|---|---|---|---|---|---|
| | MD | MRL | NSV | Short-tailed shrew | Meadow vole | Red fox | American robin | American kestrel |
| Fluoranthene | | X | | | | | | |
| Indeno(1,2,3-cd)pyrene | | X | | | | | | |
| Naphthalene | | X | | | | | | |
| Phenanthrene | | X | | | | | | |
| Pyrene | | X | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | |
| 1,2-Dichlorobenzene | | X | | | | | | |

MD - Maximum Detect
MRL - Maximum Reporting Limit
NSV - No Screening Value

**Table 5-13**
**Soil Bioconcentration and Bioaccumulation Factors Used For Plants and Soil Invertebrates - Baseline**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Plant BCF (dry weight) | | Soil-Invertebrate BAF (dry weight) | |
|---|---|---|---|---|
| | Value | Reference | Value | Reference |
| **Metals** | | | | |
| Arsenic | 0.037 | Bechtel Jacobs 1998 | 0.26 | Sample et al. 1998a |
| Cadmium | 0.514 | Bechtel Jacobs 1998 | 7.66 | Sample et al. 1998a |
| Chromium | 0.008 | Baes et al. 1984 | 0.32 | Sample et al. 1998a |
| Lead | 0.038 | Bechtel Jacobs 1998 | 0.31 | Sample et al. 1998a |
| Mercury | 0.344 | Bechtel Jacobs 1998 | 1.19 | Sample et al. 1998a |
| Selenium | 0.567 | Bechtel Jacobs 1998 | 0.98 | Sample et al. 1998a |
| Zinc | 0.358 | Bechtel Jacobs 1998 | 2.48 | Sample et al. 1998a |

**Table 5-14**
**Soil Bioaccumulation Factors Used For Small Mammals - Baseline**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Soil-Mouse BAF (dry weight) | | Soil-Vole BAF (dry weight) | | Soil-Shrew BAF (dry weight) | |
|---|---|---|---|---|---|---|
| | Value | Reference | Value | Reference | Value | Reference |
| **Metals** | | | | | | |
| Arsenic | 0.003 | Sample et al. 1998b | 0.005 | Sample et al. 1998b | 0.004 | Sample et al. 1998b |
| Cadmium | 0.144 | Sample et al. 1998b | 0.134 | Sample et al. 1998b | 2.212 | Sample et al. 1998b |
| Chromium | 0.092 | Sample et al. 1998b | 0.125 | Sample et al. 1998b | 0.094 | Sample et al. 1998b |
| Lead | 0.055 | Sample et al. 1998b | 0.041 | Sample et al. 1998b | 0.148 | Sample et al. 1998b |
| Mercury | 0.073 | Sample et al. 1998b | 0.067 | Sample et al. 1998b | 0.067 | Sample et al. 1998b |
| Selenium | 0.258 | Sample et al. 1998b | 0.022 | Sample et al. 1998b | 0.273 | Sample et al. 1998b |
| Zinc | 0.509 | Sample et al. 1998b | 0.293 | Sample et al. 1998b | 0.862 | Sample et al. 1998b |

**Table 5-15**
**Exposure Parameters for Upper Trophic Level Ecological Receptors - Baseline**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Receptor | Body Weight (kg) | | Water Ingestion Rate (L/day) | | Food Ingestion Rate (kg/day - dry) | |
|---|---|---|---|---|---|---|
| | Value | Reference | Value | Reference | Value | Reference |
| **Birds** | | | | | | |
| American kestrel | 0.1140 | USEPA 1993 | 0.01377 | allometric equation | 0.01094 | USEPA 1993 |
| American robin | 0.0773 | USEPA 1993 | 0.01062 | allometric equation | 0.00552 | Levey and Karasov 1989 |
| **Mammals** | | | | | | |
| Meadow vole | 0.0428 | Silva and Downing 1995 | 0.00899 | USEPA 1993 | 0.00209 | USEPA 1993 |
| Short-tailed shrew | 0.0169 | USEPA 1993 | 0.00376 | USEPA 1993 | 0.00150 | USEPA 1993 |

**Table 5-15**
**Exposure Parameters for Upper Trophic Level Ecological Receptors - Baseline**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Receptor | Dietary Composition (percent) | | | | | | | Soil/ Sediment Ingestion (percent) | |
|---|---|---|---|---|---|---|---|---|---|
| | Terr. Plants | Soil Invert. | Small Mammals | Fish/ Frogs | Aquatic Plants | Aquatic Invert. | Reference | Value | Reference |
| **Birds** | | | | | | | | | |
| American kestrel | 0 | 0 | 98.0 | 0 | 0 | 0 | USEPA 1993 | 2.0 | Assumed based on diet |
| American robin | 51.6 | 43.6 | 0 | 0 | 0 | 0 | Martin et al. 1951 | 4.8 | Sample and Suter 1994 |
| **Mammals** | | | | | | | | | |
| Meadow vole | 97.6 | 0 | 0 | 0 | 0 | 0 | USEPA 1993 | 2.4 | Beyer et al. 1994 |
| Short-tailed shrew | 0 | 87.0 | 0 | 0 | 0 | 0 | USEPA 1993; Sample and Suter 1994 | 13.0 | Sample and Suter 1994 |

**Table 5-16**
**Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints - Baseline**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasilibity Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Assessment Endpoint | Risk Hypothesis | Measurement Endpoint | Receptor |
|---|---|---|---|
| Survival, growth, and reproduction of terrestrial soil invertebrate communities | Are site-related chemical concentrations in surface soils sufficient to adversely effect soil invertebrate communities? | Comparison of mean chemical concentrations in surface soils with soil screening values. | Soil Invertebrates (earthworms) |
| Survival, growth, and reproduction of terrestrial plant communities | Are site-related chemical concentrations in surface soils sufficient to adversely effect terrestrial plant communities? | Comparison of mean chemical concentrations in surface soils with soil screening values. | Terrestrial plants |
| Survival, growth, and reproduction of terrestrial mammalian herbivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species populations that may consume terrestrial plants from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on mean soil concentrations. | Meadow vole |
| Survival, growth, and reproduction of terrestrial mammalian insectivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian species populations that may consume terrestrial invertebrates from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on mean soil concentrations. | Short-tailed shrew |
| Survival, growth, and reproduction of terrestrial avian omnivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species populations that may consume terrestrial plants and invertebrates from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on mean soil concentrations. | American robin |
| Survival, growth, and reproduction of terrestrial avian carnivore populations | Are site-related chemical concentrations in surface soil sufficient to cause adverse effects (on growth, survival, or reproduction) to avian species populations that may consume small mammals from the site? | Comparison of literature-derived chronic No Observed Adverse Effect Level (NOAEL) and Lowest Observed Adverse Effect Level (LOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on mean soil concentrations. | American kestrel |

**Table 5-17**
**Step 3 Screening Statistics - Site 10 Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean | Screening Value | Frequency of Exceedance | Mean Hazard Quotient[1] | COC? |
|---|---|---|---|---|---|---|---|---|---|
| **Metals (MG/KG)** | | | | | | | | | |
| Aluminum | 2.03 - 2.23 | 7 / 7 | 9,830 | AS10-SS03-(0-0.5) | 7,911 | 50.0 | 7 / 7 | 158 | YES |
| Antimony | 0.37 - 7.60 | 0 / 7 | -- | -- | 0.72 | 5.00 | -- / -- | 0.14 | (NO) |
| Chromium | 0.07 - 0.08 | 7 / 7 | 14.7 | AS10-SS03-(0-0.5) | 12.6 | 0.40 | 7 / 7 | 31.6 | YES |
| Iron | 7.32 - 8.03 | 7 / 7 | 27,200 | HCS-PWA-29S | 22,800 | 200 | 7 / 7 | 114 | YES |
| Manganese | 0.05 - 0.05 | 7 / 7 | 1,140 | AS10-SS06-(0-0.5) | 904 | 500 | 7 / 7 | 1.81 | YES |
| Mercury | 0.05 - 0.06 | 5 / 7 | 0.13 | AS10-SS02-(0-0.5) | 0.09 | 0.10 | 4 / 7 | 0.90 | NO |
| Vanadium | 0.07 - 0.08 | 7 / 7 | 24.5 | AS10-SS06-(0-0.5) | 21.4 | 2.00 | 7 / 7 | 10.7 | YES |
| Zinc | 0.12 - 0.13 | 7 / 7 | 130 | AS10-SS02-(0-0.5) | 79.4 | 50.0 | 7 / 7 | 1.59 | YES |
| **Semivolatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 2,4,5-Trichlorophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | 430 | -- / -- | 1.12 | (NO) |
| 2,4-Dimethylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| 2-Chlorophenol | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| 2-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| 4-Methylphenol | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| 4-Nitrophenol | 960 - 960 | 0 / 1 | -- | -- | 480 | 380 | -- / -- | 1.26 | (NO) |
| Acenaphthylene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Benzo(a)anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Benzo(a)pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Benzo(b)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Benzo(g,h,i)perylene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Benzo(k)fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Chrysene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Dibenz(a,h)anthracene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Fluoranthene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Indeno(1,2,3-cd)pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Naphthalene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |

**Table 5-17**
**Step 3 Screening Statistics - Site 10 Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Reporting Limit Range | Frequency of Detection | Maximum Concentration Detected | Sample ID of Maximum Concentration | Arithmetic Mean | Screening Value | Frequency of Exceedance | Mean Hazard Quotient[1] | COC? |
|---|---|---|---|---|---|---|---|---|---|
| Phenanthrene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| Pyrene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | |
| 1,2-Dichlorobenzene | 400 - 400 | 0 / 1 | -- | -- | 200 | 100 | -- / -- | 2.00 | (NO) |

Shading indicates that the constituent was not detected.

**Table 5-18**
**Summary of Hazard Quotients for Food Web Exposures - Baseline**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Short-tailed shrew | | Meadow vole | | American robin | | American kestrel | |
|---|---|---|---|---|---|---|---|---|
| | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL | NOAEL | LOAEL |
| **Metals** | | | | | | | | |
| Arsenic | 1.55 | 0.15 | 0.14 | 0.01 | 0.03 | 0.01 | <0.01 | <0.01 |
| Cadmium | 0.12 | 0.01 | <0.01 | <0.01 | 0.04 | <0.01 | 0.02 | <0.01 |
| Chromium | 0.03 | <0.01 | <0.01 | <0.01 | 0.17 | 0.03 | 0.15 | 0.03 |
| Lead | 0.09 | <0.01 | <0.01 | <0.01 | 0.26 | 0.03 | 0.06 | <0.01 |
| Mercury | 0.29 | 0.06 | 0.05 | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| Selenium | 0.16 | 0.10 | 0.05 | 0.03 | 0.04 | 0.01 | 0.01 | <0.01 |
| Zinc | 0.10 | 0.05 | <0.01 | <0.01 | 0.51 | 0.06 | 0.31 | 0.03 |

**Table 5-19**
**Summary of COCs - Step 3**
**Site 10 -Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Surface Soil | | | | Food Web | | |
|---|---|---|---|---|---|---|---|
| | FOD | FOE | Maximum HQ | Mean HQ | Receptor | Endpoint | Mean HQ |
| Aluminum | 7 / 7 | 7 / 7 | 197 | 158 | | | |
| Arsenic | | | | | Short-tailed shrew | NOAEL | 1.55 |
| Chromium | 7 / 7 | 7 / 7 | 36.8 | 31.6 | | | |
| Iron | 7 / 7 | 7 / 7 | 136 | 114 | | | |
| Manganese | 7 / 7 | 7 / 7 | 2.28 | 1.81 | | | |
| Vanadium | 7 / 7 | 7 / 7 | 12.3 | 10.7 | | | |
| Zinc | 7 / 7 | 7 / 7 | 2.60 | 1.59 | | | |

FOD - Frequency of Detection
FOE - Frequency of Exceedance

**Table 5-20**
**Background Comparison - Site 10 Surface Soil**
**Site 10 - Former TCE Still at Building 157**
**Risk Assessment and Feasibility Study for Site 10 Soil**
***Allegany Ballistics Laboratory, Rocket Center, West Virginia***

| Chemical | Site 10 Surface Soils | | | Background Surface Soils | | | Frequency of Background UTL Exceedance for Site Soils | Maximum Ratio of Site Soils to Background UTL | Site Concentration Significantly Higher Than Background (Means Test)? | Ratio of Maximums | Ratio of Means |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency of Detection | Maximum Concentration Detected | Arithmetic Mean | Upper Tolerance Limit | Maximum Concentration Detected | Arithmetic Mean | | | | | |
| **Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | 7 / 7 | 9,830 | 7,911 | 7,970 | 9,710 | 5,650 | 4 / 7 | 1.23 | Yes | 1.01 | 1.40 |
| Arsenic | 7 / 7 | 7.80 | 6.19 | 10.9 | 10.9 | 5.52 | 0 / 7 | 0.72 | No | 0.72 | 1.12 |
| Chromium | 7 / 7 | 14.7 | 12.6 | 13.9 | 15.4 | 10.4 | 2 / 7 | 1.06 | Yes | 0.95 | 1.22 |
| Iron | 7 / 7 | 27,200 | 22,800 | 27,900 | 27,600 | 21,600 | 0 / 7 | 0.97 | No | 0.99 | 1.06 |
| Manganese | 7 / 7 | 1,140 | 904 | 1,090 | 1,040 | 775 | 1 / 7 | 1.05 | No | 1.10 | 1.17 |
| Mercury | 5 / 7 | 0.13 | 0.09 | 0.31 | 0.31 | 0.04 | 0 / 7 | 0.42 | Yes | 0.42 | 2.25 |
| Vanadium | 7 / 7 | 24.5 | 21.4 | 17.8 | 18.4 | 13.7 | 6 / 7 | 1.38 | Yes | 1.33 | 1.56 |
| Zinc | 7 / 7 | 130 | 79.4 | 136 | 136 | 66.6 | 0 / 7 | 0.96 | Yes | 0.96 | 1.19 |

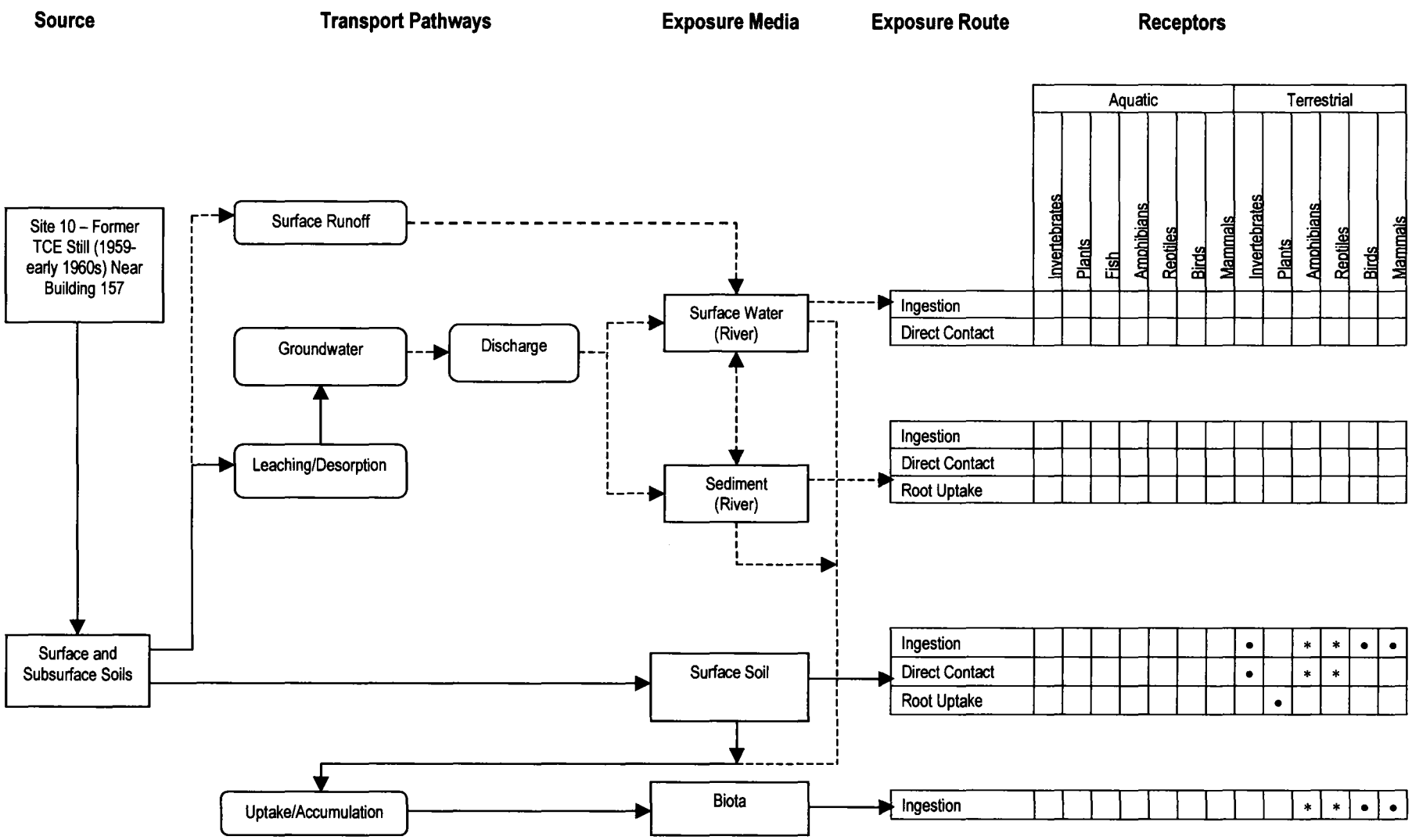


**Figure 5-1**
**Preliminary Conceptual Model**
**ABL - Site 10**

SECTION 6

# Conclusions and Recommendations

The HHRA evaluated the potential human-health risks associated with current and potential future exposures to surface soil and combined surface and subsurface soil at the site. Two essential and naturally occurring nutrients, iron and manganese, were identified as potential contributors to a noncarcinogenic hazard for two receptors (child resident - iron and manganese, and construction worker - iron) evaluated in the risk assessment. However, the receptor-specific intakes were consistent with established safe or recommended daily doses and, therefore, should not be considered a health concern.

The results of the ERA for Site 10 soil indicate there are low to negligible risks for both upper trophic level receptors (via food web exposure) and lower trophic level receptors (via direct exposure). In addition to constituent concentrations comparable to background levels or below risk screening levels, the relatively small size of the site and the limited terrestrial habitat quality present at Site 10 will limit potential exposures. Further, only vanadium consistently exceeded its background concentration, but the metal is not a known site-related constituent.

Because the Site 10 surface and subsurface soil constituent concentrations do not pose unacceptable risks to human health or the environment, no remedial action is deemed necessary for the site.

SECTION 7

# Feasibility Study

The results of surface and subsurface soil samples were used to evaluate potential current and future risks associated with human and ecological exposure to Site 10 soil.

The results of this evaluation indicate that existing constituent concentrations in Site 10 soil do not pose an unacceptable risk to human health or the environment. For this reason, no remedial action is deemed necessary for Site 10 soil and, therefore, no remedial alternatives were evaluated.

SECTION 8

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# Appendix A
# Raw Analytical Results for Site 10 Soil

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-1/28 | | PWA-10 | PWA-11/12 | | PWA-13/14 | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-28ON | HCS-PWA-1ON | HCS-PWA-10ON | HCS-PWA-11ON | HCS-PWA-12ON | HCS-PWA-14ON | HCS-PWA-14ON/DUP | HCS-PWA-13 |
| Sample Date | 07/13/92 | 08/12/92 | 07/13/92 | 07/13/92 | 07/13/92 | 01/01/92 | 01/01/92 | 07/21/92 |
| **Chemical Name** | | | | | | | | |
| | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | |
| 1,1,1-Trichloroethane | 10 U | 10 U | 10 U | 10 U | 8.5 U | 9.60 U | 10 U | 6 U |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| 1,1-Dichloroethane | 20 U | 20 U | 20 U | 20 U | 17 U | 19 U | 20 U | 6 U |
| 1,1-Dichloroethene | 20 U | 20 U | 20 U | 20 U | 17 U | 19 U | 20 U | 6 U |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| 1,2-Dichloroethene (total) | NA | NA | NA | NA | NA | NA | NA | 6 U |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | NA | 13 U |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | NA | 13 U |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | NA | 13 U |
| Acetone | NA | NA | NA | NA | NA | NA | NA | 13 UJC |
| Benzene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Bromoform | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Bromomethane | NA | NA | NA | NA | NA | NA | NA | 13 U |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Chloroethane | NA | NA | NA | NA | NA | NA | NA | 13 U |
| Chloroform | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Chloromethane | NA | NA | NA | NA | NA | NA | NA | 13 U |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Methylene chloride | 20 U | 20 U | 20 U | 20 U | 17 U | 19 U | 20 U | 13 UJ |
| Styrene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | NA | 4 J |
| Toluene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| Trichloroethene | 10 U | 10 U | 10 U | 78 | 170 | 52 | 45 | 34 |
| Vinyl acetate | NA | NA | NA | NA | NA | NA | NA | 13 UJC |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | NA | 13 U |
| Xylene, total | NA | NA | NA | NA | NA | NA | NA | 6 U |
| cis-1,2-Dichloroethene | 20 U | 20 U | 20 U | 20 U | 17 U | 19 U | 20 U | NA |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| trans-1,2-Dichloroethene | 20 U | 20 U | 20 U | 20 U | 17 U | 19 U | 20 U | NA |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | NA | 6 U |
| | | | | | | | | |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-1/28 | | PWA-10 | PWA-11/12 | | PWA-13/14 | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-28ON | HCS-PWA-1ON | HCS-PWA-10ON | HCS-PWA-11ON | HCS-PWA-12ON | HCS-PWA-14ON | HCS-PWA-14ON/DUP | HCS-PWA-13 |
| Sample Date | 07/13/92 | 08/12/92 | 07/13/92 | 07/13/92 | 07/13/92 | 01/01/92 | 01/01/92 | 07/21/92 |
| **Chemical Name** | | | | | | | | |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Bis(2-chloro-1-methylethyl) ether | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA |

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Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-1/28 | | PWA-10 | PWA-11/12 | | PWA-13/14 | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-28ON | HCS-PWA-1ON | HCS-PWA-10ON | HCS-PWA-11ON | HCS-PWA-12ON | HCS-PWA-14ON | HCS-PWA-14ON/DUP | HCS-PWA-13 |
| Sample Date | 07/13/92 | 08/12/92 | 07/13/92 | 07/13/92 | 07/13/92 | 01/01/92 | 01/01/92 | 07/21/92 |
| **Chemical Name** | | | | | | | | |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | NA |

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Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | | PWA-15/16 | | PWA-17/18 | | PWA-19/20 | | | PWA-24 | | PWA-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-13ON | HCS-PWA-15ON | HCS-PWA-16ON | HCS-PWA-17ON | HCS-PWA-18ON | HCS-PWA-20ON | HCS-PWA-19 | HCS-PWA-19ON | HCS-PWA-24 | HCS-PWA-24ON | HCS-PWA-25ON |
| Sample Date | 07/21/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/21/92 | 07/21/92 | 07/22/92 | 07/22/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 11 U | 8.90 U | 9.60 U | 10 U | 8.5 U | 9.60 U | 6 U | 9.60 U | 6 U | 9.60 U | 9.20 U |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| 1,1-Dichloroethane | 21 U | 18 U | 19 U | 20 U | 17 U | 19 U | 6 U | 19 U | 6 U | 19 U | 18 U |
| 1,1-Dichloroethene | 21 U | 18 U | 19 U | 20 U | 17 U | 19 U | 6 U | 19 U | 6 U | 630 | 18 U |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| 1,2-Dichloroethene (total) | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 U | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 U | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 U | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | 5 J | NA | 12 UJC | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 UJC | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | 12 UJC | NA | 12 U | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | 12 UJC | NA | 12 U | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 U | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Methylene chloride | 21 U | 18 U | 19 U | 20 U | 17 U | 19 U | 7 JC | 19 U | 12 UJ | 19 U | 18 U |
| Styrene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| Trichloroethene | 90 | 110 | 280 | 10 U | 8.5 U | 9.60 U | 6 U | 9.60 U | 9 JE | 9.60 U | 9.20 U |
| Vinyl acetate | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 UJC | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | 12 U | NA | 12 U | NA | NA |
| Xylene, total | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| cis-1,2-Dichloroethene | 21 U | 18 U | 40 | 20 U | 17 U | 19 U | NA | 19 U | NA | 19 U | 18 U |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| trans-1,2-Dichloroethene | 21 U | 18 U | 19 U | 20 U | 17 U | 19 U | NA | 19 U | NA | 19 U | 18 U |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | 6 U | NA | 6 U | NA | NA |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | | | | |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

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B - Analyte not detected above associated blank
J - Reported value is estimated

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U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | | PWA-15/16 | | PWA-17/18 | | PWA-19/20 | | | PWA-24 | | PWA-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-13ON | HCS-PWA-15ON | HCS-PWA-16ON | HCS-PWA-17ON | HCS-PWA-18ON | HCS-PWA-20ON | HCS-PWA-19 | HCS-PWA-19ON | HCS-PWA-24 | HCS-PWA-24ON | HCS-PWA-25ON |
| Sample Date | 07/21/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/21/92 | 07/21/92 | 07/22/92 | 07/22/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | 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 | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | 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 | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Bis(2-chloro-1-methylethyl) ether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

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U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | | PWA-15/16 | | PWA-17/18 | | PWA-19/20 | | | PWA-24 | | PWA-25 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-13ON | HCS-PWA-15ON | HCS-PWA-16ON | HCS-PWA-17ON | HCS-PWA-18ON | HCS-PWA-20ON | HCS-PWA-19 | HCS-PWA-19ON | HCS-PWA-24 | HCS-PWA-24ON | HCS-PWA-25ON |
| Sample Date | 07/21/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/21/92 | 07/21/92 | 07/22/92 | 07/22/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | |
| Hexachloroethane | NA | 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 | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | 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 | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-26 | PWA-29S/2/29/7 | | | | PWA-3/21 | | | PWA-4/6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-26ON | HCS-PWA-2ON | HCS-PWA-7ON | HCS-PWA-29 | HCS-PWA-29S | HCS-PWA-21ON | HCS-PWA-3 | HCS-PWA-3ON | HCS-PWA-4ON | HCS-PWA-6 | HCS-PWA-6ON | HCS-PWA-22ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 11/15/94 | 11/15/94 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 9.60 U | 9.5 U | 9.10 U | NA | NA | 9.30 U | 6 UJC | 9.5 U | 100 | 27 JC | 31 | 10 U |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | NA | 6 UJC | NA | NA | 6 UJC | NA | NA |
| 1,1-Dichloroethane | 19 U | 19 U | 18 U | NA | NA | 19 U | 6 UJS | 19 U | 21 U | 6 UJS | 21 U | 20 U |
| 1,1-Dichloroethene | 19 U | 19 U | 18 U | NA | NA | 8,700 | 6 UJS | 19 U | 21 U | 2 JS | 21 U | 20 U |
| 1,2,4-Trichlorobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| 1,2-Dichloroethene (total) | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| Acetone | NA | NA | NA | NA | NA | NA | 12 UJB | NA | NA | 12 UJB | NA | NA |
| Benzene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | NA | 6 UJC | NA | NA | 6 UJC | NA | NA |
| Bromoform | NA | NA | NA | NA | NA | NA | 6 UJC | NA | NA | 6 UJC | NA | NA |
| Bromomethane | NA | NA | NA | NA | NA | NA | 12 UJC | NA | NA | 12 UJC | NA | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | NA | 6 UJC | NA | NA | 6 UJC | NA | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Chloroethane | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| Chloroform | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Chloromethane | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | NA | 6 UJC | NA | NA | 6 UJC | NA | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Methylene chloride | 19 U | 19 U | 18 U | NA | NA | 19 U | 22 UJB | 19 U | 21 U | 16 UJB | 21 U | 20 U |
| Styrene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Toluene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| Trichloroethene | 9.60 U | 140 | 72 | NA | NA | 9.30 U | 7 JES | 9.5 U | 11 U | 2 JES | 11 U | 10 U |
| Vinyl acetate | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | NA | 12 UJS | NA | NA | 12 UJS | NA | NA |
| Xylene, total | NA | NA | NA | NA | NA | NA | 3 JS | NA | NA | 6 UJS | NA | NA |
| cis-1,2-Dichloroethene | 19 U | 20 | 18 U | NA | NA | 19 U | NA | 89 | 21 U | NA | 21 U | 20 U |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| trans-1,2-Dichloroethene | 19 U | 19 U | 18 U | NA | NA | 19 U | NA | 19 U | 21 U | NA | 21 U | 20 U |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | NA | 6 UJS | NA | NA | 6 UJS | NA | NA |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 2,4,5-Trichlorophenol | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-26 | PWA-29S/2/29/7 | | | | PWA-3/21 | | | PWA-4/6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-26ON | HCS-PWA-2ON | HCS-PWA-7ON | HCS-PWA-29 | HCS-PWA-29S | HCS-PWA-21ON | HCS-PWA-3 | HCS-PWA-3ON | HCS-PWA-4ON | HCS-PWA-6 | HCS-PWA-6ON | HCS-PWA-22ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 11/15/94 | 11/15/94 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | | |
| 2,4-Dichlorophenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Bis(2-chloro-1-methylethyl) ether | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | 400 UJ | 400 UJ | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-26 | PWA-29S/2/29/7 | | | | PWA-3/21 | | | PWA-4/6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-26ON | HCS-PWA-2ON | HCS-PWA-7ON | HCS-PWA-29 | HCS-PWA-29S | HCS-PWA-21ON | HCS-PWA-3 | HCS-PWA-3ON | HCS-PWA-4ON | HCS-PWA-6 | HCS-PWA-6ON | HCS-PWA-22ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 11/15/94 | 11/15/94 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | | | | | |
| Hexachloroethane | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | 970 U | 960 U | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | 400 UJ | 400 UJ | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | 400 U | 400 U | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | | | | | |
| Aluminum | NA | NA | NA | 8,540 | 9,040 | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | 7.10 UJ | 7.60 UJ | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | 13.1 J | 6.5 J | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | 159 | 120 | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | 1.30 | 1.20 | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | 2.30 J | 2.30 U | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | 2,990 | 5,380 | NA | NA | NA | NA | NA | NA | NA |
| Chromium | NA | NA | NA | 12.3 | 13.4 | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | 15.3 | 12.9 | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | 22.3 | 18.1 | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | 41,300 | 27,200 | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | 18.8 | 22 | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | 1,610 | 1,560 | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | 1,200 | 1,070 | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | 0.100 B | 0.0600 U | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | 26.3 | 18.4 | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | 908 B | 1,090 B | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | 0.440 U | 0.860 B | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | 2.10 J | 0.950 R | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | 46.6 U | 25.6 U | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | 0.660 U | 0.710 U | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | 26.3 | 23.9 | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | 87 J | 62.2 J | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | 6,550 | 28,000 | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-5/22 | | PWA-8/27 | | PWA-9/23 | | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-5ON | HCS-PWA-5ON/DUP | HCS-PWA-27ON | HCS-PWA-8ON | HCS-PWA-23ON | HCS-PWA-9 | HCS-PWA-9/DUP | HCS-PWA-9ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | |
| 1,1,1-Trichloroethane | 9.30 U | 9.20 U | 9.60 U | 10 U | 9.20 U | 7 U | 6 U | 10 U |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| 1,1-Dichloroethane | 19 U | 18 U | 20 U | 35 | 18 U | 7 U | 6 U | 20 U |
| 1,1-Dichloroethene | 19 U | 18 U | 20 U | 21 U | 18 U | 7 U | 6 U | 20 U |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| 1,2-Dichloroethene (total) | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| 2-Hexanone | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| Acetone | NA | NA | NA | NA | NA | 41 UJB | 28 UJB | NA |
| Benzene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Bromodichloromethane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Bromoform | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Bromomethane | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| Carbon disulfide | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Carbon tetrachloride | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Chlorobenzene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Chloroethane | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| Chloroform | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Chloromethane | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| Dibromochloromethane | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Ethylbenzene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Methylene chloride | 19 U | 18 U | 20 U | 21 U | 18 U | 13 UJB | 13 UJ | 20 U |
| Styrene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Tetrachloroethene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Toluene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| Trichloroethene | 9.30 U | 9.20 U | 9.60 U | 10 U | 9.20 U | 1 J | 3 J | 10 U |
| Vinyl acetate | NA | NA | NA | NA | NA | 13 UJC | 13 UJC | NA |
| Vinyl chloride | NA | NA | NA | NA | NA | 13 U | 13 U | NA |
| Xylene, total | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| cis-1,2-Dichloroethene | 19 U | 18 U | 20 U | 21 U | 18 U | NA | NA | 20 U |
| cis-1,3-Dichloropropene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| trans-1,2-Dichloroethene | 19 U | 18 U | 20 U | 21 U | 18 U | NA | NA | 20 U |
| trans-1,3-Dichloropropene | NA | NA | NA | NA | NA | 7 U | 6 U | NA |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated

R - Unreliable result
U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-5/22 | | PWA-8/27 | | PWA-9/23 | | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-5ON | HCS-PWA-5ON/DUP | HCS-PWA-27ON | HCS-PWA-8ON | HCS-PWA-23ON | HCS-PWA-9 | HCS-PWA-9/DUP | HCS-PWA-9ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | |
| 2,4-Dichlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,4-Dinitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Bromophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chloroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Chlorophenyl-phenylether | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Methylphenol | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA | NA | NA | NA | NA |
| Anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Bis(2-chloro-1-methylethyl) ether | NA | NA | NA | NA | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | NA |

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U - Analyte not detected

Table A-1
Historic RI and Phase II RI Soil Data
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | PWA-5/22 | | PWA-8/27 | | PWA-9/23 | | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | HCS-PWA-5ON | HCS-PWA-5ON/DUP | HCS-PWA-27ON | HCS-PWA-8ON | HCS-PWA-23ON | HCS-PWA-9 | HCS-PWA-9/DUP | HCS-PWA-9ON |
| Sample Date | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 | 07/13/92 |
| **Chemical Name** | | | | | | | | |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | NA | NA | NA | NA | NA | NA | NA | NA |
| Barium | NA | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | NA | NA | NA | NA | NA | NA | NA | NA |
| Calcium | NA | NA | NA | NA | NA | NA | NA | NA |
| Chromium | NA | NA | NA | NA | NA | NA | NA | NA |
| Cobalt | NA | NA | NA | NA | NA | NA | NA | NA |
| Copper | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron | NA | NA | NA | NA | NA | NA | NA | NA |
| Lead | NA | NA | NA | NA | NA | NA | NA | NA |
| Magnesium | NA | NA | NA | NA | NA | NA | NA | NA |
| Manganese | NA | NA | NA | NA | NA | NA | NA | NA |
| Mercury | NA | NA | NA | NA | NA | NA | NA | NA |
| Nickel | NA | NA | NA | NA | NA | NA | NA | NA |
| Potassium | NA | NA | NA | NA | NA | NA | NA | NA |
| Selenium | NA | NA | NA | NA | NA | NA | NA | NA |
| Silver | NA | NA | NA | NA | NA | NA | NA | NA |
| Sodium | NA | NA | NA | NA | NA | NA | NA | NA |
| Thallium | NA | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA | NA |
| Zinc | NA | NA | NA | NA | NA | NA | NA | NA |
| | | | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | NA |

NA - Not analyzed
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R - Unreliable result
U - Analyte not detected

Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | | AS10-SB02 | | AS10-SB03 | | AS10-SB03 | | AS10-SB04 | | AS10-SB05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SS01-(0-0.5) | | AS10-SS02-(0-0.5) | | AS10-SS03-(0-0.5) | | AS10-SS03P-(0-0.5) | | AS10-SS04-(0-0.5) | | AS10-SS05-(0-0.5) | |
| Sample Date | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | |
| **Chemical Name** | | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,1,2,2-Tetrachloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,1,2-Trichloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,1-Dichloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,1-Dichloroethene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,2,4-Trichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | |
| 1,2-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | |
| 1,2-Dichloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,2-Dichloropropane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 1,3-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | |
| 1,4-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Butanone | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 2-Hexanone | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| 4-Methyl-2-pentanone | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Acetone | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Benzene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Bromodichloromethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Bromoform | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Bromomethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Carbon disulfide | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Carbon tetrachloride | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Chlorobenzene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Chloroethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Chloroform | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Chloromethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Dibromochloromethane | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Ethylbenzene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Methylene chloride | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Styrene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Tetrachloroethene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Toluene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| Trichloroethene | 12 | U | 13 | U | 2.3 | J | 13 | U | 13 | U | 3.1 | J |
| Vinyl chloride | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| cis-1,2-Dichloroethene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| cis-1,3-Dichloropropene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| m- and p-Xylene | 12 | U | 1.9 | J | 2.9 | J | 5.7 | J | 2.6 | J | 3 | J |
| o-Xylene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |

U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
R - Unreliable result

Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | | AS10-SB02 | | AS10-SB03 | | | | AS10-SB04 | | AS10-SB05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SS01-(0-0.5) | | AS10-SS02-(0-0.5) | | AS10-SS03-(0-0.5) | | AS10-SS03P-(0-0.5) | | AS10-SS04-(0-0.5) | | AS10-SS05-(0-0.5) | |
| Sample Date | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | |
| **Chemical Name** | | | | | | | | | | | | |
| trans-1,2-Dichloroethene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| trans-1,3-Dichloropropene | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U |
| | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | |
| 2,2'-Oxybis(1-chloropropane) | NA | | NA | | NA | | NA | | NA | | NA | |
| 2,4,5-Trichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2,4,6-Trichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2,4-Dichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2,4-Dimethylphenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2,4-Dinitrophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Chloronaphthalene | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Chlorophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Methylnaphthalene | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Methylphenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | |
| 2-Nitrophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 3,3'-Dichlorobenzidine | NA | | NA | | NA | | NA | | NA | | NA | |
| 3-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | |
| 4,6-Dinitro-2-methylphenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Bromophenyl-phenylether | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Chloro-3-methylphenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Chloroaniline | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Chlorophenyl-phenylether | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Methylphenol | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | |
| 4-Nitrophenol | NA | | NA | | NA | | NA | | NA | | NA | |
| Acenaphthene | NA | | NA | | NA | | NA | | NA | | NA | |
| Acenaphthylene | NA | | NA | | NA | | NA | | NA | | NA | |
| Anthracene | NA | | NA | | NA | | NA | | NA | | NA | |
| Benzo(a)anthracene | NA | | NA | | NA | | NA | | NA | | NA | |
| Benzo(a)pyrene | NA | | NA | | NA | | NA | | NA | | NA | |
| Benzo(b)fluoranthene | NA | | NA | | NA | | NA | | NA | | NA | |
| Benzo(g,h,i)perylene | NA | | NA | | NA | | NA | | NA | | NA | |
| Benzo(k)fluoranthene | NA | | NA | | NA | | NA | | NA | | NA | |
| Butylbenzylphthalate | NA | | NA | | NA | | NA | | NA | | NA | |
| Carbazole | NA | | NA | | NA | | NA | | NA | | NA | |
| Chrysene | NA | | NA | | NA | | NA | | NA | | NA | |
| Di-n-butylphthalate | NA | | NA | | NA | | NA | | NA | | NA | |
| Di-n-octylphthalate | NA | | NA | | NA | | NA | | NA | | NA | |

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B - Analyte not detected above associated blank
J - Reported value is estimated
R - Unreliable result

Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | AS10-SB02 | AS10-SB03 | | AS10-SB04 | AS10-SB05 |
|---|---|---|---|---|---|---|
| Sample ID | AS10-SS01-(0-0.5) | AS10-SS02-(0-0.5) | AS10-SS03-(0-0.5) | AS10-SS03P-(0-0.5) | AS10-SS04-(0-0.5) | AS10-SS05-(0-0.5) |
| Sample Date | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 |
| **Chemical Name** | | | | | | |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA | NA | NA |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA | NA | NA |
| Naphthalene | NA | NA | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA |
| | | | | | | |
| **Explosives (UG/KG)** | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA | NA | NA |
| | | | | | | |
| **Total Metals (MG/KG)** | | | | | | |
| Aluminum | 6,500 | 8,430 | 9,830 | NA | 6,370 | 5,900 |
| Antimony | 0.37 U | 0.4 U | 0.4 U | NA | 0.4 U | 0.4 U |
| Arsenic | 5.8 | 6.8 | 7.8 | NA | 5.1 | 4.4 |
| Barium | 88.2 | 95.1 | 105 | NA | 90.6 | 94.3 |
| Beryllium | 0.89 J | 1 J | 1.1 J | NA | 0.98 J | 1 J |
| Cadmium | 0.25 B | 0.05 U | 0.05 U | NA | 0.05 U | 0.05 U |
| Calcium | 3,950 | 4,420 | 4,360 | NA | 3,900 | 4,050 |
| Chromium | 10.7 | 13.3 | 14.7 | NA | 10.9 | 10.8 |
| Cobalt | 10.4 J | 11.2 J | 11.8 J | NA | 10.5 J | 11.3 J |
| Copper | 12.8 | 13.7 | 14.1 | NA | 12.9 | 13.4 |

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Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | AS10-SB02 | AS10-SB03 | | AS10-SB04 | AS10-SB05 |
|---|---|---|---|---|---|---|
| Sample ID | AS10-SS01-(0-0.5) | AS10-SS02-(0-0.5) | AS10-SS03-(0-0.5) | AS10-SS03P-(0-0.5) | AS10-SS04-(0-0.5) | AS10-SS05-(0-0.5) |
| Sample Date | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 |
| **Chemical Name** | | | | | | |
| Iron | 19,100 | 21,900 | 25,300 | NA | 19,700 | 19,600 |
| Lead | 19.5 | 23.4 | 20.3 | NA | 19.6 | 17.7 |
| Magnesium | 1,120 J | 1,660 | 1,510 | NA | 1,180 J | 1,150 J |
| Manganese | 751 | 865 | 898 | NA | 854 | 752 |
| Mercury | 0.08 | 0.13 | 0.06 U | NA | 0.11 J | 0.12 J |
| Nickel | 12.8 | 16.1 | 16.9 | NA | 13.3 | 14.7 |
| Potassium | 1,220 | 1,390 | 1,780 | NA | 1,050 J | 952 J |
| Selenium | 0.4 U | 1 J | 0.42 U | NA | 0.43 U | 0.42 U |
| Silver | 0.48 BN | 0.55 B | 0.6 B | NA | 0.3 B | 0.24 B |
| Sodium | 93.9 U | 100 U | 99.1 U | NA | 137 J | 99.5 U |
| Thallium | 2.9 B | 2.6 B | 2.1 B | NA | 1.6 B | 1.2 B |
| Vanadium | 19.4 | 21.4 | 24.4 | NA | 18.8 | 17.1 |
| Zinc | 98.8 | 130 | 65.7 | NA | 68.7 | 52.5 |
| | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA |

U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate

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Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB06 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|
| Sample ID | AS10-SS06-(0-0.5) | | HCS-PWA-29S | |
| Sample Date | 06/07/00 | | 11/15/94 | |
| **Chemical Name** | | | | |
| | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | |
| 1,1,1-Trichloroethane | 13 | U | NA | |
| 1,1,2,2-Tetrachloroethane | 13 | U | NA | |
| 1,1,2-Trichloroethane | 13 | U | NA | |
| 1,1-Dichloroethane | 13 | U | NA | |
| 1,1-Dichloroethene | 13 | U | NA | |
| 1,2,4-Trichlorobenzene | NA | | 400 | U |
| 1,2-Dichlorobenzene | NA | | 400 | U |
| 1,2-Dichloroethane | 13 | U | NA | |
| 1,2-Dichloropropane | 13 | U | NA | |
| 1,3-Dichlorobenzene | NA | | 400 | U |
| 1,4-Dichlorobenzene | NA | | 400 | U |
| 2-Butanone | 13 | U | NA | |
| 2-Hexanone | 13 | U | NA | |
| 4-Methyl-2-pentanone | 13 | U | NA | |
| Acetone | 13 | U | NA | |
| Benzene | 13 | U | NA | |
| Bromodichloromethane | 13 | U | NA | |
| Bromoform | 13 | U | NA | |
| Bromomethane | 13 | U | NA | |
| Carbon disulfide | 13 | U | NA | |
| Carbon tetrachloride | 13 | U | NA | |
| Chlorobenzene | 13 | U | NA | |
| Chloroethane | 13 | U | NA | |
| Chloroform | 13 | U | NA | |
| Chloromethane | 13 | U | NA | |
| Dibromochloromethane | 13 | U | NA | |
| Ethylbenzene | 13 | U | NA | |
| Methylene chloride | 13 | U | NA | |
| Styrene | 13 | U | NA | |
| Tetrachloroethene | 13 | U | NA | |
| Toluene | 13 | U | NA | |
| Trichloroethene | 13 | U | NA | |
| Vinyl chloride | 13 | U | NA | |
| cis-1,2-Dichloroethene | 13 | U | NA | |
| cis-1,3-Dichloropropene | 13 | U | NA | |
| m- and p-Xylene | 2.2 | J | NA | |
| o-Xylene | 13 | U | NA | |

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Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB06 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|
| Sample ID | AS10-SS06-(0-0.5) | | HCS-PWA-29S | |
| Sample Date | 06/07/00 | | 11/15/94 | |
| **Chemical Name** | | | | |
| trans-1,2-Dichloroethene | 13 | U | NA | |
| trans-1,3-Dichloropropene | 13 | U | NA | |
| | | | | |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | |
| 2,2'-Oxybis(1-chloropropane) | NA | | 400 | U |
| 2,4,5-Trichlorophenol | NA | | 960 | U |
| 2,4,6-Trichlorophenol | NA | | 400 | U |
| 2,4-Dichlorophenol | NA | | 400 | U |
| 2,4-Dimethylphenol | NA | | 400 | U |
| 2,4-Dinitrophenol | NA | | 960 | U |
| 2-Chloronaphthalene | NA | | 400 | U |
| 2-Chlorophenol | NA | | 400 | U |
| 2-Methylnaphthalene | NA | | 400 | U |
| 2-Methylphenol | NA | | 400 | U |
| 2-Nitroaniline | NA | | 960 | U |
| 2-Nitrophenol | NA | | 400 | U |
| 3,3'-Dichlorobenzidine | NA | | 400 | U |
| 3-Nitroaniline | NA | | 960 | U |
| 4,6-Dinitro-2-methylphenol | NA | | 960 | U |
| 4-Bromophenyl-phenylether | NA | | 400 | U |
| 4-Chloro-3-methylphenol | NA | | 400 | U |
| 4-Chloroaniline | NA | | 400 | U |
| 4-Chlorophenyl-phenylether | NA | | 400 | U |
| 4-Methylphenol | NA | | 400 | U |
| 4-Nitroaniline | NA | | 960 | U |
| 4-Nitrophenol | NA | | 960 | U |
| Acenaphthene | NA | | 400 | U |
| Acenaphthylene | NA | | 400 | U |
| Anthracene | NA | | 400 | U |
| Benzo(a)anthracene | NA | | 400 | U |
| Benzo(a)pyrene | NA | | 400 | U |
| Benzo(b)fluoranthene | NA | | 400 | U |
| Benzo(g,h,i)perylene | NA | | 400 | U |
| Benzo(k)fluoranthene | NA | | 400 | U |
| Butylbenzylphthalate | NA | | 400 | U |
| Carbazole | NA | | 400 | U |
| Chrysene | NA | | 400 | U |
| Di-n-butylphthalate | NA | | 400 | U |
| Di-n-octylphthalate | NA | | 400 | UJ |

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Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB06 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|
| Sample ID | AS10-SS06-(0-0.5) | | HCS-PWA-29S | |
| Sample Date | 06/07/00 | | 11/15/94 | |
| **Chemical Name** | | | | |
| Dibenz(a,h)anthracene | NA | | 400 | U |
| Dibenzofuran | NA | | 400 | U |
| Diethylphthalate | NA | | 400 | U |
| Dimethyl phthalate | NA | | 400 | U |
| Fluoranthene | NA | | 400 | U |
| Fluorene | NA | | 400 | U |
| Hexachlorobenzene | NA | | 400 | U |
| Hexachlorobutadiene | NA | | 400 | U |
| Hexachlorocyclopentadiene | NA | | 400 | U |
| Hexachloroethane | NA | | 400 | U |
| Indeno(1,2,3-cd)pyrene | NA | | 400 | U |
| Isophorone | NA | | 400 | U |
| Naphthalene | NA | | 400 | U |
| Pentachlorophenol | NA | | 960 | U |
| Phenanthrene | NA | | 400 | U |
| Phenol | NA | | 400 | U |
| Pyrene | NA | | 400 | U |
| bis(2-Chloroethoxy)methane | NA | | 400 | U |
| bis(2-Chloroethyl)ether | NA | | 400 | U |
| bis(2-Ethylhexyl)phthalate | NA | | 400 | UJ |
| n-Nitroso-di-n-propylamine | NA | | 400 | U |
| n-Nitrosodiphenylamine | NA | | 400 | U |
| | | | | |
| **Explosives (UG/KG)** | | | | |
| 2,4-Dinitrotoluene | NA | | 400 | U |
| 2,6-Dinitrotoluene | NA | | 400 | U |
| Nitrobenzene | NA | | 400 | U |
| | | | | |
| **Total Metals (MG/KG)** | | | | |
| Aluminum | 9,310 | | 9,040 | |
| Antimony | 0.49 | B | 7.60 | UJ |
| Arsenic | 6.9 | | 6.5 | J |
| Barium | 131 | | 120 | |
| Beryllium | 1.3 | | 1.20 | |
| Cadmium | 0.05 | U | 2.30 | U |
| Calcium | 7,140 | | 5,380 | |
| Chromium | 14.7 | | 13.4 | |
| Cobalt | 12.8 | J | 12.9 | |
| Copper | 16.8 | | 18.1 | |

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Table A-2
Raw Surface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| **Station ID** | AS10-SB06 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|
| **Sample ID** | AS10-SS06-(0-0.5) | | HCS-PWA-29S | |
| **Sample Date** | 06/07/00 | | 11/15/94 | |
| **Chemical Name** | | | | |
| Iron | **26,800** | | **27,200** | |
| Lead | **21.6** | | **22** | |
| Magnesium | **1,820** | | **1,560** | |
| Manganese | **1,140** | | **1,070** | |
| Mercury | **0.13** | | 0.0600 | U |
| Nickel | **18.7** | | **16.4** | |
| Potassium | **1,440** | | 1,090 | B |
| Selenium | 0.44 | U | 0.860 | B |
| Silver | 0.58 | B | 0.950 | R |
| Sodium | **117** | J | 25.6 | U |
| Thallium | 1.3 | B | 0.710 | U |
| Vanadium | **24.5** | | **23.9** | |
| Zinc | **78** | | **62.2** | J |
| | | | | |
| **Wet Chemistry (MG/KG)** | | | | |
| Total organic carbon (TOC) | NA | | **28,000** | |

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Table A-2
Raw Subsurface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | | AS10-SB02 | | AS10-SB03 | | AS10-SB04 | | AS10-SB05 | | AS10-SB06 | | PWA-13/14 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SB01-(2-4) | | AS10-SB02-(2-4) | | AS10-SB03-(2-4) | | AS10-SB04-(2-4) | | AS10-SB05-(2-4) | | AS10-SB06-(2-4) | | HCS-PWA-13 | | HCS-PWA-29 | |
| Sample Date | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 07/21/92 | | 11/15/94 | |
| **Chemical Name** | | | | | | | | | | | | | | | | |
| **Volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,1,2,2-Tetrachloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,1,2-Trichloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,1-Dichloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,1-Dichloroethene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,2,4-Trichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 1,2-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 1,2-Dichloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,2-Dichloroethene (total) | NA | | NA | | NA | | NA | | NA | | NA | | 6 | U | NA | |
| 1,2-Dichloropropane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| 1,3-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 1,4-Dichlorobenzene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2-Butanone | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| 2-Hexanone | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| 4-Methyl-2-pentanone | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| Acetone | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | UJC | NA | |
| Benzene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Bromodichloromethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Bromoform | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Bromomethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| Carbon disulfide | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Carbon tetrachloride | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Chlorobenzene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Chloroethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| Chloroform | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Chloromethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| Dibromochloromethane | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Ethylbenzene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Methylene chloride | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | UJ | NA | |
| Styrene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Tetrachloroethene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 4 | J | NA | |
| Toluene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| Trichloroethene | 3.2 | J | 1.7 | J | 6.6 | J | 4.1 | J | 26 | | 18 | | 34 | | NA | |

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Table A-2
Raw Subsurface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | | AS10-SB02 | | AS10-SB03 | | AS10-SB04 | | AS10-SB05 | | AS10-SB06 | | PWA-13/14 | | PWA-29S/2/29/7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SB01-(2-4) | | AS10-SB02-(2-4) | | AS10-SB03-(2-4) | | AS10-SB04-(2-4) | | AS10-SB05-(2-4) | | AS10-SB06-(2-4) | | HCS-PWA-13 | | HCS-PWA-29 | |
| Sample Date | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 06/07/00 | | 07/21/92 | | 11/15/94 | |
| **Chemical Name** | | | | | | | | | | | | | | | | |
| Vinyl acetate | NA | | NA | | NA | | NA | | NA | | NA | | 13 | UJC | NA | |
| Vinyl chloride | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | |
| Xylene, total | NA | | NA | | NA | | NA | | NA | | NA | | 6 | U | NA | |
| cis-1,2-Dichloroethene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | | NA | |
| cis-1,3-Dichloropropene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| m- and p-Xylene | 3.1 | J | 12 | U | 2.3 | J | 13 | U | 3.1 | J | 2.4 | J | NA | | NA | |
| o-Xylene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | | NA | |
| trans-1,2-Dichloroethene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | NA | | NA | |
| trans-1,3-Dichloropropene | 13 | U | 12 | U | 13 | U | 13 | U | 13 | U | 13 | U | 6 | U | NA | |
| | | | | | | | | | | | | | | | | |
| **Semi-volatile Organic Compounds (UG/KG)** | | | | | | | | | | | | | | | | |
| 2,4,5-Trichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 2,4,6-Trichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2,4-Dichlorophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2,4-Dimethylphenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2,4-Dinitrophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 2-Chloronaphthalene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2-Chlorophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2-Methylnaphthalene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2-Methylphenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 2-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 2-Nitrophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 3,3'-Dichlorobenzidine | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 3-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 4,6-Dinitro-2-methylphenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 4-Bromophenyl-phenylether | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 4-Chloro-3-methylphenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 4-Chloroaniline | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 4-Chlorophenyl-phenylether | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 4-Methylphenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| 4-Nitroaniline | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| 4-Nitrophenol | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 970 | U |
| Acenaphthene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| Acenaphthylene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |
| Anthracene | NA | | NA | | NA | | NA | | NA | | NA | | NA | | 400 | U |

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Table A-2
Raw Subsurface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| Station ID | AS10-SB01 | AS10-SB02 | AS10-SB03 | AS10-SB04 | AS10-SB05 | AS10-SB06 | PWA-13/14 | PWA-29S/2/29/7 | |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | AS10-SB01-(2-4) | AS10-SB02-(2-4) | AS10-SB03-(2-4) | AS10-SB04-(2-4) | AS10-SB05-(2-4) | AS10-SB06-(2-4) | HCS-PWA-13 | HCS-PWA-29 | |
| Sample Date | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 07/21/92 | 11/15/94 | |
| **Chemical Name** | | | | | | | | | |
| Benzo(a)anthracene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Benzo(a)pyrene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Benzo(b)fluoranthene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Benzo(g,h,i)perylene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Benzo(k)fluoranthene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Bis(2-chloro-1-methylethyl) ether | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Butylbenzylphthalate | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Carbazole | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Chrysene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Di-n-butylphthalate | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Di-n-octylphthalate | NA | NA | NA | NA | NA | NA | NA | 400 | UJ |
| Dibenz(a,h)anthracene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Diethylphthalate | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Dimethyl phthalate | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Fluoranthene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Fluorene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Hexachlorobenzene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Hexachlorobutadiene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Hexachlorocyclopentadiene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Hexachloroethane | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Isophorone | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Naphthalene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Pentachlorophenol | NA | NA | NA | NA | NA | NA | NA | 970 | U |
| Phenanthrene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Phenol | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| Pyrene | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA | NA | NA | NA | 400 | UJ |
| n-Nitroso-di-n-propylamine | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| n-Nitrosodiphenylamine | NA | NA | NA | NA | NA | NA | NA | 400 | U |
| | | | | | | | | | |
| **Explosives (UG/KG)** | | | | | | | | | |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate

Table A-2
Raw Subsurface Soil Data for Risk Assessment
Site 10 - Former TCE Still at Building 157
Allegany Ballistics Laboratory, Rocket Center, West Virginia

| **Station ID** | AS10-SB01 | AS10-SB02 | AS10-SB03 | AS10-SB04 | AS10-SB05 | AS10-SB06 | PWA-13/14 | PWA-29S/2/29/7 |
|---|---|---|---|---|---|---|---|---|
| **Sample ID** | AS10-SB01-(2-4) | AS10-SB02-(2-4) | AS10-SB03-(2-4) | AS10-SB04-(2-4) | AS10-SB05-(2-4) | AS10-SB06-(2-4) | HCS-PWA-13 | HCS-PWA-29 |
| **Sample Date** | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 06/07/00 | 07/21/92 | 11/15/94 |
| **Chemical Name** | | | | | | | | |
| 2,4-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | 400 U |
| 2,6-Dinitrotoluene | NA | NA | NA | NA | NA | NA | NA | 400 U |
| Nitrobenzene | NA | NA | NA | NA | NA | NA | NA | 400 U |
| | | | | | | | | |
| **Total Metals (MG/KG)** | | | | | | | | |
| Aluminum | 8,450 | 8,970 | 9,040 | 6,890 | 9,650 | 8,800 | NA | 8,540 |
| Antimony | 0.4 U | 0.38 U | 0.4 U | 0.39 U | 0.4 U | 0.4 U | NA | 7.10 UJ |
| Arsenic | 10 | 6.4 | 7.6 | 8.7 | 12.3 | 13.2 | NA | 13.1 J |
| Barium | 128 | 112 | 137 | 174 | 193 | 132 | NA | 159 |
| Beryllium | 1.4 | 1.3 | 1.3 | 1.3 | 1.5 | 1.5 | NA | 1.30 |
| Cadmium | 0.05 U | 0.05 U | 0.05 U | 0.05 U | 0.05 U | 0.05 U | NA | 2.30 J |
| Calcium | 3,440 | 2,950 | 3,660 | 3,760 | 4,380 | 3,920 | NA | 2,990 |
| Chromium | 15.9 | 15.6 | 16.4 | 13.2 | 17.1 | 16.4 | NA | 12.3 |
| Cobalt | 12.7 | 13.2 | 15.5 | 22.8 | 20 | 13.7 | NA | 15.3 |
| Copper | 19.5 | 21.5 | 18.8 | 20.3 | 20.3 | 20.6 | NA | 22.3 |
| Iron | 36,100 | 28,300 | 34,600 | 30,400 | 38,500 | 40,500 | NA | 41,300 |
| Lead | 19.7 | 19.5 | 18.5 | 19.6 | 19.6 | 20.4 | NA | 18.8 |
| Magnesium | 1,320 | 1,270 | 1,670 | 1,420 | 1,590 | 1,500 | NA | 1,610 |
| Manganese | 461 | 638 | 981 | 1,910 | 1,990 | 669 | NA | 1,200 |
| Mercury | 1.2 | 0.06 U | 0.24 | 0.09 J | 0.13 | 0.13 | NA | 0.100 B |
| Nickel | 17.5 | 22.8 | 24.2 | 27.3 | 29.3 | 22.4 | NA | 26.3 |
| Potassium | 869 J | 1,010 J | 1,010 J | 640 J | 871 J | 846 J | NA | 908 B |
| Selenium | 0.42 U | 0.4 U | 0.43 U | 0.42 U | 0.43 U | 0.64 J | NA | 0.440 U |
| Silver | 0.45 B | 0.45 B | 0.52 B | 0.6 B | 1.3 B | 0.68 B | NA | 2.10 J |
| Sodium | 132 J | 116 J | 119 J | 151 J | 100 U | 149 J | NA | 46.6 U |
| Thallium | 3.6 B | 2.5 B | 2.4 B | 2.4 B | 4.1 B | 2.9 B | NA | 0.660 U |
| Vanadium | 25.2 | 24.2 | 23.7 | 20.9 | 26.2 | 27.5 | NA | 26.3 |
| Zinc | 127 | 192 | 77.6 | 91.2 | 76.4 | 88.2 | NA | 87 J |
| | | | | | | | | |
| **Wet Chemistry (MG/KG)** | | | | | | | | |
| Total organic carbon (TOC) | NA | NA | NA | NA | NA | NA | NA | 6,550 |

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
U - Analyte not detected
UJ - Not detected, quantitation limit may be inaccurate

# Appendix B
# Statistical Comparison Procedures

# Appendix B

Comparisons of central tendency were performed to help determine what parameters exceed background based on facility background data and Site 10 soil data. These comparisons were made for surface and subsurface soil for 10. For all of these analyses, proxy values were substituted for any qualitative, non-detect values to enable the statistical calculations. These proxy substitutions were calculated as ½ the detection limit.

The appropriate type of central tendency comparison test was determined based on the assumed statistical distribution of the parent distributions of the two data sets. The distributional assumption is the best estimate of the distribution of a parent (or target) population. The determination of whether or not the data distribution could be considered normal was based on the results of the Shapiro-Wilk W test (EPA, 2000; Gilbert, 1987) using a significance level of 0.05. If the p-value for this test was less than 0.05 then the distributional assumption of normality was rejected. Otherwise, the data was treated as being normally distributed.

For cases where both sample populations appeared to be normally distributed, a t-test (EPA, 2000; Gilbert, 1987) was run on the data to determine whether the means of the two populations appear to be different from one another. If the two sets did not both appear to be normally distributed, then a nonparametric comparison of the two populations was used to compare the central tendency of the two populations. For a two sample comparison, the nonparametric test used is known as the Wilcoxon Rank Sum test (EPA, 2002; Gilbert, 1987) since it makes use of the sum of the ranks of the ordered (smallest to largest concentration for the combined two data sets) concentrations. For most cases this approach resulted in a nonparametric comparison being made.

The p-values presented in the tables are the probability that the observed differences in central tendency (between the background and site populations) would occur merely by chance. When this probability fell below a one-tailed significance level of 0.05, the decision was that there was a significant difference between the two populations. (Such a one-tailed test is only concerned with whether site exceeds background or not. A two-tailed test would be concerned with potential exceedances by either data group.) The significance level of 0.05 limits the potential false conclusion that the populations are not different (when they actually are) to one in twenty times. This is a common significance level for two sample comparisons (EPA, 2000; Gilbert, 1987).

# Appendix C
# Human Health Risk Assessment Tables

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site 10, Allegany Ballistics Laboratory

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current/Future | Surface Soil | Surface Soil | Site 10 Surface Soil | Industrial Worker | Adult | Dermal Absorption | On-site | Quant | Site workers may contact site surface soil. |
| | | | | | | Ingestion | On-site | Quant | Site workers may contact site surface soil. |
| | | | | Trespasser/Visitor | Adolescents | Dermal Absorption | On-site | Quant | Nearby residents may trespass on site and contact site surface soil. |
| | | | | | | Ingestion | On-site | Quant | Nearby residents may trespass on site and contact site surface soil. |
| | | Air | Airborne Particulates from Site 10 Surface Soil | Industrial Worker | Adult | Inhalation | On-site | Quant | Site workers may inhale dust particulates released from surface soil while conducting maintenance activities. |
| | | | | Trespasser/Visitor | Adolescent | Inhalation | On-site | Quant | Nearby residents may trespass on site and inhale dust particulates from surface soil. |
| | Subsurface Soil | Air | Volatile Emissions from Site 10 Subsurface Soil | Industrial Worker | Adult | Inhalation | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | | Trespasser/Visitor | Adolescent | Inhalation | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| Future | Soil* | Soil* | Site 10 Soil | Resident | Adult | Dermal Absorption | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | | Ingestion | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child | Dermal Absorption | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | | Ingestion | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child/Adult | Dermal Absorption | On-site | Quant | Although unlikely, site may be used for future residential development. This is for cancer risk only. |
| | | | | | | Ingestion | On-site | Quant | Although unlikely, site may be used for future residential development. This is for cancer risk only. |
| | | | | Construction Worker | Adult | Dermal Absorption | On-site | Quant | Construction worker may be exposed to surface and subsurface soil during excavation activities |
| | | | | | | Ingestion | On-site | Quant | Construction worker may be exposed to surface and subsurface soil during excavation activities |
| | | | | Trespasser/Visitor | Adolescent | Dermal Absorption | On-site | Quant | Trespasser/Visitors may be exposed to soil while visiting the site. |
| | | | | | | Ingestion | On-site | Quant | Trespasser/Visitors may be exposed to soil while visiting the site. |
| | | Air | Airborne Paticulates from Site 10 Soil | Resident | Adult | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child/Adult | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development. This is for cancer risk only. |
| | | | | Construction Worker | Adult | Inhalation | On-site | Quant | Construction workers may inhale fugitive dust from soil during excavation activities. |
| | | | | Trespasser/Visitor | Adolescent | Inhalation | On-site | Quant | Trespasser/Visitors may inhale dust particulates released from soil while visiting the site. |
| | | Air | Volatile Emissions from Site 10 Soil | Resident | Adult | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development |
| | | | | | Child/Adult | Inhalation | On-site | Quant | Although unlikely, site may be used for future residential development. This is for cancer risk only. |
| | | | | Construction Worker | Adult | Inhalation | On-site | Quant | Construction workers may inhale vapors from soil during excavation activities. |
| | | | | Trespasser/Visitor | Adolescent | Inhalation | On-site | Quant | Trespasser/Visitors may inhale volatiles emissions from soil while visiting the site. |
| | | Groundwater | Shallow Aquifer - Tap Water | Resident | Adult | Ingestion | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | | | Child | Dermal Absorption | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | | | | Ingestion | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | | | Child/Adult | Ingestion | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | Shallow Aquifer - Water in Excavation Pit | Construction Worker | Adult | Ingestion | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |
| | | | | | | Dermal Absorption | On-site | Qual | Constituents selected in this scenario will be discussed qualitatively. |

*Combined surface and subsurface soil.

Table 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 79-01-6 | Trichloroethene | 0.0023 | J | 0.0031 | J | MG/KG | AS10-SS05-(0-0.5) | 2/7 | 0.012 - 0.013 | 0.0031 | N/A | N/A | N/A | N/A | NO | NTX |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 6/7 | 0.012 - 0.013 | 0.0057 | N/A | N/A | N/A | N/A | NO | NTX |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 7/7 | 2.03 - 2.23 | 9830 | 11250 | 7,821 N | N/A | N/A | YES | ASL |
| 7440-38-2 | Arsenic | 4.4 | | 7.8 | | MG/KG | AS10-SS03-(0-0.5) | 7/7 | 0.35 - 0.38 | 7.8 | 11.5 | 0.426 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 131 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.02 - 0.03 | 131 | 120 | 548 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.3 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.02 - 0.03 | 1.3 | 1.2 | 15.6 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 3,900 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.58 - 0.63 | 7140 | N/A | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 14.7 | | MG/KG | AS10-SS03-(0-0.5) AS10-SS06-(0-0.5) | 7/7 | 0.07 - 0.08 | 14.7 | 20.5 | 23.5 N | N/A | N/A | NO | BSL |
| 7440-48-4 | Cobalt | 10.4 | J | 12.9 | | MG/KG | HCS-PWA-29S | 7/7 | 0.07 - 0.08 | 12.90 | 22 | 160 N | N/A | N/A | NO | BSL |
| 7440-50-8 | Copper | 12.8 | | 18.1 | | MG/KG | HCS-PWA-29S | 7/7 | 0.18 - 0.2 | 18.10 | 24.4 | 313 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 27,200 | | MG/KG | HCS-PWA-29S | 7/7 | 7.32 - 8.03 | 27200 | 28700 | 2,300 N | N/A | N/A | YES | ASL |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 7/7 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 751 | | 1,140 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.05 - 0.05 | 1140 | 1070 | 156 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 0.13 | | MG/KG | AS10-SS02-(0-0.5) AS10-SS06-(0-0.5) | 5/7 | 0.05 - 0.06 | 0.13 | 0.17 | 2.30 N | N/A | N/A | NO | BSL |
| 7440-02-0 | Nickel | 12.8 | | 18.7 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.09 - 0.1 | 18.7 | 27.6 | 156 N | N/A | N/A | NO | BSL |
| 7440-09-7 | Potassium | 952 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 6/7 | 8.45 - 9.27 | 1780 | 1850 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 1 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 1/7 | 0.4 - 0.44 | 1 | 2.4 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 117 | J | 137 | J | MG/KG | AS10-SS04-(0-0.5) | 2/7 | 25.60 - 101.23 | 137 | N/A | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 24.5 | | MG/KG | AS10-SS06-(0-0.5) | 7/7 | 0.07 - 0.08 | 24.5 | 25.5 | 54.8 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 130 | | MG/KG | AS10-SS02-(0-0.5) | 7/7 | 0.12 - 0.13 | 130 | 107 | 2,346 N | N/A | N/A | NO | BSL |

Screening for nonresident adult only. Screening levels are presented in Table 2A Supplement for nonresident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen particulate screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2A Supplement.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Subsurface Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/7 | 0.006 - 0.013 | 0.004 | | 12.0 | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 7/7 | 0.006 - 0.013 | 0.034 | | 0.1 | N/A | N/A | NO | BSL |
| - | m- and p-Xylene | 0.0023 | J | 0.0031 | J | MG/KG | AS10-SB01-(2-4) AS10-SB05-(2-4) | 4/6 | 0.012 - 0.013 | 0.0031 | | 78.6 | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 6,890 | | 9,650 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 2.09 - 2.17 | 9,650 | 22500 | N/A | N/A | N/A | NO | NTX |
| 7440-38-2 | Arsenic | 6.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 7/7 | 0.36 - 0.37 | 13.2 | 13.1 | N/A | N/A | N/A | NO | NTX |
| 7440-39-3 | Barium | 112 | | 193 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 0.02 - 0.02 | 193 | 220 | N/A | N/A | N/A | NO | NTX |
| 7440-41-7 | Beryllium | 1.30 | | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 7/7 | 0.02 - 0.02 | 1.5 | 1.5 | N/A | N/A | N/A | NO | NTX |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/7 | 0.05 - 0.05 | 2.3 | 2.3 | N/A | N/A | N/A | NO | NTX |
| 7440-70-2 | Calcium | 2,950 | | 4,380 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 0.59 - 0.62 | 4,380 | 67000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 12.3 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 0.07 - 0.07 | 17.1 | 24 | N/A | N/A | N/A | NO | NTX |
| 7440-48-4 | Cobalt | 12.7 | | 22.8 | | MG/KG | AS10-SB04-(2-4) | 7/7 | 0.07 - 0.07 | 22.8 | 19 | N/A | N/A | N/A | NO | NUT |
| 7440-50-8 | Copper | 18.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 7/7 | 0.19 - 0.2 | 22.3 | 31.6 | N/A | N/A | N/A | NO | NTX |
| 7439-89-6 | Iron | 28,300 | | 41,300 | | MG/KG | HCS-PWA-29 | 7/7 | 7.53 - 7.83 | 41,300 | 41300 | N/A | N/A | N/A | NO | NTX |
| 7439-92-1 | Lead | 18.5 | | 20.4 | | MG/KG | AS10-SB06-(2-4) | 7/7 | 0.14 - 0.15 | 20.4 | 23.2 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,270 | | 1,670 | | MG/KG | AS10-SB03-(2-4) | 7/7 | 0.64 - 0.67 | 1,670 | 2730 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 0.05 - 0.05 | 1,990 | 1240 | N/A | N/A | N/A | NO | NTX |
| 7439-97-6 | Mercury | 0.09 | J | 1.2 | | MG/KG | AS10-SB01-(2-4) | 5/7 | 0.05 - 0.06 | 1.2 | 0.050 | N/A | N/A | N/A | NO | NUT |
| 7440-02-0 | Nickel | 17.5 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 7/7 | 0.1 - 0.1 | 29.3 | 27.0 | N/A | N/A | N/A | NO | NTX |
| 7440-09-7 | Potassium | 640 | J | 1,010 | J | MG/KG | AS10-SB02-(2-4) AS10-SB03-(2-4) | 6/7 | 8.7 - 9.04 | 1,010 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 0.64 | J | MG/KG | AS10-SB06-(2-4) | 1/7 | 0.4 - 0.44 | 0.64 | 0.48 | N/A | N/A | N/A | NO | NTX |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/7 | 0.05 - 0.05 | 2.10 | 2.1 | N/A | N/A | N/A | NO | NUT |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 5/7 | 46.6 - 100 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 20.9 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 7/7 | 0.07 - 0.07 | 27.5 | 33.4 | N/A | N/A | N/A | NO | NUT |
| 7440-66-6 | Zinc | 76.4 | | 192 | | MG/KG | AS10-SB02-(2-4) | 7/7 | 0.12 - 0.12 | 192 | 87 | N/A | N/A | N/A | NO | NTX |

Screening for nonresident adult only. Screening levels are presented in Table 2A for nonresident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen volatile screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2A Supplement.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Subsurface Soil
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Subsurface Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | Essential Nutrient (NUT) |
| | | | | | | | | | | | | | | | | Below Screening Level (BSL) |

Table 2.4

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | 1.2 C | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | 1.6 C | N/A | N/A | NO | BSL |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | 16000 N | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | 7,821 N | N/A | N/A | YES | ASL |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | 0.426 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | 548 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | 15.6 N | N/A | N/A | NO | BSL |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | 3.91 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | NA | N/A | N/A | NO | BSL |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | 23.5 N | N/A | N/A | NO | BSL |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | 160 N | N/A | N/A | NO | BSL |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | 313 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | 2,300 N | N/A | N/A | YES | ASL |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | 400 | N/A | N/A | NO | BSL |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | NA | N/A | N/A | NO | BSL |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | 156 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | 2.35 N | N/A | N/A | NO | BSL |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | 156 N | N/A | N/A | NO | BSL |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | NA | N/A | N/A | NO | BSL |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | NA | N/A | N/A | NO | BSL |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | 54.8 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | 2,346 N | N/A | N/A | NO | BSL |

* Surface soil & subsurface soil combined

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Risk-Based Concentration Table, April 25, 2003, U.S. EPA Region III, Jennifer Hubbard.

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

RBC value for m-xylene used as surrogate for m- and p-xylene.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.4

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Trichloroethene screening value is calculated based on a noncarcinogenic hazard of 0.1. The noncarcinogenic screening level at HQ=0.1 is more conservative than the carcinogenic value provided in the Region III RBC table.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | N/A | N/A | N/A | NO | NTX |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | N/A | N/A | N/A | NO | NTX |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | N/A | N/A | N/A | NO | NTX |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | 7,821 N | N/A | N/A | YES | ASL |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | 0.426 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | 548 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | 15.6 N | N/A | N/A | NO | BSL |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | 3.91 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | 23.5 N | N/A | N/A | NO | BSL |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | 160 N | N/A | N/A | NO | BSL |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | 313 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | 2,300 N | N/A | N/A | YES | ASL |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | 156 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | 2.30 N | N/A | N/A | NO | BSL |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | 156 N | N/A | N/A | NO | BSL |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | 54.8 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | 2,346 N | N/A | N/A | NO | BSL |

* Surface soil & subsurface soil combined

Screening for resident adult only. Screening levels are presented in Table 2B Supplement for resident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen particulate screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2B Supplement

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

Trichloroethene screening value is calculated based on a noncarcinogenic hazard of 0.1. The noncarcinogenic screening level at HQ=0.1 is more conservative than the carcinogenic value provided in the Region III RBC table.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.6

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | N/A | N/A | N/A | NO | NTX |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | N/A | N/A | N/A | NO | NTX |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | N/A | N/A | N/A | NO | NTX |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | 7,821 N | N/A | N/A | YES | ASL |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | 0.426 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | 548 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | 15.6 N | N/A | N/A | NO | BSL |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | 3.91 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | 23.5 N | N/A | N/A | NO | BSL |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | 160 N | N/A | N/A | NO | BSL |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | 313 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | 2,300 N | N/A | N/A | YES | ASL |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | 156 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | 2.30 N | N/A | N/A | NO | BSL |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | 156 N | N/A | N/A | NO | BSL |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | 54.8 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | 2,346 N | N/A | N/A | NO | BSL |

* Surface soil & subsurface soil combined

Screening for resident child only. Screening levels are presented in Table 2C Supplement for resident child.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen particulate screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2C Supplement.

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.6

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

Trichloroethene screening value is calculated based on a noncarcinogenic hazard of 0.1. The noncarcinogenic screening level at HQ=0.1 is more conservative than the carcinogenic value provided in the Region III RBC table.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.7

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | N/A | N/A | N/A | NO | NTX |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | N/A | N/A | N/A | NO | NTX |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | N/A | N/A | N/A | NO | NTX |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | 7,821 N | N/A | N/A | YES | ASL |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | 0.426 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | 548 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | 15.6 N | N/A | N/A | NO | BSL |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | 3.91 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | 23.5 N | N/A | N/A | NO | BSL |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | 160 N | N/A | N/A | NO | BSL |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | 313 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | 2,300 N | N/A | N/A | YES | ASL |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | 156 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | 2.30 N | N/A | N/A | NO | BSL |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | 156 N | N/A | N/A | NO | BSL |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | 39.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | 54.8 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | 2,346 N | N/A | N/A | NO | BSL |

* Surface soil & subsurface soil combined

Screening for nonresident adult only. Screening levels are presented in Table 2D Supplement for nonresident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen particulate screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2D Supplemen

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.8

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.7

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

Trichloroethene screening value is calculated based on a noncarcinogenic hazard of 0.1. The noncarcinogenic screening level at HQ=0.1 is more conservative than the carcinogenic value provided in the Region III RBC table.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.8

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | 9.4E-01 | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | 6.0E-02 | N/A | N/A | NO | BSL |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | 7.9E+01 | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | N/A | N/A | N/A | NO | NTX |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | N/A | N/A | N/A | NO | NTX |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | N/A | N/A | N/A | NO | NTX |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | N/A | N/A | N/A | NO | NTX |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | N/A | N/A | N/A | NO | NTX |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | N/A | N/A | N/A | NO | NTX |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | N/A | N/A | N/A | NO | NTX |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | N/A | N/A | N/A | NO | NTX |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | N/A | N/A | N/A | NO | NTX |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | N/A | N/A | N/A | NO | NTX |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | N/A | N/A | N/A | NO | NTX |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | N/A | N/A | N/A | NO | NTX |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | N/A | N/A | N/A | NO | NTX |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | N/A | N/A | N/A | NO | NTX |

* Surface soil & subsurface soil combined

Screening for resident adult only. Screening levels are presented in Table 2B Supplement for resident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen volatile screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2B Supplement.

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.9

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | 1.2 | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | 0.1 | N/A | N/A | NO | BSL |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | 28.06 | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | N/A | N/A | N/A | NO | NTX |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | N/A | N/A | N/A | NO | NTX |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | N/A | N/A | N/A | NO | NTX |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | N/A | N/A | N/A | NO | NTX |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | N/A | N/A | N/A | NO | NTX |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | N/A | N/A | N/A | NO | NTX |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | N/A | N/A | N/A | NO | NTX |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | N/A | N/A | N/A | NO | NTX |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | N/A | N/A | N/A | NO | NTX |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | N/A | N/A | N/A | NO | NTX |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | N/A | N/A | N/A | NO | NTX |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | N/A | N/A | N/A | NO | NTX |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | N/A | N/A | N/A | NO | NTX |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | N/A | N/A | N/A | NO | NTX |

* Surface soil & subsurface soil combined

Screening for resident child only. Screening levels are presented in Table 2C Supplement for resident child.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen volatile screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2C Supplement.

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.9

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.10

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | 1.2 C | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | 0.1 C | N/A | N/A | NO | BSL |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | 78.56 N | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | 22500 | N/A | N/A | N/A | NO | NTX |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | 13.1 | N/A | N/A | N/A | NO | NTX |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | 220 | N/A | N/A | N/A | NO | NTX |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | 1.5 | N/A | N/A | N/A | NO | NTX |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | 292000 | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | 24 | N/A | N/A | N/A | NO | NTX |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | 22.0 | N/A | N/A | N/A | NO | NTX |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | 31.6 | N/A | N/A | N/A | NO | NTX |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | 41300 | N/A | N/A | N/A | NO | NTX |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | 41.5 | N/A | N/A | N/A | NO | NTX |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | 14100 | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | 1240 | N/A | N/A | N/A | NO | NTX |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | 0.17 | N/A | N/A | N/A | NO | NTX |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | 27.6 | N/A | N/A | N/A | NO | NTX |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | 1880 | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | 2.4 | N/A | N/A | N/A | NO | NTX |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | 2.1 | N/A | N/A | N/A | NO | NTX |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.60 - 101.23 | 151 | 105 | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | 33.4 | N/A | N/A | N/A | NO | NTX |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | 107 | N/A | N/A | N/A | NO | NTX |

* Surface soil & subsurface soil combined

Screening for nonresident adult only. Screening levels are presented in Table 2D Supplement for nonresident adult.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values available for metals (maximum concentrations).

[4] Screening Toxicity value is the the lowest between the noncarcinogen and carcinogen volatile screening levels, soil saturation concentration, and residential soil ingestion RBC, Table 2D Supplement.

RBC value for cadmium-food used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.10

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Table 2.11

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Groundwater
Exposure Point: Shallow Aquifer-Tap Water

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127-18-4 | Tetrachloroethene | 0.004 | J | 0.004 | J | MG/KG | HCS-PWA-13 | 1/14 | 0.006 - 0.013 | 0.004 | N/A | 0.0047 C | N/A | N/A | NO | BSL |
| 79-01-6 | Trichloroethene | 0.0017 | J | 0.034 | | MG/KG | HCS-PWA-13 | 9/14 | 0.006 - 0.013 | 0.034 | N/A | 0.00026 N | N/A | N/A | YES | ASL |
| - | m- and p-Xylene | 0.0019 | J | 0.0057 | J | MG/KG | AS10-SS03P-(0-0.5) | 10/13 | 0.012 - 0.013 | 0.0057 | N/A | 25 N | N/A | N/A | NO | BSL |
| 7429-90-5 | Aluminum | 5,900 | | 9,830 | | MG/KG | AS10-SS03-(0-0.5) | 14/14 | 2.03 - 2.23 | 9830 | N/A | N/A | N/A | N/A | NO | NTX |
| 7440-38-2 | Arsenic | 4.4 | | 13.2 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.35 - 0.38 | 13.2 | N/A | 0.026 C | N/A | N/A | YES | ASL |
| 7440-39-3 | Barium | 88.2 | | 193 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.02 - 0.03 | 193 | N/A | 210 N | N/A | N/A | NO | BSL |
| 7440-41-7 | Beryllium | 0.89 | J | 1.5 | | MG/KG | AS10-SB05-(2-4) AS10-SB06-(2-4) | 14/14 | 0.02 - 0.03 | 1.5 | N/A | 120 N | N/A | N/A | NO | BSL |
| 7440-43-9 | Cadmium | 2.30 | J | 2.30 | J | MG/KG | HCS-PWA-29 | 1/14 | 0.05 - 2.29 | 2.30 | N/A | 2.7 N | N/A | N/A | NO | BSL |
| 7440-70-2 | Calcium | 2,950 | | 7,140 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.58 - 0.63 | 7140 | N/A | N/A | N/A | N/A | NO | NUT |
| 7440-47-3 | Chromium | 10.7 | | 17.1 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.07 - 0.08 | 17.1 | N/A | 4.2 N | N/A | N/A | YES | ASL |
| 7440-48-4 | Cobalt | 10.4 | J | 22.8 | | MG/KG | AS10-SB04-(2-4) | 14/14 | 0.07 - 0.08 | 22.8 | N/A | N/A | N/A | N/A | NO | NTX |
| 7440-50-8 | Copper | 12.8 | | 22.3 | | MG/KG | HCS-PWA-29 | 14/14 | 0.18 - 0.2 | 22.30 | N/A | 1100 N | N/A | N/A | NO | BSL |
| 7439-89-6 | Iron | 19,100 | | 41,300 | | MG/KG | HCS-PWA-29 | 14/14 | 7.32 - 8.03 | 41300 | N/A | N/A | N/A | N/A | NO | NTX |
| 7439-92-1 | Lead | 17.7 | | 23.4 | | MG/KG | AS10-SS02-(0-0.5) | 14/14 | 0.14 - 0.15 | 23.4 | N/A | 400 | N/A | N/A | NO | BSL |
| 7439-95-4 | Magnesium | 1,120 | J | 1,820 | | MG/KG | AS10-SS06-(0-0.5) | 14/14 | 0.62 - 0.68 | 1820 | N/A | N/A | N/A | N/A | NO | NUT |
| 7439-96-5 | Manganese | 461 | | 1,990 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.05 - 0.05 | 1990 | N/A | 95 N | N/A | N/A | YES | ASL |
| 7439-97-6 | Mercury | 0.08 | | 1.2 | | MG/KG | AS10-SB01-(2-4) | 10/14 | 0.05 - 0.06 | 1.2 | N/A | N/A | N/A | N/A | NO | NTX |
| 7440-02-0 | Nickel | 12.8 | | 29.3 | | MG/KG | AS10-SB05-(2-4) | 14/14 | 0.09 - 0.1 | 29.3 | N/A | N/A | N/A | N/A | NO | NTX |
| 7440-09-7 | Potassium | 640 | J | 1,780 | | MG/KG | AS10-SS03-(0-0.5) | 12/14 | 8.45 - 9.27 | 1780 | N/A | N/A | N/A | N/A | NO | NUT |
| 7782-49-2 | Selenium | 0.64 | J | 1 | J | MG/KG | AS10-SS02-(0-0.5) | 2/14 | 0.4 - 0.44 | 1 | N/A | 1.9 N | N/A | N/A | NO | BSL |
| 7440-22-4 | Silver | 2.10 | J | 2.10 | J | MG/KG | HCS-PWA-29 | 1/13 | 0.05 - 0.05 | 2.10 | N/A | 3.1 N | N/A | N/A | NO | BSL |
| 7440-23-5 | Sodium | 116 | J | 151 | J | MG/KG | AS10-SB04-(2-4) | 7/14 | 25.6 - 101.23 | 151 | N/A | N/A | N/A | N/A | NO | NUT |
| 7440-62-2 | Vanadium | 17.1 | | 27.5 | | MG/KG | AS10-SB06-(2-4) | 14/14 | 0.07 - 0.08 | 27.5 | N/A | 510 N | N/A | N/A | NO | BSL |
| 7440-66-6 | Zinc | 52.5 | | 192 | | MG/KG | AS10-SB02-(2-4) | 14/14 | 0.12 - 0.13 | 192 | N/A | 1400 N | N/A | N/A | NO | BSL |

* Surface soil & subsurface soil combined

The constituents selected through the soil to groundwater pathway will be discussed qualitatively only.

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Soil Screening Levels at DAF=20, April 25, 2003, U.S. EPA Region III, Jennifer Hubbard.

RBC value for cadmium-water used as surrogate for cadmium.

RBC value for Chromium VI used for total chromium.

Lead screening toxicity value is 400 mg/kg, the EPA residential soil screening level for lead.

RBC value for manganese-nonfood used as surrogate for manganese.

RBC value for mercuric chloride used as surrogate for mercury.

SQL = Sample Quantification Limit

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

Table 2.11

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Groundwater
Exposure Point: Shallow Aquifer-Tap Water

| CAS Number | Chemical | Minimum [1] Concentration | Minimum Qualifier | Maximum [1] Concentration | Maximum 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 | COPC Flag | Rationale for [5] Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

RBC value for m-xylene used as surrogate for m- and p-xylene.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

## Table 2A Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by a nonresident adult
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | | | | | |
| Tetrachloroethene | 2.0E-01 | 2.2E+02 | N/A | 2.0E-03 | 2.04E+01 | N/A | **1.2E+01** | **2.3E+02** | **1.2E+01** |
| Trichloroethene | 1.0E-02 | 1.40E+01 | N/A | 4.0E-01 | 1.02E-01 | N/A | **1.6E+00** | **1.3E+03** | **1.0E-01** |
| m- and p-Xylene | 3.0E-02 | 7.86E+01 | N/A | N/A | N/A | N/A | **1.6E+04** | **4.2E+02** | **7.9E+01** |
| **Non-Volatile Compounds** | | | | | | | | | |
| Aluminum | 1.0E-03 | N/A | 4.8E+05 | N/A | N/A | N/A | **7.8E+03** | **N/A** | **7.8E+03** |
| Arsenic | N/A | N/A | N/A | 1.5E+01 | N/A | 9.4E+02 | **4.3E-01** | **N/A** | **4.3E-01** |
| Barium | 1.4E-04 | N/A | 6.7E+04 | N/A | N/A | N/A | **5.5E+02** | **N/A** | **5.5E+02** |
| Beryllium | 5.7E-06 | N/A | 2.7E+03 | 8.4E+00 | N/A | 1.7E+03 | **1.6E+01** | **N/A** | **1.6E+01** |
| Calcium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Chromium | 3.0E-05 | N/A | 1.4E+04 | 4.1E+01 | N/A | 3.4E+02 | **2.3E+01** | **N/A** | **2.3E+01** |
| Cobalt | 5.0E-06 | N/A | 2.4E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Copper | N/A | N/A | N/A | N/A | N/A | N/A | **3.1E+02** | **N/A** | **3.1E+02** |
| Iron | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |
| Lead | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Magnesium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Manganese | 1.4E-05 | N/A | 6.7E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Mercury | 8.6E-05 | N/A | 4.1E+04 | N/A | N/A | N/A | **2.3E+00** | **N/A** | **2.3E+00** |
| Nickel | N/A | N/A | N/A | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Potassium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Sodium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Vanadium | N/A | N/A | N/A | N/A | N/A | N/A | **5.5E+01** | **N/A** | **5.5E+01** |
| Zinc | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |

**Screening Level Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil**

**Volatile Screening Level** (mg/kg) = $\dfrac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/VF]}$

**Particulate Screening Level** (mg/kg) = $\dfrac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/PEF]}$

| EXPOSURE ASSUMPTIONS FOR NONCARCINOGENS | |
|---|---|
| Exposure setting | **Parameter** |
| THQ - Target hazard quotient (unitless) | 0.1 |
| ATn - Averaging time non-carcinogens (year) | 24 |
| RfD - Inhalation reference dose (mg/kg/day) | Chemical specific |
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 24 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

**Screening Level Equation for Inhalation of Carcinogenic Contaminants in Residential Soil**

**Volatile Screening Level** (mg/kg) = $\dfrac{TR * ATc * 365\ days/year}{SF * EF * ED * [1/VF] * (1/70\ kg) * (20m^3/d)}$

**Particulate Screening Level** (mg/kg) = $\dfrac{TR * ATc * 365\ days/year}{SF * EF * ED * [1/PEF] * (1/70\ kg) * (20m^3/d)}$

| EXPOSURE ASSUMPTIONS FOR CARCINOGENS | |
|---|---|
| Exposure setting | **Parameter** |
| TR - Target cancer risk (unitless) | 1.0E-06 |
| ATc - Averaging time carcinogens (years) | 70 |
| SF - Inhalation slope factor $(mg/kg/d)^{-1}$ | chemical specific |

## Table 2A Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by a nonresident adult
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 24 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

* Residential soil RBC from EPA Region III Risk- Based Concentration Table, April 200.

** Soil saturation concentration is provided in Table 2F Supplement.

*** Lowest RBC is the the lowest between the noncarcinogen and carcinogen volatile and particulate screening levels, soil saturation concentration, and residential soil ingestion RBC.

## Table 2B Supplement
### Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by the Residential adult (Lifetime resident for carcinogens only)
### Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | | | | | |
| Tetrachloroethene | 1.4E-01 | 1.5E+02 | N/A | 2.0E-02 | 9.40E-01 | N/A | **1.2E+00** | **2.3E+02** | **9.4E-01** |
| Trichloroethene | 1.0E-02 | 1.4E+01 | N/A | 4.0E-01 | 6.01E-02 | N/A | **1.6E+00** | **1.3E+03** | **6.0E-02** |
| m- and p-Xylene | 3.0E-02 | 7.9E+01 | N/A | N/A | N/A | N/A | **1.6E+04** | **4.2E+02** | **7.9E+01** |
| **Non-Volatile Compounds** | | | | | | | | | |
| Aluminum | 1.0E-03 | N/A | 4.8E+05 | N/A | N/A | N/A | **7.8E+03** | **N/A** | **7.8E+03** |
| Arsenic | N/A | N/A | N/A | 1.5E+01 | N/A | 5.5E+02 | **4.3E-01** | **N/A** | **4.3E-01** |
| Barium | 1.4E-04 | N/A | 6.7E+04 | N/A | N/A | N/A | **5.5E+02** | **N/A** | **5.5E+02** |
| Beryllium | 5.7E-06 | N/A | 2.7E+03 | 8.4E+00 | N/A | 9.8E+02 | **1.6E+01** | **N/A** | **1.6E+01** |
| Cadmium | 5.7E-05 | N/A | 2.7E+04 | 6.3E+00 | N/A | 1.3E+03 | **3.9E+00** | **N/A** | **3.9E+00** |
| Calcium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Chromium | 3.0E-05 | N/A | 1.4E+04 | 4.1E+01 | N/A | 2.0E+02 | **2.3E+01** | **N/A** | **2.3E+01** |
| Cobalt | 5.0E-06 | N/A | 2.4E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Copper | N/A | N/A | N/A | N/A | N/A | N/A | **3.1E+02** | **N/A** | **3.1E+02** |
| Iron | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |
| Lead | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Magnesium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Manganese | 1.4E-05 | N/A | 6.7E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Mercury | 8.6E-05 | N/A | 4.1E+04 | N/A | N/A | N/A | **2.3E+00** | **N/A** | **2.3E+00** |
| Nickel | N/A | N/A | N/A | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Potassium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Silver | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Sodium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Vanadium | N/A | N/A | N/A | N/A | N/A | N/A | **5.5E+01** | **N/A** | **5.5E+01** |
| Zinc | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |

**Screening Level Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil**

**Volatile Screening Level** (mg/kg) = $\dfrac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/VF]}$

**Particulate Screening Level** (mg/kg) $\dfrac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/PEF]}$

| EXPOSURE ASSUMPTIONS FOR NONCARCINOGENS | |
|---|---|
| Exposure setting | **Parameter** |
| THQ - Target hazard quotient (unitless) | 0.1 |
| ATn - Averaging time non-carcinogens (year) | 24 |
| RfD - Inhalation reference dose (mg/kg/day) | Chemical specific |
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 24 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

## Table 2B Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by the Residential adult (Lifetime resident for carcinogens only)
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|

**Screening Level Equation for Inhalation of Carcinogenic Contaminants in Residential Soil**

$$\text{Volatile Screening Level (mg/kg)} = \frac{TR * ATc * 365\ days/year}{SF * EF * [1/VF] * ((1/15\ kg) * (12\ m^3/d * 6\ yr)) + ((1/70\ kg) * (20m^3/d * 24\ yr))}$$

$$\text{Particulate Screening Level (mg/kg)} \frac{TR * ATc * 365\ days/year}{SF * EF * [1/PEF] * ((1/15\ kg) * (12\ m^3/d * 6\ yr)) + ((1/70\ kg) * (20m^3/d * 24\ yr))}$$

| EXPOSURE ASSUMPTIONS FOR CARCINOGENS | | |
|---|---|---|
| Exposure setting | | Parameter |
| TR - Target cancer risk (unitless) | | 1.0E-06 |
| ATc - Averaging time carcinogens (years) | | 70 |
| SF - Inhalation slope factor $(mg/kg/d)^{-1}$ | | chemical specific |
| EF - Exposure frequency (days/year) | | 350 |
| ED - Exposure duration (year) | Adult | Child |
| | 24 | 6 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | | 1.32E+09 |

* Residential soil RBC from EPA Region III Risk- Based Concentration Table, April 2003.

** Soil saturation concentration is provided in Table 2F Supplement.

*** Lowest RBC is the the lowest between the noncarcinogen and carcinogen volatile and particulate screening levels, soil saturation concentration, and residential soil ingestion RBC.

## Table 2C Supplement
### Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by the Residential Child (Lifetime resident for carcinogens only)
### Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | | | | | |
| Tetrachloroethene | 1.4E-01 | 5.5E+01 | N/A | 2.0E-02 | 1.20E+00 | N/A | **1.2E+00** | **2.3E+02** | **1.2E+00** |
| Trichloroethene | 1.0E-02 | 5.0E+00 | N/A | 4.0E-01 | 1.12E-01 | N/A | **1.6E+00** | **1.3E+03** | **1.1E-01** |
| m- and p-Xylene | 3.0E-02 | 2.8E+01 | N/A | N/A | N/A | N/A | **1.6E+04** | **4.2E+02** | **2.8E+01** |
| **Non-Volatile Compounds** | | | | | | | | | |
| Aluminum | 1.0E-03 | N/A | 1.7E+05 | N/A | N/A | N/A | **7.8E+03** | **N/A** | **7.8E+03** |
| Arsenic | N/A | N/A | N/A | 1.5E+01 | N/A | 5.5E+02 | **4.3E-01** | **N/A** | **4.3E-01** |
| Barium | 1.4E-04 | N/A | 2.4E+04 | N/A | N/A | N/A | **5.5E+02** | **N/A** | **5.5E+02** |
| Beryllium | 5.7E-06 | N/A | 9.8E+02 | 8.4E+00 | N/A | 9.8E+02 | **1.6E+01** | **N/A** | **1.6E+01** |
| Cadmium | 5.7E-05 | N/A | 9.8E+03 | 6.3E+00 | N/A | 1.3E+03 | **3.9E+00** | **N/A** | **3.9E+00** |
| Calcium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Chromium | 3.0E-05 | N/A | 5.2E+03 | 4.1E+01 | N/A | 2.0E+02 | **2.3E+01** | **N/A** | **2.3E+01** |
| Cobalt | 5.0E-06 | N/A | 8.6E+02 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Copper | N/A | N/A | N/A | N/A | N/A | N/A | **3.1E+02** | **N/A** | **3.1E+02** |
| Iron | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |
| Lead | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Magnesium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Manganese | 1.4E-05 | N/A | 2.4E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Mercury | 8.6E-05 | N/A | 1.5E+04 | N/A | N/A | N/A | **2.3E+00** | **N/A** | **2.3E+00** |
| Nickel | N/A | N/A | N/A | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Potassium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Silver | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Sodium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Vanadium | N/A | N/A | N/A | N/A | N/A | N/A | **5.5E+01** | **N/A** | **5.5E+01** |
| Zinc | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |

**Screening Level Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil**

$$\text{Volatile Screening Level (mg/kg)} = \frac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/15kg * 12m^3/d) * 1/VF]}$$

$$\text{Particulate Screening Level (mg/kg)} \quad \frac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/15kg * 12m^3/d) * 1/PEF]}$$

| EXPOSURE ASSUMPTIONS FOR NONCARCINOGENS | |
|---|---|
| Exposure setting | **Parameter** |
| THQ - Target hazard quotient (unitless) | 0.1 |
| ATn - Averaging time non-carcinogens (year) | 6 |
| RfD - Inhalation reference dose (mg/kg/day) | Chemical specific |
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 6 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

## Table 2C Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by the Residential Child (Lifetime resident for carcinogens only)
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|

**Screening Level Equation for Inhalation of Carcinogenic Contaminants in Residential Soil**

$$\text{Volatile Screening Level (mg/kg)} = \frac{TR * ATc * 365\ days/year}{SF * EF * [1/VF] * ((1/15\ kg) * (12\ m^3/d * 6\ yr)) + ((1/70\ kg) * (20 m^3/d * 24\ yr))}$$

$$\text{Particulate Screening Level (mg/kg)} \frac{TR * ATc * 365\ days/year}{SF * EF * [1/PEF] * ((1/15\ kg) * (12\ m^3/d * 6\ yr)) + ((1/70\ kg) * (20 m^3/d * 24\ yr))}$$

| EXPOSURE ASSUMPTIONS FOR CARCINOGENS | | |
|---|---|---|
| Exposure setting | | Parameter |
| TR - Target cancer risk (unitless) | | 1.0E-06 |
| ATc - Averaging time carcinogens (years) | | 70 |
| SF - Inhalation slope factor $(mg/kg/d)^{-1}$ | | chemical specific |
| EF - Exposure frequency (days/year) | | 350 |
| ED - Exposure duration (year) | Adult | Child |
| | 24 | 6 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | | 1.32E+09 |

* Residential soil RBC from EPA Region III Risk- Based Concentration Table, April 2003.

** Soil saturation concentration is provided in Table 2F Supplement.

*** Lowest RBC is the the lowest between the noncarcinogen and carcinogen volatile and particulate screening levels, soil saturation concentration, and residential soil ingestion RBC.

## Table 2D Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by a nonresident adult
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| **Volatile Organic Compounds** | | | | | | | | | |
| Tetrachloroethene | 1.4E-01 | 1.5E+02 | N/A | 2.0E-02 | 2.04E+00 | N/A | **1.2E+00** | **2.3E+02** | **1.2E+00** |
| Trichloroethene | 1.0E-02 | 1.4E+01 | N/A | 4.0E-01 | 1.02E-01 | N/A | **1.6E+00** | **1.3E+03** | **1.0E-01** |
| m- and p-Xylene | 3.0E-02 | 7.9E+01 | N/A | N/A | N/A | N/A | **1.6E+04** | **4.2E+02** | **7.9E+01** |
| **Non-Volatile Compounds** | | | | | | | | | |
| Aluminum | 1.0E-03 | N/A | 4.8E+05 | N/A | N/A | N/A | **7.8E+03** | **N/A** | **7.8E+03** |
| Arsenic | N/A | N/A | N/A | 1.5E+01 | N/A | 9.4E+02 | **4.3E-01** | **N/A** | **4.3E-01** |
| Barium | 1.4E-04 | N/A | 6.7E+04 | N/A | N/A | N/A | **5.5E+02** | **N/A** | **5.5E+02** |
| Beryllium | 5.7E-06 | N/A | 2.7E+03 | 8.4E+00 | N/A | 1.7E+03 | **1.6E+01** | **N/A** | **1.6E+01** |
| Cadmium | 5.7E-05 | N/A | 2.7E+04 | 6.3E+00 | N/A | 2.2E+03 | **3.9E+00** | **N/A** | **3.9E+00** |
| Calcium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Chromium | 3.0E-05 | N/A | 1.4E+04 | 4.1E+01 | N/A | 3.4E+02 | **2.3E+01** | **N/A** | **2.3E+01** |
| Cobalt | 5.0E-06 | N/A | 2.4E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Copper | N/A | N/A | N/A | N/A | N/A | N/A | **3.1E+02** | **N/A** | **3.1E+02** |
| Iron | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |
| Lead | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Magnesium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Manganese | 1.4E-05 | N/A | 6.7E+03 | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Mercury | 8.6E-05 | N/A | 4.1E+04 | N/A | N/A | N/A | **2.3E+00** | **N/A** | **2.3E+00** |
| Nickel | N/A | N/A | N/A | N/A | N/A | N/A | **1.6E+02** | **N/A** | **1.6E+02** |
| Potassium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Selenium | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Silver | N/A | N/A | N/A | N/A | N/A | N/A | **3.9E+01** | **N/A** | **3.9E+01** |
| Sodium | N/A | N/A | N/A | N/A | N/A | N/A | **N/A** | **N/A** | **N/A** |
| Vanadium | N/A | N/A | N/A | N/A | N/A | N/A | **5.5E+01** | **N/A** | **5.5E+01** |
| Zinc | N/A | N/A | N/A | N/A | N/A | N/A | **2.3E+03** | **N/A** | **2.3E+03** |

**Screening Level Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil**

$$\text{Volatile Screening Level (mg/kg)} = \frac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/VF]}$$

$$\text{Particulate Screening Level (mg/kg)} = \frac{THQ * ATn * 365\ days/year}{EF * ED * [(1/RfD * 1/70kg * 20m^3/d) * 1/PEF]}$$

| EXPOSURE ASSUMPTIONS FOR NONCARCINOGENS | |
|---|---|
| Exposure setting | **Parameter** |
| THQ - Target hazard quotient (unitless) | 0.1 |
| ATn - Averaging time non-carcinogens (year) | 24 |
| RfD - Inhalation reference dose (mg/kg/day) | Chemical specific |
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 24 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

## Table 2D Supplement
## Screening Levels for Direct Inhalation of Volatiles and Fugitive Dusts by a nonresident adult
## Site 10, Allegany Ballistics Laboratory

| Chemical | Inhalation Reference Dose (RfD) (mg/kg/day) | Volatile Screening Level Noncarcinogen (mg/kg) | Particulate Screening Level Noncarcinogen (mg/kg) | Inhalation Slope Factor (SF) $(mg/kg/day)^{-1}$ | Volatile Screening Level Carcinogen (mg/kg) | Particulate Screening Level Carcinogen (mg/kg) | Residential* Soil RBC (mg/kg) | Soil Saturation** Concentration $C_{sat}$ (mg/kg) | Lowest*** SSLs (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|

**Screening Level Equation for Inhalation of Carcinogenic Contaminants in Residential Soil**

$$\text{Volatile Screening Level (mg/kg)} = \frac{TR * ATc * 365\ days/year}{SF * EF * ED * [1/VF] * (1/70\ kg) * (20m^3/d)}$$

$$\text{Particulate Screening Level (mg/kg)} \frac{TR * ATc * 365\ days/year}{SF * EF * ED * [1/PEF] * (1/70\ kg) * (20m^3/d)}$$

| EXPOSURE ASSUMPTIONS FOR CARCINOGENS | |
|---|---|
| Exposure setting | Parameter |
| TR - Target cancer risk (unitless) | 1.0E-06 |
| ATc - Averaging time carcinogens (years) | 70 |
| SF - Inhalation slope factor $(mg/kg/d)^{-1}$ | chemical specific |
| EF - Exposure frequency (days/year) | 350 |
| ED - Exposure duration (year) | 24 |
| VF - Soil-to-air volatilization factor (m3/kg)-Table 2E Supplement | Chemical specific |
| PEF - Particulate emission factor (m3/kg) | 1.32E+09 |

* Residential soil RBC from EPA Region III Risk- Based Concentration Table, April 2003.
** Soil saturation concentration is provided in Table 2F Supplement.
*** Lowest RBC is the the lowest between the noncarcinogen and carcinogen volatile and particulate screening levels, soil saturation concentration, and residential soil ingestion RBC.

**Table 2E Supplement**
**Calculation of Generic Chemical Specific VF Factors**
**Site 10, Allegany Ballistics Laboratory**

| Chemical (eg.) | Diffusivity in Air ($D_i$) ($cm^2/s$) | Henry's Law Constant (H') (unitless) | Diffusivity in Water ($D_w$) ($cm^2/s$) | Soil Organic Carbon Partition Coeff. ($K_{oc}$) ($cm^3/g$) | Soil Water Partition Coeff. ($K_d = K_{oc} \times F_{oc}$) ($g/cm^3$) | Solubility in Water (S) (mg/L) | |
|---|---|---|---|---|---|---|---|
| ***Volatile Organic Compounds*** | | | | | | | |
| Tetrachloroethene | 7.20E-02 | 7.54E-01 | 8.20E-06 | 1.55E+02 | 9.30E-01 | 2.00E+02 | |
| Trichloroethene | 7.90E-02 | 4.22E-01 | 9.10E-06 | 1.66E+02 | 9.96E-01 | 1.10E+03 | |
| m- and p-Xylene | 7.00E-02 | 3.01E-01 | 7.80E-06 | 4.07E+02 | 2.44E+00 | 1.61E+02 | |

**Volatilization factor (VF) = ($m^3/kg$)**

$$\frac{Q/C * (3.14 * D_A * T)^{1/2} * 10^{-4}\ m^2/cm^2}{2 * r_b * D_A}$$

**Apparent Diffusivity ($D_A$) = ($cm^2/s$)**

$$\frac{[(Q_a^{10/3} * D_i * H' + Q_w^{10/3} * D_w)/n^2]}{(r_b * K_d + Q_w + Q_a * H')}$$

| Parameters | Values |
|---|---|
| Q/C - Inverse of the mean concentration at the center of a 0.5-acre-square source using Harrisburg ($g/m^2$-s per $kg/m^3$) | 81.9 |
| T - Exposure interval(s) | 9.5E+08 |
| $r_b$ - Soil bulk density ($g/cm^3$) | 1.5 |
| $Q_a$ - Air-filled soil porosity ($L_{air}/L_{water}$) = n - $Q_w$ | 0.28 |
| n - Total soil porosity (Lpore/Lsoil) = 1 - ($r_b/r_s$) | 0.43 |
| $Q_w$ - Water-filled soil porosity (Lwater/Lsoil) | 0.15 |
| $r_s$ - Soil particle density ($g/cm^3$) | 2.65 |
| $f_{oc}$ - fraction organic carbon in soil (g/g) | 0.006 |

Chemical and physical properties from USEPA, 1996, *Soil Screening Guidance: User's Guide*, EPA/540/R-96/018.
** Soil saturation concentration is provided in Table 2F Supplement.

**Table 2F Supplement**
**Derivation of Soil Saturation Limit**
**Site 10, Allegany Ballistics Laboratory**

| Chemical (eg.) | Solubility in Water (S) (mg/L-water) | Henry's Law Constant (H') (unitless) | Soil Organic Carbon Partition Coeff. ($K_{oc}$) ($cm^3/g$) | Soil Water Partition Coeff. ($K_d = K_{oc} \times F_{oc}$) ($g/cm^3$) | Soil Saturation Concentration ($C_{sat}$) (mg/kg) |
|---|---|---|---|---|---|
| ***Volatile Organic Compounds*** | | | | | |
| Tetrachloroethene | 2.00E+02 | 7.54E-01 | 1.55E+02 | 9.30E-01 | 2.3E+02 |
| Trichloroethene | 1.10E+03 | 4.22E-01 | 1.66E+02 | 9.96E-01 | 1.3E+03 |
| m- and p-Xylene | 1.61E+02 | 3.01E-01 | 4.07E+02 | 2.44E+00 | 4.2E+02 |

**Soil Saturation Limit for Organics**

$$C_s = S/\rho_b\,[Kd * \rho_b + \Theta w + \Theta a * H']$$

(mg/kg)

**Parameters**

| | | |
|---|---|---|
| $C_{sat}$ (mg/kg): | calculated | soil saturation concentration |
| S (mg/L-water): | chem-specific | solubility in water |
| $K_d$ (L/kg): | chem-specific | soil-water particion coefficient |
| $K_{oc}$ (L/Kg): | chem-specific | organic carbon partition coefficient, organic constituents |
| $F_{oc}$ (g/g): | 0.006 | fraction organic carbon in soil |
| $\Theta_w$ ($L_{water}/L_{soil}$): | 0.15 | water-filled soil porosity |
| $\Theta_a$ (Lair/Lsoil): | 0.28 | air-filled soil porosity ($n-\Theta_w$) |
| H' (unitless): | chem-specific | dimensionless Henry's law constant |
| $\rho_b$ (kg/L): | 1.5 | dry soil bulk density |
| $\rho_s$ (kg/L): | 2.65 | soil particle density |
| n (Lpore/Lsoil): | 0.43 | total soil porosity ($1-\rho_b/\rho_s$) |

Kd, Koc, H', S and default values for additional parameters from USEPA's *Soil Screening Guidance: User's Guide, EPA/540/R-96/018, July 1996.*

Table 3.1

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 10 Surface Soil

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 7,911 | 9,095 | 9,830 | | MG/KG | 9,095 | 95% UCL-N | W-Test (4) | 9,095 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 6.19 | 7.04 | 7.80 | | MG/KG | 7.04 | 95% UCL-N | W-Test (4) | 7.04 | 95% UCL-N | W-Test (4) |
| Iron | MG/KG | 22,800 | 25,413 | 27,200 | | MG/KG | 25,842 | 95% UCL-T | W-Test (4) | 25,842 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 904 | 1,014 | 1,140 | | MG/KG | 1,029 | 95% UCL-T | W-Test (4) | 1,029 | 95% UCL-T | W-Test (4) |

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.2

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 7,911 | 9,095 | 9,830 | | MG/KG | 9,095 | 95% UCL-N | W-Test (4) | 9,095 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 6.19 | 7.04 | 7.80 | | MG/KG | 7.04 | 95% UCL-N | W-Test (4) | 7.04 | 95% UCL-N | W-Test (4) |
| Iron | MG/KG | 22,800 | 25,413 | 27,200 | | MG/KG | 25,842 | 95% UCL-T | W-Test (4) | 25,842 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 904 | 1,014 | 1,140 | | MG/KG | 1,029 | 95% UCL-T | W-Test (4) | 1,029 | 95% UCL-T | W-Test (4) |

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: At Site 10

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 8,266 | 8,878 | 9,830 | | MG/KG | 8,878 | 95% UCL-N | W-Test (4) | 8,878 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 8.19 | 9.56 | 13.2 | | MG/KG | 9.87 | 95% UCL-T | W-Test (4) | 9.87 | 95% UCL-T | W-Test (4) |
| Iron | MG/KG | 29,236 | 32,954 | 41,300 | | MG/KG | 33,813 | 95% UCL-T | W-Test (4) | 33,813 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 1,013 | 1,223 | 1,990 | | MG/KG | 1,265 | 95% UCL-T | W-Test (1) | 1,265 | 95% UCL-T | W-Test (1) |

* Surface soil & subsurface soil combined.

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.4

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 8,266 | 8,878 | 9,830 | | MG/KG | 8,878 | 95% UCL-N | W-Test (4) | 8,878 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 8.19 | 9.56 | 13.2 | | MG/KG | 9.87 | 95% UCL-T | W-Test (4) | 9.87 | 95% UCL-T | W-Test (4) |
| Iron | MG/KG | 29,236 | 32,954 | 41,300 | | MG/KG | 33,813 | 95% UCL-T | W-Test (4) | 33,813 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 1,013 | 1,223 | 1,990 | | MG/KG | 1,265 | 95% UCL-T | W-Test (1) | 1,265 | 95% UCL-T | W-Test (1) |

* Surface soil & subsurface soil combined.

Screening for resident adult only.

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.5

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 8,266 | 8,878 | 9,830 | | MG/KG | 8,878 | 95% UCL-N | W-Test (4) | 8,878 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 8.19 | 9.56 | 13.2 | | MG/KG | 9.87 | 95% UCL-T | W-Test (4) | 9.87 | 95% UCL-T | W-Test (4) |
| Iron | MG/KG | 29,236 | 32,954 | 41,300 | | MG/KG | 33,813 | 95% UCL-T | W-Test (4) | 33,813 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 1,013 | 1,223 | 1,990 | | MG/KG | 1,265 | 95% UCL-T | W-Test (1) | 1,265 | 95% UCL-T | W-Test (1) |

* Surface soil & subsurface soil combined.

Screening for resident child only.

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.6

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Aluminum | MG/KG | 8,266 | 8,878 | 9,830 | | MG/KG | 8,878 | 95% UCL-N | W-Test (4) | 8878 | 95% UCL-N | W-Test (4) |
| Arsenic | MG/KG | 8.19 | 9.56 | 13.2 | | MG/KG | 9.87 | 95% UCL-T | W-Test (4) | 9.87 | 95% UCL-T | W-Test (4) |
| Iron | MG/KG | 29,236 | 32,954 | 41,300 | | MG/KG | 33,813 | 95% UCL-T | W-Test (4) | 33,813 | 95% UCL-T | W-Test (4) |
| Manganese | MG/KG | 1,013 | 1,223 | 1,990 | | MG/KG | 1,265 | 95% UCL-T | W-Test (1) | 1,265 | 95% UCL-T | W-Test (1) |

* Surface soil & subsurface soil combined.

Screening for nonresident adult only.

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

Table 3.7

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Groundwater
Exposure Point: At Site 10

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Trichloroethene | MG/KG | 0.009 | 0.014 | 0.034 | | MG/KG | 0.0174 | 95% UCL-T | W-Test (1) | 0.0174 | 95% UCL-T | W-Test (1) |
| Arsenic | MG/KG | 8.19 | 9.56 | 13.2 | | MG/KG | 9.87 | 95% UCL-T | W-Test (4) | 9.87 | 95% UCL-T | W-Test (4) |
| Chromium | MG/KG | 14 | 15.0 | 17.1 | | MG/KG | 15.0 | 95% UCL-N | W-Test (4) | 15 | 95% UCL-N | W-Test (4) |
| Manganese | MG/KG | 1,013 | 1,223 | 1,990 | | MG/KG | 1,265 | 95% UCL-T | W-Test (1) | 1,265 | 95% UCL-T | W-Test (1) |

* Surface soil & subsurface soil combined.

Full statistics for data included in Appendix.

For non-detects, 1/2 sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Options: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T);
Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

(2) 95% UCL (or mean) exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(3) Shapiro-Wilks W Test indicates data are normally distributed.

(4) Shapiro-Wilks W Test inconclusive. Use of 95% UCL (normal or transformed) that best fits the data according to the results of the Shapiro-Wilks W Test for EPC.

(5) Maximum detected concentration used because sample size is less than 5.

(6) Mean value used because sample size is less than 5.

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | | see Table --- | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | 50 | EPA, 1993 | CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | 6.6 | EPA, 1997 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 9,125 | EPA, 1989 | 2,409 | EPA, 1997 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | - - | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 5,300 | EPA, 1997, [1] | 2,000 | EPA, 1997, [1] | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.16 | EPA, 1997, (2) | 0.16 | EPA, 1997, (2) | ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [3] | 1 | [3] | |
| | DABS | Dermal Absorption Factor Solids | -- | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | 6.6 | EPA, 1997 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 9,125 | EPA, 1989 | 2,409 | EPA, 1997 | |

This exposure scenario is also applicable to Industrial worker exposure to surface soil at Sites 3 and 10.

(1) RME SA includes head, hands, forearms, and lower legs. CT surface area includes head and hands.

(2) SSAF is based on the average of maximum adherence factor for utility workers no.1 and 2. Calculations are presented in Table 4.1.A.

(3) Professional judgement assuming 1 event/day.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.1.A
Calculation of Soil to Skin Adherence Factor
Site 10 Allegany Balistics Laboratory

| Body Part ($cm^2/s$) | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Adherence Factor per Body Part ($mg/cm^2$) | | Soil to Skin Adherence Factor (SSAF) |
|---|---|---|---|---|---|---|
| | Male | Female | | Average Utility Workers No.1 and 2 | Adherence Factor * SA | ($mg\text{-}cm^2/event$) |
| Head | 1300 | 1110 | 1205 | 0.3 | 361.5 | |
| Hands | 990 | 817 | 903.5 | 0.295 | 266.5325 | **0.16** |
| Forearms | 1310 | 1035 | 1172.5 | 0.25 | 293.125 | |
| Lower Legs | 2560 | 2180 | 2370 | N/A | N/A | |
| Total | | | **5651** | | **921** | |

Assumed forearm-to-arm ratio is 0.45 to account for only mean surface area of arms available for females. EFH Table 6-4.
Assumed face-to-head ratio is 3 to account for only mean adherence factor of face available. EFH Table 6-12

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | 50 | EPA, 1993 | CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 52 | (1) | 52 | (1) | |
| | ED | Exposure Duration | years | 9 | (2) | 9 | (2) | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(3) | 51 | EPA, 1997,(3) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 4,600 | EPA, 1997, (4) | 3,700 | EPA, 1997, (4) | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.16 | EPA, 1997, (5) | 0.16 | EPA, 1997, (5) | ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [6] | 1 | [6] | |
| | DABS | Dermal Absorption Factor Solids | – | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 52 | (1) | 52 | (1) | |
| | ED | Exposure Duration | years | 9 | (2) | 9 | (2) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(3) | 51 | EPA, 1997,(3) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to surface soil at Sites 3 and 10.

(1) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(2) Professional Judgement assuming adolescents from 9 to 18 years of age.

(3) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

(4) Surface area is 25% of total surface area for 12-15 year old male. 95th percentile for total surface area is 1.85 $m^2$, 50th percentile for total surface area is 1.49 $m^2$.

(5) Soil to skin adherence factor is based on maximum adherence factor for soccer No.1, calculations presented in Table 4.2.A.

(6) Professional judgement assuming 1 event/day.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.


DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.2.A
Calculation of Soil to Skin Adherence Factor
Site 10 Allegany Balistics Laboratory

| Age | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Mean Percentage of Total SA | | | | Total SA of Body Parts (cm2) | Adherence Factor per Bc Soccer No.1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | | Head | Hands | Forearms | Lower Legs | | Head | Hands | Forearm |
| <1 | 6030 | 5790 | 5910 | 18.2 | 5.30 | 6.17 | 8.24 | 2240 | 0.036 | 0.11 | 0.00495 |
| 1<2 | 6030 | 5790 | 5910 | 16.5 | 5.68 | 5.85 | 9.24 | 2203 | | | |
| 2<3 | 6030 | 5790 | 5910 | 14.2 | 5.30 | 5.31 | 9.28 | 2015 | | | |
| 3<4 | 6640 | 6490 | 6565 | 13.6 | 6.07 | 6.48 | 10.72 | 2421 | | | |
| 4<5 | 7310 | 7060 | 7185 | 13.8 | 5.7 | 6.30 | 11.12 | 2653 | | | |
| 5<6 | 7930 | 7790 | 7860 | 13.8 | 5.7 | 6.30 | 11.12 | 2902 | | | |
| 6<7 | 8660 | 8430 | 8545 | 13.1 | 4.71 | 5.90 | 10.84 | 2952 | | | |
| 7<8 | 9360 | 9170 | 9265 | 13.1 | 4.71 | 5.90 | 10.84 | 3201 | | | |
| 8<9 | 10000 | 10000 | 10000 | 13.1 | 4.71 | 5.90 | 10.84 | 3455 | | | |
| 9<10 | 10700 | 10600 | 10650 | 12.0 | 5.30 | 5.54 | 11.48 | 3655 | | | |
| 10<11 | 11800 | 11700 | 11750 | 12.0 | 5.30 | 5.54 | 11.48 | 4032 | | | |
| 11<12 | 12300 | 13000 | 12650 | 12.0 | 5.30 | 5.54 | 11.48 | 4341 | | | |
| 12<13 | 13400 | 14000 | 13700 | 8.74 | 5.39 | 6.17 | 12.20 | 4452 | | | |
| 13<14 | 14700 | 14800 | 14750 | 9.97 | 5.11 | 5.45 | 12.80 | 4915 | | | |
| 14<15 | 16100 | 15500 | 15800 | 9.97 | 5.11 | 5.45 | 12.80 | 5265 | | | |
| 15<16 | 17000 | 15700 | 16350 | 9.97 | 5.11 | 5.45 | 12.80 | 5449 | | | |
| 16<17 | 17600 | 16000 | 16800 | 7.96 | 5.68 | 5.90 | 13.44 | 5540 | | | |
| 17<18 | 18000 | 16300 | 17150 | 7.58 | 5.13 | 7.88 | 12.32 | 5643 | | | |
| | | | **Average of Ages 1-18** | **12.20** | **5.30** | **5.94** | **11.28** | | | | |

Assumed forearm-to-arm ratio is 0.45 to account for only mean surface area of arms available. EFH Table 6-8.
Assumed lower leg-to-leg ratio is 0.40 to account for only mean surface area of legs available. EFH Table 6-8.

TABLE 4.3

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | site specific | EPA, 1996 | site specific | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 1.5 | EPA, 1997 [2] | 0.6 | EPA, 1997 [2] | |
| | ET | Exposure Time | hr/day | 8 | (1) | 8 | (1) | CA ($mg/m^3$) = CS (1/PEF) |
| | EF | Exposure Frequency | days/year | 250 | EPA,1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | 6.6 | EPA, 1997 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 9,125 | EPA, 1989 | 2409 | EPA, 1989 | |

This exposure scenario is also applicable to Industrial worker exposure to airborne particulates released from surface soil at Sites 3 and 10.

(1) Professional Judgement based on maintenance activities that would occur 8 hrs per day.

[2] RME is the Inhalation rate of outdoor workers with moderate activities. CT is the average of long-term inhalation rate for the adult female and male, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

TABLE 4.4

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | site specific | EPA, 1996 | site specific | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.833 | [5] | 0.542 | EPA, 1997, [5] | |
| | ET | Exposure Time | hr/day | 1.8 | (1) | 1.8 | (1) | CA ($mg/m^3$) = CS (1/PEF) |
| | EF | Exposure Frequency | days/year | 48 | (2) | 48 | (2) | |
| | ED | Exposure Duration | years | 9 | (3) | 9 | (3) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(4) | 51 | EPA, 1997,(4) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to airborne particulates released from surface soil at Sites 3 and 10.

(1) Professional Judgement assuming trespasser would spend a maximum of 1.8 hours at the site.

(2) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(3) Professional Judgement assuming adolescents from 9 to 18 years of age.

(4) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

[5] RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 4.5

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 1.5 | EPA, 1997 [2] | 0.6 | EPA, 1997 [2] | |
| | ET | Exposure Time | hr/day | 8 | (1) | 8 | (1) | CA ($mg/m^3$) = CS (1/VF) |
| | EF | Exposure Frequency | days/year | 250 | EPA,1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | 6.6 | EPA, 1997 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 9,125 | EPA, 1989 | 2409 | EPA, 1989 | |

This exposure scenario is also applicable to Industrial worker exposure to volatile emissions from surface soil at Sites 3 and 10.

(1) Professional Judgement based on maintenance activities that would occur 8 hrs per day.

[2] RME is the Inhalation rate of outdoor workers with moderate activities. CT is the average of long-term inhalation rate for the adult female and male, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

TABLE 4.6

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.833 | [5] | 0.542 | EPA, 1997, [5] | |
| | ET | Exposure Time | hr/day | 1.8 | (1) | 1.8 | (1) | CA ($mg/m^3$) = CS (1/VF) |
| | EF | Exposure Frequency | days/year | 48 | (2) | 48 | (2) | |
| | ED | Exposure Duration | years | 9 | (3) | 9 | (3) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(4) | 51 | EPA, 1997,(4) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to volatile emissions from surface soil at Sites 3 and 10.

(1) Professional Judgement assuming trespasser would spend a maximum of 1.8 hours at the site.

(2) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(3) Professional Judgement assuming adolescents from 9 to 18 years of age.

(4) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

[5] RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

Workbook: copy of Tab4_Site10_ABL.xls
Worksheet: t4.6

12/21/2003

TABLE 4.7

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | | see Table ---- | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | 50 | EPA, 1993 | CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | EPA, 1989 | 3,285 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | | see Table ---- | - - | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 6,600 | EPA, 1997, (1) | 5,700 | EPA, 1997, (1) | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.05 | EPA, 1997, (2) | 0.05 | EPA, 1997, (2) | ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [3] | 1 | [3] | |
| | DABS | Dermal Absorption Factor Solids | -- | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to residents exposure to soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Surface area based on resident wearing shorts, short sleeve shirt, and shoes. RME value is 95th percentile and CT value is 50th percentile.

(2) Soil to skin adherence factor is based on maximum adherence factor for gardeners no. 2. Calculations are presented in Table 4.7.A.

(3) Professional judgement assuming 1 event/day.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.7.A
Calculation of Soil to Skin Adherence Factor
Site 10 Allegany Balistics Laboratory

| Body Part ($cm^2$/s) | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Adherence Factor per Body Part ($mg/cm^2$) | | Soil to Skin Adherence Factor (SSAF) |
|---|---|---|---|---|---|---|
| | Male | Female | | Gardener No.2 | Adherence Factor * SA | ($mg\text{-}cm^2$/event) |
| Head | 1300 | 1110 | 1205 | 0.047 | 56.635 | |
| Hands | 990 | 817 | 903.5 | 0.18 | 162.63 | **0.05** |
| Forearms | 1310 | 1035 | 1172.5 | 0.054 | 63.315 | |
| Lower Legs | 2560 | 2180 | 2370 | 0.022 | N/A | |
| Total | | | **5651** | | **283** | |

Assumed forearm-to-arm ratio is 0.45 to account for only mean surface area of arms available for females. EFH Table 6-4.
Assumed face-to-head ratio is 3 to account for only mean adherence factor of face available. EFH Table 6-12

TABLE 4.8

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 200 | EPA, 1991 | 100 | EPA, 1993 | CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 16.6 | EPA, 1997, [4] | 16.6 | EPA, 1997, [4] | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 2,190 | EPA, 1989 | 2,190 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 3,400 | EPA, 1997, (1) | 2,900 | EPA, 1997, (1) | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.13 | EPA, 1997, (2) | 0.13 | EPA, 1997, (2) | ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [3] | 1 | [3] | |
| | DABS | Dermal Absorption Factor Solids | – | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | BW | Body Weight | kg | 16.6 | EPA, 1997, [4] | 16.6 | EPA, 1997, [4] | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 2,190 | EPA, 1989 | 2,190 | EPA, 1989 | |

This exposure scenario is also applicable to residents exposure to soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Surface area based on resident wearing shorts and short sleever shirt. RME value is 95th percentile and CT value is 50th percentile.

(2) Soil to skin adherence factor is the average of the maximum adherence factor for daycare kids no. 1a, 1b, 2 and 3 . Calculations are presented in Table 4.8.A.

(3) Professional judgement assuming 1 event/day.

(4) RME and CT body weight is the average of mean body weight of children ages 1 through 6, Table 7-3, EFH 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.


DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.8.A
Calculation of Soil to Skin Adherence Factor
Site 10, Allegany Balistics Laboratory

| Age | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Mean Percentage of Total SA | | | | Total SA of Body Parts (cm2) | Adherence Factor per Bc Average of Daycare Kids No | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | | Head | Hands | Forearms | Lower Legs | | Head | Hands | Forearm |
| <1 | 6030 | 5790 | 5910 | 18.2 | 5.30 | 6.17 | 8.24 | 2240 | N/A | 0.09 | 0.023 |
| 1<2 | 6030 | 5790 | 5910 | 16.5 | 5.68 | 5.85 | 9.24 | 2203 | | | |
| 2<3 | 6030 | 5790 | 5910 | 14.2 | 5.30 | 5.31 | 9.28 | 2015 | | | |
| 3<4 | 6640 | 6490 | 6565 | 13.6 | 6.07 | 6.48 | 10.72 | 2421 | | | |
| 4<5 | 7310 | 7060 | 7185 | 13.8 | 5.7 | 6.30 | 11.12 | 2653 | | | |
| 5<6 | 7930 | 7790 | 7860 | 13.8 | 5.7 | 6.30 | 11.12 | 2902 | | | |
| 6<7 | 8660 | 8430 | 8545 | 13.1 | 4.71 | 5.90 | 10.84 | 2952 | | | |
| 7<8 | 9360 | 9170 | 9265 | 13.1 | 4.71 | 5.90 | 10.84 | 3201 | | | |
| 8<9 | 10000 | 10000 | 10000 | 13.1 | 4.71 | 5.90 | 10.84 | 3455 | | | |
| 9<10 | 10700 | 10600 | 10650 | 12.0 | 5.30 | 5.54 | 11.48 | 3655 | | | |
| 10<11 | 11800 | 11700 | 11750 | 12.0 | 5.30 | 5.54 | 11.48 | 4032 | | | |
| 11<12 | 12300 | 13000 | 12650 | 12.0 | 5.30 | 5.54 | 11.48 | 4341 | | | |
| 12<13 | 13400 | 14000 | 13700 | 8.74 | 5.39 | 6.17 | 12.20 | 4452 | | | |
| 13<14 | 14700 | 14800 | 14750 | 9.97 | 5.11 | 5.45 | 12.80 | 4915 | | | |
| 14<15 | 16100 | 15500 | 15800 | 9.97 | 5.11 | 5.45 | 12.80 | 5265 | | | |
| 15<16 | 17000 | 15700 | 16350 | 9.97 | 5.11 | 5.45 | 12.80 | 5449 | | | |
| 16<17 | 17600 | 16000 | 16800 | 7.96 | 5.68 | 5.90 | 13.44 | 5540 | | | |
| 17<18 | 18000 | 16300 | 17150 | 7.58 | 5.13 | 7.88 | 12.32 | 5643 | | | |
| | | | **Average of Ages 1-18** | **12.20** | **5.30** | **5.94** | **11.28** | | | | |

Assumed forearm-to-arm ratio is 0.45 to account for only mean surface area of arms available. EFH Table 6-8.
Assumed lower leg-to-leg ratio is 0.40 to account for only mean surface area of legs available. EFH Table 6-8.

TABLE 4.9

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S-A | Ingestion Rate of Soil, Adult | mg/day | 100 | EPA, 1991 | 50 | EPA, 1993 | CS x IR-S-Adj x EF x CF3 x 1/AT |
| | IR-S-C | Ingestion Rate of Soil, Child | mg/day | 200 | EPA, 1991 | 100 | EPA, 1993 | |
| | IR-S-Adj | Ingestion Rate of Soil, Age-adjusted | mg-year/kg-day | 106.57 | calculated | 18.48 | calculated | IR-S-Adj (mg-year/kd-day) = |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | (ED-C x IR-S-C / BW-C) + (ED-A x IR-S-A / BW-A) |
| | ED-A | Exposure Duration, Adult | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | ED-C | Exposure Duration, Child | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW-A | Body Weight , Adult | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | BW-C | Body Weight, Child | kg | 16.6 | EPA, 1997 | 16.6 | EPA, 1997 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | CDI (mg/kg-day) = |
| | SA-A | Skin Surface Area Available for Contact, Adult | $cm^2$ | 6,600 | EPA, 1997a | 5,700 | EPA, 1997a | CS x DA-Adj x DABS x CF3 x EF x 1/AT |
| | SA-C | Skin Surface Area Available for Contact, Child | $cm^2$ | 3,400 | EPA, 1997b | 2,900 | EPA, 1997b | |
| | SSAF-A | Soil to Skin Adherence Factor | $mg/cm^2$-day | 0.05 | EPA, 1997 | 0.05 | EPA, 1997 | DA-Adj (mg-year/kd-day) = |
| | SSAF-C | Soil to Skin Adherence Factor | $mg/cm^2$-day | 0.13 | EPA, 1997a | 0.13 | EPA, 1997a | [(ED-C x SA-C x SSAF-C / BW-C) + |
| | DA-Adj | Dermal Absorption, Age-adjusted | mg-year/kg-day | 272.9 | calculated | 82.06 | calculated | (ED-A x SA-A x SSAF-A / BW-A)] |
| | DABS | Dermal Absorption Factor Solids | – | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED-A | Exposure Duration, Adult | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | ED-C | Exposure Duration, Child | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | BW-A | Body Weight , Adult | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | BW-C | Body Weight, Child | kg | 16.6 | EPA, 1997 | 16.6 | EPA, 1997 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |

This exposure scenario is also applicable to residents exposure to soil at Sites 3 and 10.

TABLE 4.9

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil* |
| Exposure Medium: Soil* |
| Exposure Point: Site 10 Soil |
| Receptor Population: Resident |
| Receptor Age: Child/Adult |

* Surface and subsurface soil

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997a: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 1997b: Risk Assessment Guidance for Superfund. Vol.1: Supplemental guidance, Dermal Risk Assessment Guidance. Interim Guidance. NCEA-W-0364.

DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

TABLE 4.10

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 480 | EPA, 1991 | 480 | EPA, 1991 | CS x IR-S x EF x ED x ET x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | days | 365 | EPA, 1991 | 365 | EPA, 1991 | |
| | ET | Exposure Time | hrs/day | 8 | [3] | 8 | [3] | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | EPA, 1989 | 365 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table --- | | see Table --- | - - | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 5,300 | EPA, 1992, (1) | 2,000 | EPA, 1992, (1) | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.06 | EPA, 1997, (2) | 0.06 | EPA, 1997, (2) | x ET x ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [4] | 1 | [4] | |
| | DABS | Dermal Absorption Factor Solids | -- | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | 219 | EPA, 1993 | |
| | ED | Exposure Duration | days | 365 | EPA, 1991 | 365 | EPA, 1991 | |
| | ET | Exposure Time | hrs/day | 8 | [3] | 8 | [3] | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | EPA, 1989 | 365 | EPA, 1989 | |

This exposure scenario is also applicable to construction worker exposure to soil at Sites 3 and 10.

* Surface and subsurface soil

(1) RME SA includes head, hands, forearms, and lower legs. CT surface area includes head and hands.

(2) Soil to skin adherence factor is based on maximum adherence factor for construction workers. Calculations presented in Table 4.10.A.

(3) Professional judgement assuming 8 hrs per day exposure.

(4) Professional judgement assuming 1 event/day.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.


DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.10.A
Calculation of Soil to Skin Adherence Factor
Site 10 Allegany Balistics Laboratory

| Body Part ($cm^2/s$) | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Adherence Factor per Body Part ($mg/cm^2$) | | Soil to Skin Adherence Factor (SSAF) |
|---|---|---|---|---|---|---|
| | Male | Female | | Construction Workers | Adherence Factor * SA | ($mg\text{-}cm^2/event$) |
| Head | 1300 | 1110 | 1205 | 0.029 | 34.945 | 0.06 |
| Hands | 990 | 817 | 903.5 | 0.24 | 216.84 | |
| Forearms | 1310 | 1035 | 1172.5 | 0.098 | 114.905 | |
| Lower Legs | 2560 | 2180 | 2370 | 0.066 | N/A | |
| Total | | | 5651 | | 367 | |

TABLE 4.11

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | | see Table ---- | | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | 50 | EPA, 1993 | CS x IR-S x EF x ED x CF3 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 52 | (1) | 52 | (1) | |
| | ED | Exposure Duration | years | 9 | (2) | 9 | (2) | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(3) | 51 | EPA, 1997,(3) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |
| Dermal Absorption | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | | see Table ---- | | CDI (mg/kg-day) = |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 4,600 | EPA, 1997, (4) | 3,700 | EPA, 1997, (4) | CS x SA x SSAF x NOE x DABS x CF3 x EF x |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-event | 0.16 | EPA, 1997, (5) | 0.16 | EPA, 1997, (5) | ED x 1/BW x 1/AT |
| | NOE | Number of Events | events/day | 1 | [6] | 1 | [6] | |
| | DABS | Dermal Absorption Factor Solids | – | chem specific | EPA, 1995 | chem specific | EPA, 1995 | |
| | CF3 | Conversion Factor 3 | kg/mg | 0.000001 | - - | 0.000001 | - - | |
| | EF | Exposure Frequency | days/year | 52 | (1) | 52 | (1) | |
| | ED | Exposure Duration | years | 9 | (2) | 9 | (2) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(3) | 51 | EPA, 1997,(3) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to soil at Sites 3 and 10.

(1) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(2) Professional Judgement assuming adolescents from 9 to 18 years of age.

(3) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

(4) Surface area is 25% of total surface area for 12-15 year old male. 95th percentile for total surface area is 1.85 $m^2$, 50th percentile for total surface area is 1.49 $m^2$.

(5) Soil to skin adherence factor is based on maximum adherence factor for soccer No.1, calculations presented in Table 4.11.A.

(6) Professional judgement assuming 1 event/day.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1995: Assessing Dermal Exposure from Soil. EPA Region III. EPA/903-K-95-003.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

DABS: Based on Region III Technical Guidance "Assessing Dermal Exposure from Soil, December 1995", for constituents not listed used volatile organics value of 20%, semi-volatile organics value of 10%, and Inorganics value of 1%.

Table 4.11.A
Calculation of Soil to Skin Adherence Factor
Site 10 Allegany Balistics Laboratory

| Age | 50th% Total SA ($cm^2$) | | Average 50th% Total SA Combined Male & Female | Mean Percentage of Total SA | | | | Total SA of Body Parts (cm2) | Adherence Factor per Bc Soccer No.1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | | Head | Hands | Forearms | Lower Legs | | Head | Hands | Forearm |
| <1 | 6030 | 5790 | 5910 | 18.2 | 5.30 | 6.17 | 8.24 | 2240 | 0.036 | 0.11 | 0.00495 |
| 1<2 | 6030 | 5790 | 5910 | 16.5 | 5.68 | 5.85 | 9.24 | 2203 | | | |
| 2<3 | 6030 | 5790 | 5910 | 14.2 | 5.30 | 5.31 | 9.28 | 2015 | | | |
| 3<4 | 6640 | 6490 | 6565 | 13.6 | 6.07 | 6.48 | 10.72 | 2421 | | | |
| 4<5 | 7310 | 7060 | 7185 | 13.8 | 5.7 | 6.30 | 11.12 | 2653 | | | |
| 5<6 | 7930 | 7790 | 7860 | 13.8 | 5.7 | 6.30 | 11.12 | 2902 | | | |
| 6<7 | 8660 | 8430 | 8545 | 13.1 | 4.71 | 5.90 | 10.84 | 2952 | | | |
| 7<8 | 9360 | 9170 | 9265 | 13.1 | 4.71 | 5.90 | 10.84 | 3201 | | | |
| 8<9 | 10000 | 10000 | 10000 | 13.1 | 4.71 | 5.90 | 10.84 | 3455 | | | |
| 9<10 | 10700 | 10600 | 10650 | 12.0 | 5.30 | 5.54 | 11.48 | 3655 | | | |
| 10<11 | 11800 | 11700 | 11750 | 12.0 | 5.30 | 5.54 | 11.48 | 4032 | | | |
| 11<12 | 12300 | 13000 | 12650 | 12.0 | 5.30 | 5.54 | 11.48 | 4341 | | | |
| 12<13 | 13400 | 14000 | 13700 | 8.74 | 5.39 | 6.17 | 12.20 | 4452 | | | |
| 13<14 | 14700 | 14800 | 14750 | 9.97 | 5.11 | 5.45 | 12.80 | 4915 | | | |
| 14<15 | 16100 | 15500 | 15800 | 9.97 | 5.11 | 5.45 | 12.80 | 5265 | | | |
| 15<16 | 17000 | 15700 | 16350 | 9.97 | 5.11 | 5.45 | 12.80 | 5449 | | | |
| 16<17 | 17600 | 16000 | 16800 | 7.96 | 5.68 | 5.90 | 13.44 | 5540 | | | |
| 17<18 | 18000 | 16300 | 17150 | 7.58 | 5.13 | 7.88 | 12.32 | 5643 | | | |
| | | | **Average of Ages 1-18** | **12.20** | **5.30** | **5.94** | **11.28** | | | | |

Assumed forearm-to-arm ratio is 0.45 to account for only mean surface area of arms available. EFH Table 6-8.
Assumed lower leg-to-leg ratio is 0.40 to account for only mean surface area of legs available. EFH Table 6-8.

TABLE 4.12

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table — | - - | see Table — | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table — | - - | see Table — | - - | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | 1.3E+09 | EPA, 1996 | 1.3E+09 | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.83 | [2] | 0.542 | EPA, 1997, [2] | |
| | ET | Exposure Time | hr/day | 24 | (1) | 24 | (1) | CA ($mg/m^3$) = CS (1/PEF) |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA,1993 | |
| | ED | Exposure Duration | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to airborne particulates released from soil at Sites 3 and 10.

* Surface and subsurface Soil

(1) Professional Judgement conservatively assumed all day.

[2] RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EPA, 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

TABLE 4.13

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table ---- | - - | see Table — | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table ---- | - - | see Table — | - - | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | 1.3E+09 | EPA, 1996 | 1.3E+09 | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.6 | EPA, 1997,[2] | 0.3 | EPA, 1997,[2] | |
| | ET | Exposure Time | hr/day | 24 | (1) | 24 | (1) | CA ($mg/m^3$) = CS (1/PEF) |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | BW | Body Weight | kg | 16.6 | EPA, 1997, [3] | 16.6 | EPA, 1997, [3] | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 2,190 | EPA, 1989 | 2,190 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to airborne particulates released from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional Judgement conservatively assumed all day.

(2) RME inhalation rate is the average of long-term exposure of children 1 through 5 years , CT inhalation rate is short-term exposure of a resting child per recommendation by EPA, Table 5-23.

(3) RME and CT body weight is the average of mean body weight of children ages 1 through 6, Table 7-3, EFH 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 2001: Region III, Risk-based Concentration Table.

TABLE 4.14

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table ---- | - - | see Table --- | - - | CA x IN-Adj x EF x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | 1.3E+09 | EPA, 1996 | 1.3E+09 | EPA, 1996 | |
| | IN-A | Inhalation Rate, Adult | $m^3/hour$ | 0.83 | EPA, 2001 | 0.542 | EPA, 1997 | CA ($mg/m^3$) = CS (1/PEF) |
| | IN-C | Inhalation Rate, Child | $m^3/hour$ | 0.6 | EPA, 1997 | 0.3 | EPA, 1997 | IN-Adj ($m^3$-year/kd-day) = |
| | IN-Adj | Inhalation Rate, Age-adjusted | $m^3$-year/kg-day | 12.06 | calculated | 2.53 | calculated | (ED-C x IN-C x ET / BW-C) + (ED-A x IN-A x ET / BW-A) |
| | ET | Exposure Time | hours/day | 24 | (1) | 24 | (1) | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED-A | Exposure Duration, Adult | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | ED-C | Exposure Duration, Child | years | 6 | EPA, 1991 | 2 | EPA, 1991 | |
| | BW-A | Body Weight , Adult | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | BW-C | Body Weight, Child | kg | 16.6 | EPA, 1997 | 16.6 | EPA, 1997 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to airborne particulates released from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional Judgement conservatively assumed all day.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997a: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 1997b: Risk Assessment Guidance for Superfund. Vol.1: Supplemental guidance, Dermal Risk Assessment Guidance. Interim Guidance. NCEA-W-0364.

EPA, 2001: Region III, Risk-based Concentration Table.

TABLE 4.15

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table — | - - | see Table — | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table — | - - | see Table — | - - | CA x IN x ET x EF x ED x ET X 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | 1.3E+09 | EPA, 1996 | 1.3E+09 | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 3.3 | EPA, 1997, [2] | 2.5 | EPA, 1997, [2] | |
| | EF | Exposure Frequency | days/year | 250 | EPA,1991 | 219 | EPA, 1993 | CA ($mg/m^3$) = CS (1/PEF) |
| | ED | Exposure Duration | days | 365 | EPA, 1991 | 365 | EPA, 1991 | |
| | ET | Exposure Time | hrs/day | 8 | [1] | 8 | [1] | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | EPA, 1989 | 365 | EPA, 1989 | |

This exposure scenario is also applicable to construction worker exposure to airborne particulates released from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional judgement assuming 8 hrs per day exposure.

(2) RME inhalation rate is the short-term exposure to outdoor workers hourly average upper percentile and CT is the short term exposure to outdoor workers hourly average during heavy activities, as per recommendations by EPA, Table 5-23, EFH 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 4.16

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | PEF | Particulate Emissions Factor | $m^3/kg$ | 1.3E+09 | EPA, 1996 | 1.3E+09 | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.833 | [5] | 0.542 | EPA, 1997, [5] | |
| | ET | Exposure Time | hr/day | 1.8 | (1) | 1.8 | (1) | CA ($mg/m^3$) = CS (1/PEF) |
| | EF | Exposure Frequency | days/year | 48 | (2) | 48 | (2) | |
| | ED | Exposure Duration | years | 9 | (3) | 9 | (3) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(4) | 51 | EPA, 1997,(4) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to airborne particulates released from soil at Sites 3 and 10.

(1) Professional Judgement assuming trespasser would spend a maximum of 1.8 hours at the site.

(2) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(3) Professional Judgement assuming adolescents from 9 to 18 years of age.

(4) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

[5] RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 4.17

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table --- | - - | see Table --- | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table --- | - - | see Table --- | - - | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.83 | [2] | 0.542 | EPA, 1997, [2] | |
| | ET | Exposure Time | hr/day | 24 | (1) | 24 | (1) | CA ($mg/m^3$) = CS (1/VF) |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA,1993 | |
| | ED | Exposure Duration | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to volatile emissions from soil at Sites 3 and 10.

* Surface and subsurface Soil

(1) Professional Judgement conservatively assumed all day.

(2) RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EPA, 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 4.18

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table — | - - | see Table — | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table — | - - | see Table — | - - | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.6 | EPA, 1997,[2] | 0.3 | EPA, 1997,[2] | |
| | ET | Exposure Time | hr/day | 24 | (1) | 24 | (1) | CA ($mg/m^3$) = CS (1/VF) |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | 2 | EPA, 1993 | |
| | BW | Body Weight | kg | 16.6 | EPA, 1997, [3] | 16.6 | EPA, 1997, [3] | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 2,190 | EPA, 1989 | 2,190 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to volatile emissions from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional Judgement conservatively assumed all day.

(2) RME inhalation rate is the average of long-term exposure of children 1 through 5 years , CT inhalation rate is short-term exposure of a resting child per recommendation by EPA, Table 5-23.

(3) RME and CT body weight is the average of mean body weight of children ages 1 through 6, Table 7-3, EFH 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 2001: Region III, Risk-based Concentration Table.

TABLE 4.19

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table --- | - - | see Table --- | - - | CA x IN-Adj x EF x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN-A | Inhalation Rate, Adult | $m^3/hour$ | 0.83 | EPA, 2001 | 0.542 | EPA, 1997 | CA ($mg/m^3$) = CS (1/VF) |
| | IN-C | Inhalation Rate, Child | $m^3/hour$ | 0.6 | EPA, 1997 | 0.3 | EPA, 1997 | IN-Adj ($m^3$-year/kd-day) = |
| | IN-Adj | Inhalation Rate, Age-adjusted | $m^3$-year/kg-day | 12.06 | calculated | 2.53 | calculated | (ED-C x IN-C x ET / BW-C) + (ED-A x IN-A x ET / BW-A) |
| | ET | Exposure Time | hours/day | 24 | (1) | 24 | (1) | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | 234 | EPA, 1993 | |
| | ED-A | Exposure Duration, Adult | years | 24 | EPA, 1991 | 9 | EPA, 1993 | |
| | ED-C | Exposure Duration, Child | years | 6 | EPA, 1991 | 2 | EPA, 1991 | |
| | BW-A | Body Weight , Adult | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | BW-C | Body Weight, Child | kg | 16.6 | EPA, 1997 | 16.6 | EPA, 1997 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |

This exposure scenario is also applicable to resident exposure to volatile emissions from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional Judgement conservatively assumed all day.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1992: Dermal Exposure Assessment: Principals and Applications. ORD. EPA/600/8-91/011B.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997a: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 1997b: Risk Assessment Guidance for Superfund. Vol.1: Supplemental guidance, Dermal Risk Assessment Guidance. Interim Guidance. NCEA-W-0364.

EPA, 2001: Region III, Risk-based Concentration Table.

TABLE 4.20

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table — | - - | see Table — | - - | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | see Table — | - - | see Table — | - - | CA x IN x ET x EF x ED x ET X 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 3.3 | EPA, 1997, [2] | 2.5 | EPA, 1997, [2] | |
| | EF | Exposure Frequency | days/year | 250 | EPA,1991 | 219 | EPA, 1993 | CA ($mg/m^3$) = CS (1/VF) |
| | ED | Exposure Duration | days | 365 | EPA, 1991 | 365 | EPA, 1991 | |
| | ET | Exposure Time | hrs/day | 8 | [1] | 8 | [1] | |
| | BW | Body Weight | kg | 70 | EPA, 1991 | 70 | EPA, 1991 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | EPA, 1989 | 365 | EPA, 1989 | |

This exposure scenario is also applicable to construction worker exposure to volatile emissions from soil at Sites 3 and 10.

* Surface and subsurface soil

(1) Professional judgement assuming 8 hrs per day exposure.

(2) RME inhalation rate is the short-term exposure to outdoor workers hourly average upper percentile and CT is the short term exposure to outdoor workers hourly average during heavy activities, as per recommendations by EPA, Table 5-23, EFH 1997.

Sources:


EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 4.21

VALUES USED FOR DAILY INTAKE CALCULATIONS

Site 10 Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Volatile Emissions from Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | see Table 3 | see Table 3 | see Table 3 | see Table 3 | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | calc | EPA, 1996 | calc | EPA, 1996 | CA x IN x ET x EF x ED x 1/BW x 1/AT |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | calc | EPA, 1996 | calc | EPA, 1996 | |
| | IN | Inhalation Rate | $m^3/hour$ | 0.833 | [5] | 0.542 | EPA, 1997, [5] | |
| | ET | Exposure Time | hr/day | 1.8 | (1) | 1.8 | (1) | CA ($mg/m^3$) = CS (1/VF) |
| | EF | Exposure Frequency | days/year | 48 | (2) | 48 | (2) | |
| | ED | Exposure Duration | years | 9 | (3) | 9 | (3) | |
| | BW | Body Weight | kg | 51 | EPA, 1997,(4) | 51 | EPA, 1997,(4) | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | EPA, 1989 | 25,550 | EPA, 1989 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 3,285 | EPA, 1989 | 3,285 | EPA, 1989 | |

This exposure scenario is also applicable to trespasser/visitor exposure to volatile emissions from soil at Sites 3 and 10.

(1) Professional Judgement assuming trespasser would spend a maximum of 1.8 hours at the site.

(2) Professional Judgement assuming 3 days per week for 4 warm weather months per year.

(3) Professional Judgement assuming adolescents from 9 to 18 years of age.

(4) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

[5] RME inhlation rate from EPA Region III RBC Table, May, 2001, CT is the average of Long-term exposure of male and female ages 9-18, Table 5-23, EFH 1997.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. EPA/540/R-96/018.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Site 10, Allegany Ballistics Laboratory

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | Chronic | 1.0E+00 | mg/kg-day | 27% | 2.7E-01 | mg/kg-day | CNS | 100 | NCEA | 08/26/1996 |
| | Subchronic | N/A | | | | | | | | |
| Arsenic | Chronic | 3.0E-04 | mg/kg-day | 95%(3) | 3.0E-04 | mg/kg-day | Skin/Vascular | 3/1 | IRIS | 04/11/2002 |
| | Subchronic | 3.0E-04 | mg/kg-day | 95%(3) | 3.0E-04 | mg/kg-day | Skin/Vascular | 3 | HEAST | 07/08/1998 |
| Iron | Chronic | 3.0E-01 | mg/kg-day | 20% | 6.0E-02 | mg/kg-day | Gastrointestinal/Liver | 1 | NCEA | 04/09/2002 |
| | Subchronic | N/A | | | | | | | | |
| Manganese (nonfood) | Chronic | 2.0E-02 | mg/kg-day | 4% | 8.0E-04 | mg/kg-day | CNS | 1 | IRIS | 04/09/2002 |
| | Subchronic | N/A | | | | | | | | |

Footnote Instructions:

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evalution Manual (Part E, Supplemetnal Guidance for Dermal Risk Assessment( Interim). Section 4.2 and Exhibit 4-1, EPA 2001). For chemicals not found in EPA 2001, default oral ABS from RAGS Appendix A April 1999 were used per discussion with EPA in June 1999.

(2) See Risk Assessment text for the derivation of the "Absorbed RfD for Dermal"

(3) If % Absorbed $ABS_{GI}$ > 50% default value of 100% is used.

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

CNS = Central Nervous System

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

Site 10, Allegany Ballistics Laboratory

| Chemical of Potential Concern | Chronic/ Subchronic | Value Inhalation RfC | Units | Adjusted Inhalation RfD (1) | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfC:RfD: Target Organ (2) | Dates (3) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | Chronic | 3.50E-03 | $mg/m^3$ | 1.00E-03 | mg/kg-day | CNS | 300 | NCEA | 04/11/2002 |
| | Subchronic | N/A | | | | | | | |
| Arsenic | Chronic | N/A | | | | | | | |
| | Subchronic | N/A | | | | | | | |
| Iron | Chronic | N/A | | | | | | | |
| | Subchronic | N/A | | | | | | | |
| Manganese | Chronic | 5.01E-05 | $mg/m^3$ | 1.43E-05 | mg/kg-day | CNS | 1000 | IRIS | 04/09/2002 |
| | Subchronic | N/A | | | | | | | |

Footnote Instructions:

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evalution Manual (Part E, Supplemetnal Guidance for Dermal Risk Assessment( Interim). Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed RfD for Dermal"

Definitions:

NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

CNS = Central Nervous System

TABLE 6.1

CANCER TOXICITY DATA – ORAL/DERMAL

Site 10, Allegany Ballistics Laboratory

| Chemical of Potential Concern | Oral Cancer Slope Factor | Oral to Dermal Adjustment Factor | Adjusted Dermal Cancer Slope Factor (1) | Units | EPA Carcinogen Group | Source | Date (2) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|
| Arsenic | 1.5E+00 | 95%(3) | 1.5E+00 | $(mg/kg\text{-}day)^{-1}$ | A | IRIS | 04/09/2002 |

(1) Source: Risk Assessment Guidance for Superfund: Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. 2001. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for derivation of the "Absorbed Cancer Slope Factor for Dermal".

(3) If % Absorbed $ABS_{GI}$ > 50% default value of 100% is used.

De NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

USEPA R3 = Region 3 Risk-Based Concentration Table

Weight of Evidence definitions:

Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer.

Group B1 chemicals (probable human carcinogens) are agents for which there is limited evidence of possible carcinogenicity in humans.

Group B2 chemicals (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.

Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and inadequate or a lack of human data.

Group D chemicals (not classifiable as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available.

Group E chemicals (evidence of noncarcinogenicity in humans) are agents for which there is no evidence of carcinogenicity from human or animal studies, or both.

TABLE 6.2

CANCER TOXICITY DATA – INHALATION

Site 10, Allegany Ballistics Laboratory

| Chemical of Potential Concern | Unit Risk | Units | Adjustment (1) | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guidance Description | Source | Date (2) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 4.3E-03 | $(ug/m3)^{-1}$ | 3500 | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | A | IRIS | 04/11/2002 |

Definitions:

NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Tables

NCEA = National Center for Environmental Assessment

USEPA R3 = Region 3 Risk-Based Concentration Table

Weight of Evidence definitions:

Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer.

Group B1 chemicals (probable human carcinogens) are agents for which there is limited evidence of possible carcinogenicity in humans.

Group B2 chemicals (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals but inadequate or a lack of evidence in humans.

Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and inadequate or a lack of human data.

Group D chemicals (not classifiable as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available.

Group E chemicals (evidence of noncarcinogenicity in humans) are agents for which there is no evidence of carcinogenicity from human or animal studies, or both.

TABLE 7.1.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 8.9E-03 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 8.9E-03 |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 6.9E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 2.3E-02 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 2.5E-02 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 8.4E-02 |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 1.0E-03 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 5.0E-02 |
| | (Total) | | | | | | | | | | | | 1.7E-01 |
| Dermal Absorption | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 7.5E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 2.8E-03 |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 1.8E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 5.8E-03 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 2.1E-03 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 3.6E-02 |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 8.5E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 1.1E-01 |
| | (Total) | | | | | | | | | | | | 1.5E-01 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 3.2E-01 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic.
NA - not applicable.

TABLE 7.2.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 2.5E-03 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 2.5E-03 |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 2.0E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 6.6E-03 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 7.2E-03 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 2.4E-02 |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 2.9E-04 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 1.4E-02 |
| | (Total) | | | | | | | | | | | | 4.8E-02 |
| Dermal Absorption | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 1.9E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 6.9E-04 |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 4.3E-07 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 1.4E-03 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 5.3E-04 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 8.9E-03 |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 2.1E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 2.6E-02 |
| | (Total) | | | | | | | | | | | | 3.7E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 8.5E-02 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic.
NA - not applicable.

TABLE 7.3.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 9.1E+03 | mg/kg | 7.0E-06 | $mg/m^3$ | R | 8.2E-07 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 8.2E-04 |
| | Arsenic | 7.0E+00 | mg/kg | 5.4E-09 | $mg/m^3$ | R | 6.3E-10 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Iron | 2.6E+04 | mg/kg | 2.0E-05 | $mg/m^3$ | R | 2.3E-06 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Manganese | 1.0E+03 | mg/kg | 7.9E-07 | $mg/m^3$ | R | 9.2E-08 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 6.5E-03 |
| | (Total) | | | | | | | | | | | | 7.3E-03 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 7.3E-03 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 7.3. Supplement).
NA Not applicable.

**Table 7.3 Supplement**
**Calculation of Site Specific PEF Factor**

**Site 10, Allegany Ballistics Laboratory**

**Particulate Emission Factor (PEF) = ($m^3$/kg)**

$$\frac{Q/C * 3600}{0.036 * (1-V) \times (U_m/U_t)^3 \times F(X)}$$

**PEF = 1.3E+09**

| Parameters | Values |
|---|---|
| Q/C - Inverse of the mean concentration at the center of a 0.5-acre-square source using Philadelphia ($g/m^2$-s per $kg/m^3$) | 90.24 |
| V - fraction of vegetative cover (unitless) | 0.5 |
| $U_m$ - mean annual weindspeed (m/s) | 4.69 |
| Ut - equivalent threshold value of windspeed (m/s) | 11.32 |
| F(X) - function dependent on Um/Ut derived using Cowherd (1985) (Unitles: | 0.194 |

Chemical and physical properties from USEPA, 1996, *Soil Screening Guidance: User's Guide,* EPA/540/R-96/018.

TABLE 7.4.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 9.1E+03 | mg/kg | 7.0E-06 | $mg/m^3$ | R | 2.9E-08 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 2.9E-05 |
| | Arsenic | 7.0E+00 | mg/kg | 5.4E-09 | $mg/m^3$ | R | 2.3E-11 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Iron | 2.6E+04 | mg/kg | 2.0E-05 | $mg/m^3$ | R | 8.3E-08 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Manganese | 1.0E+03 | mg/kg | 7.9E-07 | $mg/m^3$ | R | 3.3E-09 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 2.3E-04 |
| | (Total) | | | | | | | | | | | | 2.6E-04 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 2.6E-04 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 7.3. Supplement).
NA Not applicable.

TABLE 7.5.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.2E-02 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 1.2E-02 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.4E-05 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 4.5E-02 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 4.6E-02 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 1.5E-01 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 1.7E-03 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 8.7E-02 |
| | (Total) | | | | | | | | | | | | 3.0E-01 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 4.0E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 1.5E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.3E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 4.5E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.5E-03 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 2.5E-02 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 5.7E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 7.1E-02 |
| | (Total) | | | | | | | | | | | | 1.0E-01 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 4.0E-01 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic.
NA - not applicable.

TABLE 7.6.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.0E-01 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 1.0E-01 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.1E-04 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 3.8E-01 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 3.9E-01 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 1.3E+00 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 1.5E-02 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 7.3E-01 |
| | (Total) | | | | | | | | | | | | 2.5E+00 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 2.3E-03 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 8.4E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 7.6E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 2.5E-02 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 8.6E-03 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 1.4E-01 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 3.2E-04 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 4.0E-01 |
| | (Total) | | | | | | | | | | | | 5.8E-01 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 3.1E+00 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic.
NA - not applicable.

TABLE 7.7.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 4.2E-02 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 4.2E-02 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 4.6E-05 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 1.5E-01 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.6E-01 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 5.3E-01 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 5.9E-03 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 3.0E-01 |
| | (Total) | | | | | | | | | | | | 1.0E+00 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 2.8E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 1.0E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 9.2E-07 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 3.1E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.1E-03 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 1.8E-02 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 3.9E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 4.9E-02 |
| | (Total) | | | | | | | | | | | | 7.1E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 1.1E+00 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Subchronic if available; otherwise chronic.
NA - not applicable.

TABLE 7.8.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 2.5E-03 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 2.5E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 2.8E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 9.2E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 9.4E-03 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 3.1E-02 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 3.5E-04 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 1.8E-02 |
| | (Total) | | | | | | | | | | | | 6.1E-02 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.8E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 6.8E-04 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 6.1E-07 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 2.0E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 7.0E-04 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 1.2E-02 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 2.6E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 3.2E-02 |
| | (Total) | | | | | | | | | | | | 4.7E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 1.1E-01 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Subchronic if available; otherwise chronic.
NA - not applicable.

TABLE 7.9.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 1.9E-06 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 1.9E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 7.5E-09 | $mg/m^3$ | R | 2.1E-09 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Iron | 3.4E+04 | mg/kg | 2.6E-05 | $mg/m^3$ | R | 7.1E-06 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Manganese | 1.3E+03 | mg/kg | 9.7E-07 | $mg/m^3$ | R | 2.6E-07 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 1.8E-02 |
| | (Total) | | | | | | | | | | | | 2.0E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 2.0E-02 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table7.3. Supplement).
NA Not applicable.

TABLE 7.10.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 5.6E-06 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 5.6E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 7.5E-09 | $mg/m^3$ | R | 6.3E-09 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Iron | 3.4E+04 | mg/kg | 2.6E-05 | $mg/m^3$ | R | 2.2E-05 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | NA |
| | Manganese | 1.3E+03 | mg/kg | 9.7E-07 | $mg/m^3$ | R | 8.0E-07 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 5.6E-02 |
| | (Total) | | | | | | | | | | | | 6.2E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 6.2E-02 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 7.3. Supplement).
NA Not applicable.

TABLE 7.11.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 1.8E-06 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 1.8E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 7.5E-09 | $mg/m^3$ | R | 1.9E-09 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Iron | 3.4E+04 | mg/kg | 2.6E-05 | $mg/m^3$ | R | 6.7E-06 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Manganese | 1.3E+03 | mg/kg | 9.7E-07 | $mg/m^3$ | R | 2.5E-07 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 1.7E-02 |
| | (Total) | | | | | | | | | | | | 1.9E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 1.9E-02 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 7.3 Supplement).
NA Not applicable.

TABLE 7.12.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 2.8E-08 | mg/kg-day | 1.0E-03 | mg/kg-day | 3.5E-03 | mg/kg-day | 2.8E-05 |
| | Arsenic | 1.3E+01 | mg/kg | 1.0E-08 | $mg/m^3$ | R | 4.3E-11 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Iron | 5.1E+04 | mg/kg | 3.9E-05 | $mg/m^3$ | R | 1.6E-07 | mg/kg-day | NA | mg/kg-day | NA | mg/kg-day | |
| | Manganese | 5.7E+03 | mg/kg | 4.3E-06 | $mg/m^3$ | R | 1.8E-08 | mg/kg-day | 1.4E-05 | mg/kg-day | 5.0E-05 | mg/kg-day | 1.3E-03 |
| | (Total) | | | | | | | | | | | | 1.3E-03 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 1.3E-03 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 7.3 Supplement).
NA Not applicable.

TABLE 7.13.CT
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.1E-02 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 1.1E-02 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.3E-05 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 4.2E-02 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 4.4E-02 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 1.5E-01 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 1.6E-03 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 8.1E-02 |
| | (Total) | | | | | | | | | | | | 2.8E-01 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 4.3E-04 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 1.6E-03 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.4E-06 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 4.8E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.6E-03 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 2.7E-02 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 6.1E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 7.7E-02 |
| | (Total) | | | | | | | | | | | | 1.1E-01 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 3.9E-01 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Chronic.
NA - not applicable.

TABLE 7.14.CT
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose (2) | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 3.7E-02 | mg/kg-day | 1.0E+00 | mg/kg-day | NA | NA | 3.7E-02 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 4.1E-05 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 1.4E-01 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.4E-01 | mg/kg-day | 3.0E-01 | mg/kg-day | NA | NA | 4.6E-01 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 5.2E-03 | mg/kg-day | 2.0E-02 | mg/kg-day | NA | NA | 2.6E-01 |
| | (Total) | | | | | | | | | | | | 9.0E-01 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 9.1E-05 | mg/kg-day | 2.7E-01 | mg/kg-day | NA | NA | 3.4E-04 |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 3.0E-07 | mg/kg-day | 3.0E-04 | mg/kg-day | NA | NA | 1.0E-03 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 3.5E-04 | mg/kg-day | 6.0E-02 | mg/kg-day | NA | NA | 5.8E-03 |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 1.3E-05 | mg/kg-day | 8.0E-04 | mg/kg-day | NA | NA | 1.6E-02 |
| | (Total) | | | | | | | | | | | | 2.3E-02 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 9.2E-01 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
(2) Subchronic if available; otherwise chronic.
NA - not applicable.

TABLE 8.1.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 3.2E-03 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 2.5E-06 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 3.7E-06 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 9.0E-03 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 3.6E-04 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 3.7E-06 |
| Dermal Absorption | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 2.7E-04 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 6.3E-07 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 9.4E-07 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 7.7E-04 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 3.1E-05 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 9.4E-07 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 4.6E-06 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NA - not applicable.

TABLE 8.2.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Surface soil
Exposure Point: Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 3.3E-04 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 2.5E-07 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 3.8E-07 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 9.3E-04 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 3.7E-05 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 3.8E-07 |
| Dermal Absorption | Aluminum | 9.1E+03 | mg/kg | 9.1E+03 | mg/kg | M | 2.4E-05 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 7.0E+00 | mg/kg | M | 5.6E-08 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 8.4E-08 |
| | Iron | 2.6E+04 | mg/kg | 2.6E+04 | mg/kg | M | 6.8E-05 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 1.0E+03 | mg/kg | M | 2.7E-06 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 8.4E-08 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 4.6E-07 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
NA - not applicable.

TABLE 8.3.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Industrial Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 9.1E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 2.9E-07 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 5.3E-09 | $mg/m^3$ | R | 2.2E-10 | mg/kg-day | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | 3.3E-09 |
| | Iron | 2.6E+04 | mg/kg | 1.9E-05 | $mg/m^3$ | R | 8.1E-07 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 7.7E-07 | $mg/m^3$ | R | 3.2E-08 | mg/kg-day | NA | NA | NA |
| | Total | | | | | | | | | | 3.3E-09 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 3.3E-09 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 8.3 Supplement).

**Table 8.3.Supplement**
**Calculation of Site Specific PEF Factor**
**Site 10, Allegany Ballistics Laboratory**

**Particulate Emission Factor (PEF) =** $\frac{Q/C * 3600}{0.036 * (1-V) \times (U_m/U_t)^3 \times F(X)}$
**($m^3$/kg)**

**PEF = 1.3E+09**

| **Parameters** | **Values** |
|---|---|
| Q/C - Inverse of the mean concentration at the center of a 0.5-acre-square source using Philadelphia ($g/m^2$-s per $kg/m^3$) | 90.24 |
| V - fraction of vegetative cover (unitless) | 0.5 |
| $U_m$ - mean annual weindspeed (m/s) | 4.69 |
| Ut - equivalent threshold value of windspeed (m/s) | 11.32 |
| F(X) - function dependent on Um/Ut derived using Cowherd (1985) (Unitle: | 0.190 |

TABLE 8.4.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Air
Exposure Point: Airborne Particulates from Site 10 Surface Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 9.1E+03 | mg/kg | 6.8E-06 | $mg/m^3$ | R | 3.7E-09 | mg/kg-day | NA | NA | NA |
| | Arsenic | 7.0E+00 | mg/kg | 5.3E-09 | $mg/m^3$ | R | 2.8E-12 | mg/kg-day | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | 4.3E-11 |
| | Iron | 2.6E+04 | mg/kg | 1.9E-05 | $mg/m^3$ | R | 1.0E-08 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.0E+03 | mg/kg | 7.7E-07 | $mg/m^3$ | R | 4.2E-10 | mg/kg-day | NA | NA | NA |
| | Total | | | | | | | | | | 4.3E-11 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 4.3E-11 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 8.3 Supplement).

TABLE 8.5.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.3E-02 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.4E-05 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 2.2E-05 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 4.9E-02 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 1.8E-03 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 2.2E-05 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 3.3E-04 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.1E-06 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 1.7E-06 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.3E-03 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 4.7E-05 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 1.7E-06 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 2.3E-05 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
NA - not applicable.

TABLE 8.6.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 6.0E-04 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 6.6E-07 | mg/kg-day | 1.5E+00 | $(mg/kg\text{-}day)^{-1}$ | 9.9E-07 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 2.3E-03 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 8.5E-05 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 9.9E-07 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 3.9E-06 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.3E-08 | mg/kg-day | 1.5E+00 | $(mg/kg\text{-}day)^{-1}$ | 2.0E-08 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.5E-05 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 5.6E-07 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 2.0E-08 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 1.0E-06 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
NA - not applicable.

TABLE 8.7.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 3.2E-04 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 3.5E-07 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 5.3E-07 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 1.2E-03 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 4.5E-05 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 5.3E-07 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 2.3E-05 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 7.8E-08 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 1.2E-07 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 8.9E-05 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 3.3E-06 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 1.2E-07 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 6.5E-07 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
NA - not applicable.

TABLE 8.8.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.6E-06 | $mg/m^3$ | R | 1.1E-06 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 7.4E-09 | $mg/m^3$ | R | 1.2E-09 | mg/kg-day | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | 1.8E-08 |
| | Iron | 3.4E+04 | mg/kg | 2.5E-05 | $mg/m^3$ | R | 4.2E-06 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 9.5E-07 | $mg/m^3$ | R | 1.6E-07 | mg/kg-day | NA | NA | NA |
| | Total | | | | | | | | | | 1.8E-08 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 1.8E-08 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 8.3 Supplement).

TABLE 8.9.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 3 Soil
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.6E-06 | $mg/m^3$ | R | 2.5E-08 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 7.4E-09 | $mg/m^3$ | R | 2.7E-11 | mg/kg-day | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | 4.1E-10 |
| | Iron | 3.4E+04 | mg/kg | 2.5E-05 | $mg/m^3$ | R | 9.3E-08 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 9.5E-07 | $mg/m^3$ | R | 3.5E-09 | mg/kg-day | NA | NA | NA |
| | Total | | | | | | | | | | 4.1E-10 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 4.1E-10 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 8.3 Supplement).

TABLE 8.10.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Air
Exposure Point: Airborne Particulate from Site 10 Soil
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Aluminum | 8.9E+03 | mg/kg | 6.6E-06 | $mg/m^3$ | R | 3.6E-09 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 7.4E-09 | $mg/m^3$ | R | 4.0E-12 | mg/kg-day | 1.5E+01 | $(mg/kg\text{-}day)^{-1}$ | 6.0E-11 |
| | Iron | 3.4E+04 | mg/kg | 2.5E-05 | $mg/m^3$ | R | 1.4E-08 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 9.5E-07 | $mg/m^3$ | R | 5.1E-10 | mg/kg-day | NA | NA | NA |
| | Total | | | | | | | | | | 6.0E-11 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 6.0E-11 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.
Route EPC Value is equal to concentration in soil multiplied by 1/PEF (PEF is site specific, provided in Table 8.3 Supplement).

TABLE 8.11.CT
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY
Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Medium: Soil*
Exposure Medium: Soil*
Exposure Point: Site 10 Soil
Receptor Population: Resident
Receptor Age: Child/Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 1.5E-03 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 1.7E-06 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 2.5E-06 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 5.7E-03 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 2.1E-04 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 2.5E-06 |
| Dermal Absorption | Aluminum | 8.9E+03 | mg/kg | 8.9E+03 | mg/kg | M | 6.7E-05 | mg/kg-day | NA | NA | NA |
| | Arsenic | 9.9E+00 | mg/kg | 9.9E+00 | mg/kg | M | 2.2E-07 | mg/kg-day | 1.5E+00 | (mg/kg-day) $^{-1}$ | 3.3E-07 |
| | Iron | 3.4E+04 | mg/kg | 3.4E+04 | mg/kg | M | 2.5E-04 | mg/kg-day | NA | NA | NA |
| | Manganese | 1.3E+03 | mg/kg | 1.3E+03 | mg/kg | M | 9.5E-06 | mg/kg-day | NA | NA | NA |
| | (Total) | | | | | | | | | | 3.3E-07 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 2.8E-06 |

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.
NA - not applicable.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Surface Soil | Surface Soil | Site 10 Surface Soil | | | | | | | | | | | |
| | | | Aluminum | NA | -- | NA | 0.0E+00 | Aluminum | CNS | 8.9E-03 | -- | 2.8E-03 | 1.2E-02 |
| | | | Arsenic | 3.7E-06 | -- | 9.4E-07 | 4.6E-06 | Arsenic | Skin/vascular | 2.3E-02 | -- | 5.8E-03 | 2.9E-02 |
| | | | Iron | NA | -- | NA | 0.0E+00 | Iron | Gastrointestinal/Liver | 8.4E-02 | -- | 3.6E-02 | 1.2E-01 |
| | | | Manganese | NA | -- | NA | 0.0E+00 | Manganese | CNS | 5.0E-02 | -- | 1.1E-01 | 1.6E-01 |
| | | | (Total) | 3.7E-06 | 0.0E+00 | 9.4E-07 | 4.6E-06 | (Total) | | 1.7E-01 | 0.0E+00 | 1.5E-01 | 3.2E-01 |
| | | | Total Risk Across Surface Soil at Site 10 | | | | 4.6E-06 | Total Hazard Across Surface Soil at Site 10 | | | | | 3.2E-01 |
| | Air | Airborne Particulates from Site 10 Surface Soil | | | | | | | | | | | |
| | | | Aluminum | -- | NA | -- | 0.0E+00 | Aluminum | CNS | -- | 8.2E-04 | -- | 8.2E-04 |
| | | | Arsenic | -- | 3.3E-09 | -- | 3.3E-09 | Arsenic | NA | -- | NA | -- | 0.0E+00 |
| | | | Iron | -- | NA | -- | 0.0E+00 | Iron | NA | -- | NA | -- | 0.0E+00 |
| | | | Manganese | -- | NA | -- | 0.0E+00 | Manganese | CNS | -- | 6.5E-03 | -- | 6.5E-03 |
| | | | (Total) | 0.0E+00 | 3.3E-09 | 0.0E+00 | 3.3E-09 | (Total) | | 0.0E+00 | 7.3E-03 | 0.0E+00 | 7.3E-03 |
| | | | Total Risk Across Airborne Particulates from Site 10 Surface Soi | | | | 3.3E-09 | Total Hazard Across Airborne Particulates from Site 10 Surface Soi | | | | | 7.3E-03 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 4.6E-06 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 3.2E-01 |

| | |
|---|---|
| Total CNS HI = | 1.8E-01 |
| Total Liver HI = | 1.2E-01 |
| Total Skin HI = | 2.9E-02 |
| Total Vascular HI = | 2.9E-02 |
| Total Gastrointestinal HI = | 1.2E-01 |

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Surface Soil | Surface Soil | Site 10 Surface Soil | Aluminum | NA | -- | NA | 0.0E+00 | Aluminum | CNS | 2.5E-03 | -- | 6.9E-04 | 3.2E-03 |
| | | | Arsenic | 3.8E-07 | -- | 8.4E-08 | 4.6E-07 | Arsenic | Skin/vascular | 6.6E-03 | -- | 1.4E-03 | 8.0E-03 |
| | | | Iron | NA | -- | NA | 0.0E+00 | Iron | Gastrointestinal/Liver | 2.4E-02 | -- | 8.9E-03 | 3.3E-02 |
| | | | Manganese | NA | -- | NA | 0.0E+00 | Manganese | CNS | 1.4E-02 | -- | 2.6E-02 | 4.1E-02 |
| | | | (Total) | 3.8E-07 | 0.0E+00 | 8.4E-08 | 4.6E-07 | (Total) | | 4.8E-02 | 0.0E+00 | 3.7E-02 | 8.5E-02 |
| | | | Total Risk Across Surface Soil at Site 10 | | | | 4.6E-07 | Total Hazard Across Surface Soil from Site 10 | | | | | 8.5E-02 |
| | Air | Airborne Particulates from Site 10 Surface Soil | Aluminum | -- | NA | -- | 0.0E+00 | Aluminum | CNS | -- | 2.9E-05 | -- | 2.9E-05 |
| | | | Arsenic | -- | 4.3E-11 | -- | 4.3E-11 | Arsenic | NA | -- | NA | -- | 0.0E+00 |
| | | | Iron | -- | NA | -- | 0.0E+00 | Iron | NA | -- | NA | -- | 0.0E+00 |
| | | | Manganese | -- | NA | -- | 0.0E+00 | Manganese | CNS | -- | 2.3E-04 | -- | 2.3E-04 |
| | | | (Total) | 0.0E+00 | 4.3E-11 | 0.0E+00 | 4.3E-11 | (Total) | | 0.0E+00 | 2.6E-04 | 0.0E+00 | 2.6E-04 |
| | | | Total Risk Across Airborne Particulates from Site 10 Surface Soil | | | | 4.3E-11 | Total Hazard Across Airborne Particulates from Site 10 Surface Soil | | | | | 2.6E-04 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 4.6E-07 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 8.5E-02 |

| | |
|---|---|
| Total CNS HI = | 4.4E-02 |
| Total Liver HI = | 3.3E-02 |
| Total Skin HI = | 8.0E-03 |
| Total Vascular HI = | 8.0E-03 |
| Total Gastrointestinal HI = | 3.3E-02 |

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | Aluminum | CNS | 1.2E-02 | -- | 1.5E-03 | 1.4E-02 |
| | | | | | | | | Arsenic | Skin/vascular | 4.5E-02 | -- | 4.5E-03 | 5.0E-02 |
| | | | | | | | | Iron | Gastrointestinal/Liver | 1.5E-01 | -- | 2.5E-02 | 1.8E-01 |
| | | | | | | | | Manganese | CNS | 8.7E-02 | -- | 7.1E-02 | 1.6E-01 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 3.0E-01 | 0.0E+00 | 1.0E-01 | 4.0E-01 |
| | | | Total Risk Across Soil* from Site 10 | | | | 0.0E+00 | Total Risk Across Soil* from Site 10 | | | | | 4.0E-01 |
| | Air | Airborne Particulate from Site 10 Soil | | | | | | Aluminum | CNS | -- | 1.9E-03 | -- | 1.9E-03 |
| | | | | | | | | Arsenic | NA | -- | 0.0E+00 | -- | 0.0E+00 |
| | | | | | | | | Iron | NA | -- | 0.0E+00 | -- | 0.0E+00 |
| | | | | | | | | Manganese | CNS | -- | 1.8E-02 | -- | 1.8E-02 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 0.0E+00 | 2.0E-02 | 0.0E+00 | 2.0E-02 |
| | | | Total Risk Across Airborne Particulate from Site 10 Soil | | | | 0.0E+00 | Total Hazard Across Airborne Particulates from Site 10 Surface Soil | | | | | 2.0E-02 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 0.0E+00 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 4.2E-01 |

| | |
|---|---|
| Total CNS HI = | 1.9E-01 |
| Total Liver HI = | 1.8E-01 |
| Total Skin HI = | 5.0E-02 |
| Total Vascular HI = | 5.0E-02 |
| Total Gastrointestinal HI = | 1.8E-01 |

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Residen
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | Aluminum | CNS | 1.0E-01 | -- | 8.4E-03 | 1.1E-01 |
| | | | | | | | | Arsenic | Skin/vascular | 3.8E-01 | -- | 2.5E-02 | 4.1E-01 |
| | | | | | | | | Iron | Gastrointestinal/Liver | 1.3E+00 | -- | 1.4E-01 | 1.4E+00 |
| | | | | | | | | Manganese | CNS | 7.3E-01 | -- | 4.0E-01 | 1.1E+00 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 2.5E+00 | 0.0E+00 | 5.8E-01 | 3.1E+00 |
| | | | Total Risk Across Soil* from Site 10 | | | | 0.0E+00 | Total Risk Across Soil* from Site 10 | | | | | 3.1E+00 |
| | Air | Airborne Particulate from Site 10 Soil | | | | | | Aluminum | CNS | -- | 5.6E-03 | -- | 5.6E-03 |
| | | | | | | | | Arsenic | NA | -- | NA | -- | 0.0E+00 |
| | | | | | | | | Iron | NA | -- | NA | -- | 0.0E+00 |
| | | | | | | | | Manganese | CNS | -- | 5.6E-02 | -- | 5.6E-02 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 0.0E+00 | 6.2E-02 | 0.0E+00 | 6.2E-02 |
| | | | Total Risk Across Airborne Particulate from Site 10 Soil | | | | 0.0E+00 | Total Risk Across Airborne Particulate from Site 10 Soil | | | | | 6.2E-02 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 0.0E+00 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 3.2E+00 |

| | |
|---|---|
| Total CNS HI = | 1.3E+00 |
| Total Liver HI = | 1.4E+00 |
| Total Skin HI = | 4.1E-01 |
| Total Vascular HI = | 4.1E-01 |
| Total Gastrointestinal HI = | 1.4E+00 |

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | NA | -- | NA | 0.0E+00 | | | | | | |
| | | | Arsenic | 2.2E-05 | -- | 1.7E-06 | 2.3E-05 | | | | | | |
| | | | Iron | NA | -- | NA | 0.0E+00 | | | | | | |
| | | | Manganese | NA | -- | NA | 0.0E+00 | | | | | | |
| | | | (Total) | 2.2E-05 | 0.0E+00 | 1.7E-06 | 2.3E-05 | (Total) | | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | Total Risk Across Soil* at Site 10 | | | | 2.3E-05 | Total Hazard Across Soil* at Site 10 | | | | | 0.0E+00 |
| | Air | Airborne Particulate from Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | -- | NA | -- | 0.0E+00 | | | | | | |
| | | | Arsenic | -- | 1.8E-08 | -- | 1.8E-08 | | | | | | |
| | | | Iron | -- | NA | -- | 0.0E+00 | | | | | | |
| | | | Manganese | -- | NA | -- | 0.0E+00 | | | | | | |
| | | | (Total) | 0.0E+00 | 1.8E-08 | 0.0E+00 | 1.8E-08 | (Total) | | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | Total Risk Across Airborne Particulate from Site 10 Soil | | | | 1.8E-08 | Total Hazard Across Airborne Particulate from Site 10 Soil | | | | | 0.0E+00 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 2.3E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.0E+00 |

* surface and subsurface combined soil.

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | NA | – | NA | 0.0E+00 | Aluminum | CNS | 4.2E-02 | – | 1.0E-03 | 4.3E-02 |
| | | | Arsenic | 9.9E-07 | – | 2.0E-08 | 1.0E-06 | Arsenic | Skin/vascular | 1.5E-01 | – | 3.1E-03 | 1.6E-01 |
| | | | Iron | NA | – | NA | 0.0E+00 | Iron | Gastrointestinal/Liver | 5.3E-01 | – | 1.8E-02 | 5.5E-01 |
| | | | Manganese | NA | – | NA | 0.0E+00 | Manganese | CNS | 3.0E-01 | – | 4.9E-02 | 3.5E-01 |
| | | | (Total) | 9.9E-07 | 0.0E+00 | 2.0E-08 | 1.0E-06 | (Total) | | 1.0E+00 | 0.0E+00 | 7.1E-02 | 1.1E+00 |
| | | | Total Risk Across Soil* at Site 10 | | | | 1.0E-06 | Total Hazard Across Soil* at Site 10 | | | | | 1.1E+00 |
| | Air | Airborne Particulate from Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | – | NA | – | 0.0E+00 | Aluminum | CNS | – | 1.8E-03 | – | 1.8E-03 |
| | | | Arsenic | – | 4.1E-10 | – | 4.1E-10 | Arsenic | NA | – | 0.0E+00 | – | 0.0E+00 |
| | | | Iron | – | NA | – | 0.0E+00 | Iron | NA | – | 0.0E+00 | – | 0.0E+00 |
| | | | Manganese | – | NA | – | 0.0E+00 | Manganese | CNS | – | 1.7E-02 | – | 1.7E-02 |
| | | | (Total) | 0.0E+00 | 4.1E-10 | 0.0E+00 | 4.1E-10 | (Total) | | 0.0E+00 | 1.9E-02 | 0.0E+00 | 1.9E-02 |
| | | | Total Risk Across Airborne Particulate from Site 10 Soil | | | | 4.1E-10 | Total Hazard Across Airborne Particulate from Site 10 Soil | | | | | 1.9E-02 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 1.0E-06 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 1.1E+00 |

* surface and subsurface combined soil.

| | |
|---|---|
| Total CNS HI = | 4.1E-01 |
| Total Liver HI = | 5.5E-01 |
| Total Skin HI = | 1.6E-01 |
| Total Vascular HI = | 1.6E-01 |
| Total Gastrointestinal HI = | 5.5E-01 |

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescents

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | NA | -- | NA | 0.0E+00 | Aluminum | CNS | 2.5E-03 | -- | 6.8E-04 | 3.2E-03 |
| | | | Arsenic | 5.3E-07 | -- | 1.2E-07 | 6.5E-07 | Arsenic | Skin/vascular | 9.2E-03 | -- | 2.0E-03 | 1.1E-02 |
| | | | Iron | NA | -- | NA | 0.0E+00 | Iron | Gastrointestinal/Liver | 3.1E-02 | -- | 1.2E-02 | 4.3E-02 |
| | | | Manganese | NA | -- | NA | 0.0E+00 | Manganese | CNS | 1.8E-02 | -- | 3.2E-02 | 5.0E-02 |
| | | | (Total) | 5.3E-07 | 0.0E+00 | 1.2E-07 | 6.5E-07 | (Total) | | 6.1E-02 | 0.0E+00 | 4.7E-02 | 1.1E-01 |
| | | | Total Risk Across Soil* at Site 10 | | | | 6.5E-07 | Total Hazard Across Soil* at Site 10 | | | | | 1.1E-01 |
| Soil* | Air | Airborne Particulate from Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | -- | NA | -- | 0.0E+00 | Aluminum | CNS | -- | 2.8E-05 | -- | 2.8E-05 |
| | | | Arsenic | -- | 6.0E-11 | -- | 6.0E-11 | Arsenic | NA | -- | 0.0E+00 | -- | 0.0E+00 |
| | | | Iron | -- | NA | -- | 0.0E+00 | Iron | NA | -- | 0.0E+00 | -- | 0.0E+00 |
| | | | Manganese | -- | NA | -- | 0.0E+00 | Manganese | CNS | -- | 1.3E-03 | -- | 1.3E-03 |
| | | | (Total) | 0.0E+00 | 6.0E-11 | 0.0E+00 | 6.0E-11 | (Total) | | 0.0E+00 | 1.3E-03 | 0.0E+00 | 1.3E-03 |
| | | | Total Risk Across Airborne Particulate from Site 10 Soil | | | | 6.0E-11 | Total Hazard Across Airborne Particulate from Site 10 Soil | | | | | 1.3E-03 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 6.5E-07 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 1.1E-01 |

* surface and subsurface combined soil.

| | |
|---|---|
| Total CNS HI = | 5.5E-02 |
| Total Liver HI = | 4.3E-02 |
| Total Skin HI = | 1.1E-02 |
| Total Vascular HI = | 1.1E-02 |
| Total Gastrointestinal HI = | 4.3E-02 |

TABLE 9.8.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Residen
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | Aluminum | CNS | 1.1E-02 | -- | 1.6E-03 | 1.3E-02 |
| | | | | | | | | Arsenic | Skin/vascular | 4.2E-02 | -- | 4.8E-03 | 4.7E-02 |
| | | | | | | | | Iron | Gastrointestinal/Liver | 1.5E-01 | -- | 2.7E-02 | 1.7E-01 |
| | | | | | | | | Manganese | CNS | 8.1E-02 | -- | 7.7E-02 | 1.6E-01 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 2.8E-01 | 0.0E+00 | 1.1E-01 | 3.9E-01 |
| | | | Total Risk Across Soil* from Site 10 | | | | 0.0E+00 | Total Risk Across Soil* from Site 10 | | | | | 3.9E-01 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 0.0E+00 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 3.9E-01 |

| | |
|---|---|
| Total CNS HI = | 1.7E-01 |
| Total Liver HI = | 1.7E-01 |
| Total Skin HI = | 4.7E-02 |
| Total Vascular HI = | 4.7E-02 |
| Total Gastrointestinal HI = | 1.7E-01 |

TABLE 9.9.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | | | | | | |
| | | | Aluminum | NA | – | NA | 0.0E+00 | | | | | | |
| | | | Arsenic | 2.5E-06 | – | 3.3E-07 | 2.8E-06 | | | | | | |
| | | | Iron | NA | – | NA | 0.0E+00 | | | | | | |
| | | | Manganese | NA | – | NA | 0.0E+00 | | | | | | |
| | | | (Total) | 2.5E-06 | 0.0E+00 | 3.3E-07 | 2.8E-06 | (Total) | | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | Total Risk Across Soil* at Site 10 | | | | 2.8E-06 | Total Hazard Across Soil* at Site 10 | | | | | 0.0E+00 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 2.8E-06 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.0E+00 |

TABLE 9.10.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | Aluminum | CNS | 3.7E-02 | -- | 3.4E-04 | 3.7E-02 |
| | | | | | | | | Arsenic | Skin/vascular | 1.4E-01 | -- | 1.0E-03 | 1.4E-01 |
| | | | | | | | | Iron | Gastrointestinal/Liver | 4.6E-01 | -- | 5.8E-03 | 4.7E-01 |
| | | | | | | | | Manganese | CNS | 2.6E-01 | -- | 1.6E-02 | 2.8E-01 |
| | | | | | | | | (Total) | | 9.0E-01 | 0.0E+00 | 2.3E-02 | 9.2E-01 |
| | | | Total Risk Across Soil* at Site 10 | | | | 0.0E+00 | Total Hazard Across Soil* at Site 10 | | | | | 9.2E-01 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 0.0E+00 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 9.2E-01 |

| | |
|---|---|
| Total CNS HI = | 3.1E-01 |
| Total Liver HI = | 4.7E-01 |
| Total Skin HI = | 1.4E-01 |
| Total Vascular HI = | 1.4E-01 |
| Total Gastrointestinal HI = | 4.7E-01 |

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | | | | | | | | | | | |
| | | | | | | | | Arsenic | Skin/vascular | 1.0E-01 | -- | 8.4E-03 | 1.1E-01 |
| | | | | | | | | Iron | Gastrointestinal/Liver | 3.8E-01 | -- | 2.5E-02 | 4.1E-01 |
| | | | | | | | | Manganese | CNS | 1.3E+00 | -- | 1.4E-01 | 1.4E+00 |
| | | | (Total) | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 | (Total) | | 1.8E+00 | 0.0E+00 | 1.8E-01 | 2.0E+00 |
| | | | Total Risk Across Soil* from Site 10 | | | | 0.0E+00 | Total Risk Across Soil* from Site 10 | | | | | 2.0E+00 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 0.0E+00 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 2.0E+00 |

| | |
|---|---|
| Total CNS HI = | 1.4E+00 |
| Total Liver HI = | 4.1E-01 |
| Total Skin HI = | 1.1E-01 |
| Total Vascular HI = | 1.1E-01 |
| Total Gastrointestinal HI = | 4.1E-01 |

TABLE 10.2.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site 10, Allegany Ballistics Laboratory

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal Absorption | Exposure Routes Total |
| Soil* | Soil* | Site 10 Soil | Arsenic | 2.2E-05 | – | 1.7E-06 | 2.3E-05 | | | | | | |
| | | | (Total) | 2.2E-05 | 0.0E+00 | 1.7E-06 | 2.3E-05 | (Total) | | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| | | | Total Risk Across Soil* at Site 3 | | | | 2.3E-05 | Total Hazard Across Soil* at Site 3 | | | | | 0.0E+00 |
| * surface and subsurface combined soil. | | | Total Risk Across All Media and All Exposure Routes | | | | 2.3E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.0E+00 |

**Table 8-1**
**Summary of Data Quantitatively Used in Risk Assessment**
**Site 10, Allegany Ballistics Laboratory**

| Medium | Date of Sampling | Sample Location | Sample | Parameters |
|---|---|---|---|---|
| **Surface Soil** | | | | |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SS01-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB02 | AS10-SS02-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03P-(0-0.5)[1] | VOCs |
| | 06/07/00 | AS10-SB04 | AS10-SS04-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SS05-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SS06-(0-0.5) | VOCs, Total Metals |
| | 10/28/1995 | PWA-29S/2/29/7 | HCS-PWA-29S | VOCs (select), SVOCs, EXPLO (select), Total Metals |
| **Soil*** | | | | |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SS01-(0-0.5) | VOCs, Total Metals |
| Surface Soil | 06/07/00 | AS10-SB02 | AS10-SS02-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SS03P-(0-0.5)[1] | VOCs |
| | 06/07/00 | AS10-SB04 | AS10-SS04-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SS05-(0-0.5) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SS06-(0-0.5) | VOCs, Total Metals |
| | 10/28/1995 | PWA-29S/2/29/7 | HCS-PWA-29S | VOCs (select), SVOCs, EXPLO (select), Total Metals |
| Site 10 | 06/07/00 | AS10-SB01 | AS10-SB01-(2-4) | VOCs, Total Metals |
| Subsurface Soil | 06/07/00 | AS10-SB02 | AS10-SB02-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB03 | AS10-SB03-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB04 | AS10-SB04-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB05 | AS10-SB05-(2-4) | VOCs, Total Metals |
| | 06/07/00 | AS10-SB06 | AS10-SB06-(2-4) | VOCs, Total Metals |
| | 07/21/92 | PWA-13/14 | HCS-PWA-13 | Total Metals |
| | 11/15/94 | PWA-13/14 | HCS-PWA-29 | 1,2,4-Trichlorobenzene, (1,2-, 1,3-, 1,4-)Dichlorobenzene, SVOCs, EXPLO (select), Total Metals |

1 Duplicate of sample AS10-SS03-(0-0.5)
Soil* - Surface and subsurface soil combined.

**Table 8- 2**
**Summary of Chemicals of Potential Concern for the HHRA**
**Site 10, Allegany Ballistics Laboratory**

| Surface Soil | Soil* |
|---|---|
| *Ingestion, Dermal, and Inhalation of Airborne Particulates* | *Ingestion, Dermal, and Inhalation of Airborne Particulates* |
| Aluminum | Aluminum |
| Arsenic | Arsenic |
| Iron | Iron |
| Manganese | Manganese |

* Surface and subsurface soil combined.

**Table 8-3**
**Exposure Pathways**
**Site 10, Allegany Ballistics Laboratory**

| Media | Exposure Route | Current | | Future | | | |
|---|---|---|---|---|---|---|---|
| | | Industrial Worker | Trespasser/Visitor Adolescent | Trespasser/Visitor Adolescent | Construction Worker | Resident | |
| | | | | | | Adult | Child |
| Surface Soil (Site 10) | Ingestion | X | X | | | | |
| | Dermal | X | X | | | | |
| | Inhalation | X | X | | | | |
| Soil* (Site 10) | Ingestion | | | X | X | X | X |
| | Dermal | | | X | X | X | X |
| | Inhalation | | | X | X | X | X |

X Quantitative evaluation.

**Table 8-4**
**Summary of RME Cancer Risks and Hazard Indices**
**Site 10, Allegany Ballistics Laboratory**

| Receptor | Media | Exposure Route | Cancer Risk | Chemicals with Cancer Risks >$10^{-4}$ | Chemicals with Cancer Risks >$10^{-5}$ and <$10^{-4}$ | Chemicals with Cancer Risks >$10^{-6}$ and <$10^{-5}$ | Hazard Index | Chemicals with HI>1 |
|---|---|---|---|---|---|---|---|---|
| Current/Future Industrial Worker | Surface Soil - Site 10 | Ingestion | 3.7E-06 | | | Arsenic | 0.2 | |
| | | Dermal Contact | 9.4E-07 | | | | 0.2 | |
| | | Inhalation | 3.3E-09 | | | | 0.007 | |
| | | Total | 4.6E-06 | | | | 0.3 | |
| | All Media | Total | 4.6E-06 | | | | 0.3 | |
| Current/Future Adolescent Trespasser/Visitor | Surface Soil - Site 10 | Ingestion | 3.8E-07 | | | | 0.05 | |
| | | Dermal Contact | 8.4E-08 | | | | 0.04 | |
| | | Inhalation | 4.3E-11 | | | | 0.0003 | |
| | | Total | 4.6E-07 | | | | 0.09 | |
| | All Media | Total | 4.6E-07 | | | | 0.09 | |
| Future Adult Resident | Soil* - Site 10 | Ingestion | NA | | | | 0.3 | |
| | | Dermal Contact | NA | | | | 0.1 | |
| | | Inhalation | NA | | | | 0.02 | |
| | | Total | NA | | | | 0.4 | |
| | All Media | Total | NA | | | | 0.4 | |
| Future Child Resident | Soil* - Site 10 | Ingestion | NA | | | | 2.5 | Iron |
| | | Dermal Contact | NA | | | | 0.6 | |
| | | Inhalation | NA | | | | 0.06 | |
| | | Total | NA | | | | 3.2 | Iron |
| | All Media | Total | NA | | | | 3.2 | |
| Future Child/Adult Resident | Soil* - Site 10 | Ingestion | 2.2E-05 | | Arsenic | | NA | |
| | | Dermal Contact | 1.7E-06 | | | Arsenic | NA | |
| | | Inhalation | 1.8E-08 | | | | NA | |
| | | Total | 2.3E-05 | | | | NA | |
| | All Media | Total | 2.3E-05 | | | | NA | |
| Future Construction Worker | Soil* - Site 10 | Ingestion | 9.9E-07 | | | | 1.0 | |
| | | Dermal Contact | 2.0E-08 | | | | 0.07 | |
| | | Inhalation | 4.1E-10 | | | | 0.02 | |
| | | Total | 1.0E-06 | | | | 1.1 | |
| | All Media | Total | 1.0E-06 | | | | 1.1 | |
| Future Adolescent Trespasser/Visitor | Soil* - Site 10 | Ingestion | 5.3E-07 | | | | 0.06 | |
| | | Dermal Contact | 1.2E-07 | | | | 0.05 | |
| | | Inhalation | 6.0E-11 | | | | 0.001 | |
| | | Total | 6.5E-07 | | | | 0.1 | |
| | All Media | Total | 6.5E-07 | | | | 0.1 | |

**Table 8-5**
**Summary of CT Cancer Risks and Hazard Indices**
**Site 10, Allegany Ballistics Laboratory**

| Receptor | Media | Exposure Route | Cancer Risk | Chemicals with Cancer Risks $>10^{-4}$ | Chemicals with Cancer Risks $>10^{-5}$ and $<10^{-4}$ | Chemicals with Cancer Risks $>10^{-6}$ and $<10^{-5}$ | Hazard Index | Chemicals with HI>1 |
|---|---|---|---|---|---|---|---|---|
| Future Child Resident | Soil* - Site 10 | Ingestion | NA | | | | 0.3 | |
| | | Dermal Contact | NA | | | | 0.1 | |
| | | Inhalation | NA | | | | NA | |
| | | Total | NA | | | | 0.4 | |
| | All Media | Total | NA | | | | 0.4 | |
| Future Construction Worker | Soil* - Site 10 | Ingestion | NA | | | | 0.9 | |
| | | Dermal Contact | NA | | | | 0.02 | |
| | | Inhalation | NA | | | | NA | |
| | | Total | NA | | | | 0.9 | |
| | All Media | Total | NA | | | | 0.9 | |