RECORD OF DECISION

HAVERTOWN PCP SUPERFUND SITE OPERABLE UNIT 3

HAVERTOWN, DELAWARE COUNTY, PENNSYLVANIA

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 3, PHILADELPHIA, PENNSYLVANIA
April 2008

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HAVERTOWN PCP
SUPERFUND SITE
OPERABLE UNIT 3

HAVERTOWN, DELAWARE COUNTY, PENNSYLVANIA

RECORD OF DECISION
HAVERTOWN PCP
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DECLARATION

Site Name and Location

Havertown PCP Superfund Site
Havertown, Delaware County, Pennsylvania
CERCLIS ID Number PAD002338010

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Havertown Pentachlorophenol ("PCP") Superfund Site ("Site") located in Havertown, Delaware County, Pennsylvania, (see Figure 1) which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act 42 USC §§ 9601 et seq., as amended, ("CERCLA"), and the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedial action for this Site. The information supporting this decision is contained in the Administrative Record for this Site.

The Pennsylvania Department of Environment Protection ("PADEP") concurs with the selected remedy in a letter dated April 8, 2008.

Assessment of the Site

The response action selected in this Record of Decision ("ROD") is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Remedy

The remedial action described here comprises the third phase of a comprehensive remedy for the Site. Wood-treating operations conducted at the Site have resulted in residual contamination, mainly of pentachlorophenol, in soils and groundwater, some areas of the Site (Source area) have very high levels of contamination in groundwater. This contamination is considered to be a principal threat waste since it is a continuous source of groundwater contamination. EPA issued the first ROD for the Site in September 1989 which included provisions for an interim remedial action. It called for the installation of an oil-water separator to address the continued release of contaminants from the Site into the surface water of Naylors Run. In addition, that ROD called for the removal and disposal of the on-site waste.

During a soil investigation, EPA learned that the contamination on the wood-treater facility was more extensive than originally anticipated. The soil contamination was addressed in a 1996-1997 Superfund Removal Action, during which a synthetic geomembrane cap was installed over three acres of the Site.

In the second ROD for the Site, dated September 30, 1991, EPA selected an interim remedy for the contaminated shallow groundwater, known as Operable Unit 2. It provided for the installation of free-product recovery wells on the property; the rehabilitation of the existing storm sewer line; the installation of a groundwater collection drain adjacent to the existing storm sewer line under the backyards of residential properties; and the construction of a groundwater treatment plant. The continued operation of the interim remedial action will be included with this remedy as a final action for the shallow groundwater. This final remedial action (OU3) addresses contaminated groundwater throughout the Site and contaminated soils found in the Recreation and Open Space ("ROS") area of the Site. The goal of the actions is to restore the groundwater to beneficial use and to remove the contaminated soil.

The selected remedy includes:

1. Installation of an additional recovery well and associated piping to enhance performance of the current groundwater remediation system in order to prevent the off-site migration of site-related contaminants and to restore the groundwater to beneficial use.

2. Operate and maintain the existing groundwater treatment facility. Upgrade or retrofit of existing groundwater treatment facility to increase the capacity of the facility to process 60 to 70 gallons per minute of contaminated water.

3. Treat collected groundwater as necessary to meet discharge requirements.

4. In-situ flushing in the source area, with treated water from the groundwater treatment facility mixed with an emulsifier, to enhance mobilization of the principal threat waste. Construction and installation of the in-situ flushing system would include a tank for mixing and holding the flushing solution, new injection wells, piping and an upgraded pump at the collection trench sump.

5. Excavation of an area approximately 50 ft. by 50 ft. around wells SW-8 and SW-9 in the ROS area, and a narrow zone along the abandoned sewer line about 200 ft. long and 20 ft. wide. The portion of the abandoned sewer line which has not been sealed (between manhole #7 and the end of the ROS area) will be removed. All the excavated material will be properly disposed of off-site.

6. Backfilling of the excavated area with clean fill, restoration of sidewalks, curbs, utilities, etc., and planting of appropriate vegetation.

7. Installation of three recovery wells and associated piping in the ROS area to extract groundwater and transport it to the Site's groundwater treatment facility for remediation.

8. Demonstrate recovery of bethnic macroinvertibrate and fish communities, to examine the efficacy of the ROS area excavation and groundwater treatment to reduce or eliminate the contaminant releases that are the major source of risk to aquatic organisms in Naylors Run. This ecological monitoring program would be used to evaluate incremental improvement in water and sediment quality and aquatic communities.

9. Perform groundwater monitoring to ensure effectiveness of the groundwater remedy.

10. Institutional controls to protect the integrity of the remedy and to prevent the installation of groundwater wells, through groundwater use restrictions and notices for the Site and surrounding area, as appropriate An Institutional Control Implementation and Assurance Plan (ICIAP) will be developed for the Site during the remedial design to ensure appropriate institutional controls are drafted, implemented and monitored.

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). The groundwater remedy includes treatment using a groundwater extraction and treatment facility to capture and remediate the contaminated groundwater. The selected remedy also includes in-situ flushing which will treat the Source area groundwater contamination.

High concentrations of PCP, dioxin, free-product oil and many other organic contaminants, as well as inorganics, are present in the groundwater. A highly contaminated area with free-product oil exists both northwest and southeast of Eagle Road, at a depth of 20 to 40 feet below the ground surface at a concentration of 7,000-8,000 μg/L of PCP. This source area can be considered a "principal threat waste," which acts as a reservoir for continued migration of contamination to groundwater. Principal threat wastes are those source materials considered to be highly toxic or highly mobile, which would present a significant risk to human health or the environment should exposure occur. After giving careful consideration to the expectations in the NCP regarding principal threat waste, and to the nine criteria in the NCP, which EPA is required to use to evaluate various possible remedial alternatives; EPA has selected an alternative that uses treatment to address the principal threat waste.

Because the Site remedy results in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years to ensure that the remedy is, or will be, protective of human health and the environment. Such reviews have been conducted every five years since the initiation of remedial actions at the Site and will continue to be conducted.

Data Certification Checklist

The following information is included in the Decision Summary of this ROD. Additional information can be found in the Administrative Record for this Site.

ROD CERTIFICATION CHECKLIST	
Information	Location/Page Number
Chemicals of concern and respective concentrations	Section 5.2, p.8 and Tables 1-8
Baseline risk	Section 7.0, p. 12
Clean-up levels and the basis for these levels	Section 8.0, p. 23 and Tables 15 & 16
How source materials constituting principal threat are addressed	Section 7.1.6, p. 20
Current and reasonably anticipated future land use assumptions and potential future beneficial uses of groundwater	Section 6, p. 11 Section 11.4, p. 51
Potential future land and groundwater use that will be available at the Site as a result of the selected remedy	Section 11.4, p. 51
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 11.3, p. 51 and Table 19
Key factors that led to selecting the remedy	Section 11.1, p. 43

James J. Burke — 4/16/08

James J. Burke, Director
Hazardous Site Cleanup Division
EPA Region III

Date

II. DECISION SUMMARY

HAVERTOWN PCP
SUPERFUND SITE
OPERABLE UNIT 3

HAVERTOWN, DELAWARE COUNTY, PENNSYLVANIA

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Havertown PCP Superfund Site ("Site") is located in Havertown, Delaware County, Pennsylvania (Figure 1). The Site is located approximately 10 miles west of Philadelphia and is surrounded by an urban mixture of commercial establishments, industries, parks, schools and residential homes.

The Site covers approximately 12 to 15 acres, with no distinct boundaries. The Site is roughly delineated by Lawrence Road and Rittenhouse Circle to the south, the former Penn Central Railroad ("PCRR") tracks to the north, the fence on the Continental Motors property to the west, and Naylors Run to the east (Figure 2). The contamination originated from the portion of the Site which contained the National Wood Preservers ("NWP") facility. From approximately 1947 to 1963, the NWP property was used to treat wood products using pentachlorophenol ("PCP") dissolved in diesel fuel. The Comprehensive Environmental Response, Compensation, and Liability Information System ("CERCLIS") identification number for this Site is PAD002338010.

The U.S. Environmental Protection Agency ("EPA") is the lead agency for Site activities and the Pennsylvania Department of Environmental Protection ("PADEP") is the support agency.

This action addresses contamination in the groundwater throughout the Site and the soils at the Recreation and Open Space ("ROS") area of the Site. This action comprises the third and final phase of a comprehensive remedy for the Site, and no further actions (Records of Decision) are anticipated.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Source area of the Havertown PCP Superfund Site was occupied in 1947 by NWP where the treatment of wood products was the main practice. From approximately 1947 to 1963, NWP reportedly disposed of waste materials, such as diesel-type oil and PCP, into a well located in the vicinity of the former Young's Produce Market, at the corner of Lawrence and Eagle Road. However, the exact location of the well has not been identified.

In 1962, the Pennsylvania Department of Health became aware of contamination in Naylors Run, a small watercourse located to the east of the Site, and the source of its contamination was attributed to waste disposal practices at the NWP facility. In the early 1970s, the Commonwealth of Pennsylvania, Department of Environmental Resources ("PADER"), now known as PADEP, received complaints from local citizens concerning an oily substance being discharged into Naylors Run. PADER investigated and identified contaminated groundwater discharging from a storm sewer into Naylors Run, just east of the Philadelphia Chewing Gum ("PCG") property. In September 1972, PCP and fuel oil were also detected in groundwater samples collected from a well drilled on the NWP facility by PADER and the Pennsylvania Department of Transportation ("PennDOT").

PADER ordered NWP and Clifford A. Rogers, the property owner, to conduct a cleanup; however, the cleanup was never undertaken.

EPA and PADER performed multiple remedial actions in 1976. On September 10, 1976, the PADER contacted EPA Region 3, Environmental Emergency Branch, and requested assistance with the continuing oil seepage problem in Naylors Run. EPA subsequently performed a removal action under Section 311 of the Clean Water Act, 33 USC § 1321.

In 1977, the NWP facility discontinued the use of PCP and oil to treat wood products and began treating wood using metal salts.

From 1981 to 1982, EPA performed an investigation to determine the extent of contamination in Naylors Run and its effect on the ecosystem. A depressed aquatic community was found, showing some recovery from the acute toxicity previously observed. Ninety percent (90%) of the PCP being released into the stream was thought to be adsorbed by the sediment being transported down Naylors Run. Therefore, sediment deposited in pools over time could potentially act as a secondary source of contamination.

In June of 1982, at EPA's recommendation, NWP posted warning signs along Naylors Run.

The Havertown PCP Superfund Site was placed on the National Priorities List ("NPL") in 1982. Subsequently, PADER signed an agreement with EPA under which PADER would conduct the Remedial Investigation/Feasibility Study ("RI/FS") at the Site. The Site was divided into three operable units ("OUs"). OU1 addressed the discharge to Naylors Run and the on-site waste at the NWP facility. OU2 addressed the shallow groundwater at the Site. OU3 addresses deep groundwater in the Source Area and the groundwater and soil contamination in the ROS area.

EPA issued the first Record of Decision ("ROD") for the Site in September 1989 (hereinafter, "1989 ROD"). The 1989 ROD for OU1 included provisions for an interim remedial action. It called for the installation of an oil-water separator to address the continued release of contaminants from the Site into the surface water of Naylors Run. In addition, this ROD called for the removal and disposal of the on-site waste. No Potentially Responsible Parties were identified with the ability to finance the remedial actions at the Site. The OU1 remedial action was performed as a fund-lead action.

During a soil investigation, EPA learned that the contamination on the NWP facility was more extensive on the NWP facility than originally anticipated. The soil contamination was addressed in a 1996-1997 Superfund Removal Action, during which a synthetic geomembrane cap was installed over three acres of the Site. The installation of the cap removed the potential for exposure to soils contaminated with arsenic and dioxin[1] by providing an impermeable synthetic barrier and 18 inches of soil cover over the areas of contamination. In the fall of 1997, EPA covered the capped area with an additional four feet of fill and planted the fill with a mixture of seed mulch and fertilizer.

In the second ROD for the Site, dated September 30, 1991 ("1991 ROD"), EPA selected an interim remedy for the contaminated shallow groundwater, known as OU2. The fund-lead action provided for the installation of free-product recovery wells on the NWP property; the rehabilitation of the existing storm sewer line; the installation of a groundwater collection drain adjacent to the existing storm sewer line under the backyards of residential properties; and the construction of a groundwater treatment plant adjacent to the NWP property.

Phased construction began in 1997 with the treatment building construction and installation of both the extraction wells and groundwater collection trench. The treatment plant became fully operational in August 2001, with treated water being discharged to Naylors Run in accordance with the National Pollution Discharge Elimination System ("NPDES") permit limits established for the facility.

3.0 COMMUNITY PARTICIPATION

The Havertown PCP Remedial Investigation, Feasibility Study, and Baseline Risk Assessment, and other Administrative Record documents relating to the Site, were made available to the public. They are located in the Administrative Record, which can be viewed at http://www.epa.gov/arweb, or at the Administrative Record link on the sidebar of the U.S. EPA Region 3 Hazardous Site Cleanup Division Homepage at http://www.epa.gov/reg3hscd. In addition, the detailed Administrative Record can be examined at the following locations:

Haverford Township Building 2325 Darby Road Havertown, PA 19083 (610) 853-1000	Admin. Records Room US EPA Region III 1650 Arch Street Philadelphia, PA 19103 (215) 814-3157 (Please call for an appointment.)

The notice of availability of these documents was published in the *Delaware County Daily Times* on August 22, 2007. In addition, EPA sent a fact sheet summarizing the Agency's preferred remedial alternative for the Site to residences and businesses near the Site in August 2007.

[1] Dioxins and furans are presented in this plan using a "Total Equivalents" (TEQ) system, in which the total-sum concentration of polychlorinated dibenzodioxains (dioxins or PCDDs), and polychlorinated dibenzofurans (furans or PCDFs) are reported as "Total Equivalents" to the specific dioxin compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Comparisons of actual measured dioxin concentrations throughout this plan will be made using this TEQ system. For simplicity, "dioxin" or 2,3,7,8-TCDD will be used to refer to the total sum of dioxins and furans under this naming convention.

From August 22, 2007 to September 21, 2007, EPA held a 30-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study, the Proposed Plan and the other documents contained within the Administrative Record for the Site. An extension to the comment period was requested. As a result, EPA extended the comment period through October 21, 2007. On September 11, 2007, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision.

4.0 SCOPE AND ROLE

The actions proposed by EPA in this document constitute the third phase of a comprehensive approach for addressing all of the environmental problems at the Site. The remedial and removal actions taken at the Site to date and the remedial actions outlined in this document will comprise the final remedy for the Site. The actions proposed at this time, the actions already completed, and the actions currently being conducted are expected to be the final actions that will be necessary to completely address the risks from the contamination at the Site.

The Site has been divided into three operable units ("OUs"), as mentioned previously. A description is provided below:

1. Operable Unit 1 ("OU1"): As an interim remedy, an oil-water separator was installed in 1991, to reduce the oil in the storm sewer discharging to Naylors Run (the oil/water separator was removed after the OU2 remedy was installed). EPA also removed and disposed of the on-site containerized waste at the NWP facility.

2. Operable Unit 2 ("OU2"): Pursuant to a 1991 Record of Decision ("ROD"), EPA installed an on-site pump-and-treat system, with a groundwater collection trench and recovery wells to provide capture and restoration of the contaminated groundwater. The system is currently being operated to address contamination in the shallow groundwater aquifer in the source area of the Site.

3. Operable Unit 3 ("OU3"): This ROD identifies the remedy selected for OU3. OU3 is further divided into OU3A and OU3B. OU3A addresses contamination related to deep groundwater in the source area, whereas OU3B addresses contamination in Haverford Township's Recreation and Open Space ("ROS") area, located behind Rittenhouse Circle and adjacent to Washington Avenue in Havertown.

5.0 SITE CHARACTERISTICS

5.1 Surface Features, Soil and Geology, Hydrogeology, And Surface Hydrogeology

Surface Features and Resources

The Site lies approximately 300 feet above mean sea level ("MSL"). It ranges in elevation from 280 feet above MSL in the residential areas along Rittenhouse Circle, to 320 feet above MSL northwest of former Young's Produce. Generally, the topography slopes gently from northwest to southeast. The present Site topography results from major cut and fill manmade alterations to the land.

The PCG property is also flat, except for a 12 to 15 foot embankment along its southeastern border that separates the PCG property from residential backyards along Rittenhouse Circle. The PCG property drains to the southeast, toward residential areas, and onward to Naylors Run.

Potable water in the vicinity of the Havertown PCP Superfund Site is provided by AQUA American Water Company, which obtains water from Pickering Creek Reservoir, Perkiomen Creek, and from the Schuylkill River, for use in Haverford Township. Currently, there are no private groundwater drinking wells in Havertown. All water service is provided by AQUA America's supply pipe network.

The Site is comprised of urban and suburban areas, with habitat typical of a suburban stream corridor. The Havertown area is located on a major waterfowl migration route that is part of the Atlantic flyway. Locally, wetlands that serve as resting areas for migrating waterfowl are located in Tinicum Marsh at the John W. Heinz National Wildlife Refuge, which lies approximately eight miles southeast of Havertown. Runoff and groundwater seepage from the Site flows into Naylors Run and eventually enters the Heinz Refuge via Cobbs Creek. Cobbs Creek and Darby Creek are listed as warm-water fishing streams by the Pennsylvania Fish Commission.

The habitat quality within the study area is considered fair. The Glenville silt loam soils are considered moderate for supporting woodland habitat. Although narrow, the riparian corridor is wooded and includes small pockets of forested wetland. The corridor likely serves as a pathway for songbirds and mammals. There are no known undisturbed habitats (USDA, 1963) within the study area.

Extensive channelization of Naylors Run, due to urbanization, has resulted in the degradation of the stream habitat. Contamination of the stream has reduced water quality. Prior to source removal and groundwater treatment at the site, the downstream segment of stream was apparently devoid of aquatic life. Small fish have recently been observed in Naylors Run near the ROS area which suggests that their aquatic macroinvertebrate prey is also recovering. Cobbs Creek has been impacted by the Havertown PCP Site, but to a lesser degree than Naylors Run (Tetra Tech, Inc., 1990). The extent and severity of impacts has not been clearly defined, but are a part of the study included as part of this ROD. Cobbs Creek also has severe erosion problems and is expected to have a fair-quality stream habitat. This is evident from previous data (PADER, 1975), where only seven macroinvertebrate taxa were collected from Cobbs Creek, above the confluence of Naylors Run.

Soil and Geology

Based on United States Department of Agriculture ("USDA") soil maps, the majority of the soils in the area are classified as Made Land, derived from schist and gneiss materials (map symbol Me). In this soil classification, the native soil profile has been disturbed by earth moving equipment, resulting in a heterogeneous soil mixture of surface material, the subsurface soils, and fragmented, partially weathered schist and gneiss rock.

A band of Glenville silt loam borders the NWP property on the north and east. It consists of a moderately eroded soil on 3 to 8 % slopes, and develops from weathering of schist and gneiss bedrock. The shallow soil profile is typically 3 to 6 feet deep, and has a moderately low permeability. Weathering byproducts of the underlying rock generally underly deeper soils, from 6 to 30 feet below grade. These deeper soils typically preserve some of the underlying rock structures (rock fragmented orientation and oriented permeability) and are typically anisotropic in the Wissahickon Formation. Site investigations have confirmed this general pattern of soil formation.

In the vicinity of the Site, as much as 18 to 20 feet of fill soil exist above natural soil, depending on the area. Natural soil is similar to disturbed soil, and no clear soil horizon is identifiable at most drilling locations. At a well near the former Young's Produce, saw-cut timbers were encountered in the drill-hole at depths of greater than 18 feet, suggesting that there exists at least 18 feet of disturbed soil.

The Site is located in the Piedmont Uplands section of the Piedmont Physiographic Province, and is characterized by maturely dissected hills sloping gently to the southeast, underlain by a basement of crystalline igneous and metamorphic rocks. The Piedmont Uplands section is the most southerly section of the Piedmont Province in Pennsylvania.

Consolidated rock in the vicinity of the Site consists of metamorphic schist and gneiss of the Wissahickon Formation. This formation, mapped as oligoclase-mica schist, makes up the bedrock beneath the Site.

Regionally, the unconsolidated deposits that overlay the bedrock consist of saprolite (in-situ weathered bedrock), and occasional sand and gravel terrace deposits, and artificial fill. At the Site, the fill is thick (more than 18 feet thick near the former Young's Produce at the northwest corner of Eagle and Lawrence Roads). Near the collection trench associated with the treatment facility and along the bed of Naylors Run, thicker unconsolidated gravel deposits have been identified above Wissahickon Schist in certain wells and borings on Site, and appear to be related to a former channel of Naylors Run, 30 to 40 feet deep.

Hydrogeology

Groundwater at the Site flows in a southeasterly direction and occurs in two major zones. The upper zone consists of surficial soils and saprolite (heavily weathered rock). The movement of water in the saprolite zone is influenced by the degree of saprolite weathering, relict bedrock structures, compositional variations, and the thickness of the weathered zone. Vertical hydraulic gradients are small, suggesting that the aquifer at the Site is well connected by porous fracture flow.

The lower zone consists of fractured schist bedrock, with water movement occurring along interconnected fractures. Vertical hydraulic gradients are small, suggesting that the aquifer at the Site is well connected by fracture flow.
Upward flow occurs within the saturated saprolite and presumably provides observed seepage and base flow to Naylors Run, southeast of Rittenhouse Circle. The depth to groundwater below the Site ranges from approximately 23 feet below ground surface in the vicinity of former Young's Produce to seepage as springs at ground surface in the ROS area located southeast of Rittenhouse Circle. These permeable zones are closely interconnected, and typically represent one aquifer. Semi-confining layers may locally reduce aquifer interconnection, but are not widespread.

Surface Hydrogeology

The Site is drained by Naylors Run, an intermittent stream that flows through most of the Site, in a southeasterly direction. Perennial flow normally begins at the ROS area, because Naylors Run receives flow from two un-named tributary streams at the ROS area. Additionally, some flow enters Naylors Run from drains installed in yards along Naylors Run. Active seepage from these drains into Naylors Run is occasionally visible.

Currently, much of the Site closest to the NWP property consists of impervious surface, including the capped site area, street surfaces, the PCG building and parking area, and many homes/driveways. These areas drain to a storm sewer system, with outfalls that flow into Naylors Run. Naylors Run receives storm water flow from the entire nearby watershed.

The Havertown PCP Superfund Site treatment plant effluent provides a nearly constant flow in Naylors Run. Although normally an intermittent stream, this portion of Naylors Run has become a perennially flowing stream because of the treatment plant's discharge of treated water.

The total flow in Naylors Run is formed when this treatment plant effluent is combined with natural seepage originating at or near the ROS area. Naylors Run then flows through a series of natural and concrete-lined channels and pipes before entering Cobbs Creek. Channelization and surface runoff subject Naylors Run to large volumes of water during storm events, resulting in severe storm scouring and erosion in the natural portions of the stream channel areas. The confluence of Naylors Run and Cobbs Creek is approximately four miles southeast of the Site. Cobbs Creek then joins Darby Creek, and flows through Tinicum Marsh at the John W. Heinz Wildlife Refuge before discharging into the Delaware River, just east of Chester Pennsylvania

5.2 Nature and Extent of Contamination

EPA initiated the Remedial Investigation/Feasibility Study ("RI/FS") for the deep groundwater aquifer and the Recreation and Open Space area (collectively known as OU3) at the Havertown PCP Superfund Site in 2002. The objectives of the OU3 RI were generally to characterize Site conditions, determine nature and extent of contamination, and assess risks to human health and the environment related to the deep groundwater. During this investigation, EPA was informed by a resident that an abandoned sewer line manhole was located in his yard. EPA investigated and found an abandoned sanitary sewer line, which traveled from the source area of the Site to the ROS area (known as OU3B). EPA determined that the abandoned sewer line transported contaminated groundwater from the source area to the ROS area. In May 2004, EPA sealed the abandoned sanitary sewer line, which eliminated the flow of contaminated groundwater to the ROS area. Accordingly, the scope of the OU3 RI/FS was expanded to include the ROS area.

The RI confirmed that most of the contaminants in the vicinity of the Site originated from the former NWP facility. High concentrations of PCP (33000 micrograms/liter ("µg/l"), dioxin (8053.8 picograms per liter ("pg/L"), free-product oil and many other organic contaminants, as well as inorganics, are present in the groundwater. A highly contaminated area with free-product oil exists both northwest and southeast of Eagle Road, at a depth of 20 to 40 feet below the ground surface, with concentrations of 7,000-8,000 ug/L of PCP. The contamination in this Source area can be considered a "principal threat waste," which acts as a reservoir for continued migration of contamination to groundwater. There is a dissolved plume which is moving from this source area downgradient to the collection trench (part of the groundwater pump-and-treat system), at a depth of 60 to 70 feet below ground surface (see Figure 3).

The RI also concluded that the soil and groundwater contamination in the ROS area are the results of free-product oil with high concentrations of contaminants that migrated from the former NWP facility area, through the abandoned sanitary sewer line. In general, PCP and dioxin contamination in the ROS area was found in a relatively narrow zone along the abandoned sewer line (within 10 feet on either side), starting from 50 feet upstream of manhole #7 (MH-7), and extending to the end of the ROS area near the 36-inch diameter caisson wells SW-8 and SW-9 (see Figure 4). Also, an area of about 50 ft. by 50 ft. around the caisson wells is contaminated. This area of contamination probably resulted from oil and contaminated groundwater that frequently seeped out of the sanitary sewer line to the ground surface, until the sanitary sewer line was sealed in May 2004.

The investigation findings are summarized below regarding Site geology and hydrogeology, and extent of contamination:

- The aquifer system at the Havertown Site exists in both the unconsolidated saprolite (highly weathered rock) and the underlying fractured bedrock. The upper, shallow portion of the aquifer consists of the saturated portion of the saprolite (unconsolidated material) and upper bedrock where numerous fractures were observed in the rock cores. The lower portion of the aquifer consists of the bedrock where fractures are scarce.

- The lack of strong vertical gradients suggests that the Site is best considered a single hydrogeologic system with interconnecting flow between shallow and deep groundwater.

- Groundwater velocity varies considerably. Groundwater velocity in the upper portion of the aquifer is an order of magnitude higher than the velocity in the lower portion of the aquifer. Contaminants would more likely be transported further in areas with higher groundwater velocities.

- Historically, the area contaminated with measurable free-product oil and sheen on the groundwater table was estimated to encompass 7 acres (shallow groundwater), and the total area with site-related groundwater contamination in all zones (shallow and deep groundwater) was estimated to be 26 acres. However, the extent of these contaminants in groundwater has been diminished significantly since June 2001, when operation of the groundwater treatment plant commenced (see Figure 5). As of early 2006, only three shallow wells near the former NWP facility contained free-product oil. Groundwater dioxin concentrations detected in the monitoring wells across the Site have decreased dramatically (more than one order of magnitude), except for those wells located near the former NWP facility. There has also been some reduction in the PCP concentrations in the groundwater throughout the Site.

- Free-product oil, in the shallow aquifer, did not appear to migrate past the storm sewer trench behind the former PCG property. The storm sewer was lined as part of previous remedial actions and has likely acted as a barrier for oil migration and partially controlled further migration of contaminants in the shallow aquifer.

- High concentrations of site-related contaminants originating from the Source area (transported through the abandoned sanitary sewer line) were detected in shallow groundwater and soils at the ROS area.

Contaminants are migrating with normal groundwater flow. Sediment and surface water in Naylors Run do not currently contain contaminants migrating from the NWP property exceeding EPA Region 3 Risk-Based Concentrations ("RBC"s), but contain other contaminants above RBCs, which do not originate from the NWP facility.

The RI presented the major sources of contamination and their potential migration pathways. Of these pathways, several were already controlled by previous remedial actions, as follows:

1. Shallow soil contamination in the source area was controlled by capping performed during a Removal Action conducted by EPA in 1998. As a result, within the capped area, vertical migration of contaminants from soil to the groundwater underneath was controlled.

2. Shallow groundwater and free-product oil are being controlled by the collection trench and recovery wells installed as part of the OU2 remedy.

3. Seepage from the abandoned sanitary sewer line onto the ground surface, in the ROS area, was controlled by sealing the sewer line in May 2004.

However, several migration pathways identified in the RI are currently uncontrolled (or partially controlled), as described below:

1. Contaminants in soil outside the cap footprint may be dissolved by rainwater infiltration and transported to groundwater.

2. Deep groundwater with site-related contamination originating from the NWP source area can bypass or flow beneath the existing collection trench and recovery wells. This deep groundwater plume (30 to 100 feet deep in bedrock fractures) is moving southeast towards the ROS area. As part of OU2 long-term remedial action ("LTRA") and operation and maintenance ("O&M") activities, two recovery wells, RW-5 and RW-6, (refer to Figure 5) were installed in early 2006. Although their effectiveness has not been fully evaluated, these two recovery wells are designed to capture part of this underflow contamination in the areas of the recovery wells.

3. Free-product oil trapped in soil pores and small rock fractures below the water table near the source area is a continuing source of downgradient groundwater contamination. Deep groundwater is partially controlled by the current collection trench and recovery wells. As previously described, RW-5 and RW-6 are expected to recover some deep groundwater, but are not likely to significantly recover free-product oil below the water table.

4. Vapor from shallow contaminated groundwater and soil may pose indoor air quality issues, particularly near residential properties on Lawrence Road and Rittenhouse Circle. However, the volatility of the principal classes of site-related contaminants, such as PCP, dioxins, and Polycyclic Aromatic Hydrocarbons ("PAHs"), in groundwater and soil is very low, except for some diesel-fuel-related volatile organic compounds ("VOCs"). Several other substances [e.g., benzene, naphthalene, trichloroethylene ("TCE"), and vinyl chloride] present in the shallow groundwater and soil are exceeding EPA Region 3 RBCs for air quality, based on EPA indoor vapor intrusion prescreening. However, except for naphthalene, these substances do not originate from the NWP facility. Naphthalene has been detected in wells in the Source area ("principal threat waste" area). In December 2005, the EPA Site Air Specialist and Toxicologist performed an assessment of vapor intrusion for the Site. It was determined that

TCE is the main driver of vapor intrusion risk, but the majority of the wells with TCE were located upgradient of the residential areas.

5. At the ROS area, the levels of contamination in surface water and sediment are currently within the acceptable risk-based ranges. Soil contamination is localized near the abandoned sewer line. Although surface seepage was controlled by plugging the abandoned sewer line as an interim measure, soil and groundwater in the ROS area are contaminated with many contaminants originating from the NWP facility, such as dioxins, PCP, and PAHs, therefore, further remedial actions are required.

5.3 Conceptual Site Model

A Conceptual Site Model ("CSM"), developed by EPA, diagrams contaminant sources, contaminant release mechanisms and migration routes, exposure pathways, and potential human and ecological receptors. It documents what is known about human and environmental exposure under current and potential future Site conditions. The risk assessment and final response action for this Site are based on the CSM.

The CSM for this Site integrates and summarizes the information concerning sources, constituent migration pathways, and exposure routes into a combination of exposure pathways. The Conceptual Site Model (see Figures 6 and 7) identifies the key potential release mechanisms, transport media, exposure points, exposure media, exposure routes, and potential receptors.

For OU3A, the CSM identifies the downgradient migration of groundwater as the media of concern. The OU3A groundwater (deep groundwater) can volatilize into the air and/or discharge to surface water. For these exposure scenarios, inhalation, dermal adsorption and ingestion were the exposure pathways indentified for construction workers, trespassers and visitors (adolescent) and resident (adult and child).

For OU3B, the CSM also identifies the downgradient migration of groundwater (shallow and deep) as the media of concern. The migration of the contaminated groundwater can volatilize into the air, discharge to surface and subsurface soils, runoff and discharge to surface water and sediment , and the surface water can then precipitate into the sediment. For these exposure scenarios, inhalation, dermal adsorption and ingestion were the exposure pathways indentified for construction workers, trespassers and visitors (adolescent) and resident (adult and child).

6.0 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The Havertown PCP Superfund Site is predominantly comprised of urban and suburban areas in Haverford Township, Delaware County, Pennsylvania (refer to Figure 2). The Site is located in Havertown, an unincorporated town centrally located in Haverford Township. Based on the 2000 United States Census Data, 18,378 housing units are occupied by 48,498 people located in Haverford Township. Land use in Delaware County has been divided into four major categories: urban, agriculture, forest, and other uses. Of these, "urban" and "other uses" dominate land use in the county, comprising 61% and 24% of the total area, respectively (USDA, 1963).

Land use in the majority of the eastern half of Delaware County, including the vicinity of the Havertown Site, is an "urban" land use, which consists of residential, commercial, and industrial developments.

The aquifer at the Site is designated a Class IIB aquifer, capable of being used as a drinking water aquifer. Potable water at the Site is provided by AQUA America Water Company. They obtain water for Haverford Township from Pickering Creek Reservoir, Perkiomen Creek and from the Schuylkill River.

7.0 SUMMARY OF SITE RISKS

The findings of the OU3 RI were used to evaluate potential risks to human health and the environment from chronic exposure to contaminants of concern at the Havertown PCP Superfund Site. A Baseline Human Health Risk Assessment was conducted in order to estimate the probability and magnitude of potential adverse human health effects from exposure to Site contaminants, assuming no further response actions were taken at the Site. The risk evaluation was further broken down into risks from OU3A (deep aquifer in the source area) and OU3B (ROS area). A screening level ecological risk assessment was conducted to identify the potential of the Site contaminants to adversely affect ecological resources in the absence of further response actions at the Site. The risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the final remedial action at the Site. The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

This section of the ROD summarizes the results of both the baseline human health risk assessment and the ecological risk assessment.

7.1 Summary of Human Health Risk Assessment

The Human Health Risk Assessment estimates what risks the Site poses if no additional actions were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The Human Health Risk Assessment for OU3 complements and expands the risk assessment previously performed for OU2. The Human Health Risk Assessment ("RA") for OU3 was prepared in order to determine the current and potential future effects of contaminants in soil and groundwater in the absence of further cleanup actions at the Site. This section of the ROD summarizes the results of the Human Health Risk Assessment for this site.

The RA considered the effects of exposure to different media at the Site. The RA consisted of a four step process: (1) the identification of chemicals of potential concern ("COPCs"), i.e., those that have the potential to cause adverse health effects; (2) an exposure assessment, which identified actual and potential exposure pathways, potentially exposed populations, and the magnitude of possible exposure; (3) a toxicity assessment, which identified the adverse health effects associated with exposure to each COPC and the relationship between the extent of exposure and the likelihood or severity of adverse effects; and (4) a risk characterization, which integrated the three previous steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks. A summary of these components of the human health risk assessment for OU3, which support the need for remedial action, is discussed below.

7.1.1 Contaminants of Concern

Contaminants at the various exposure areas at the Havertown PCP Site were identified from samples of soil, groundwater, surface water, and sediment. Over 100 contaminants (including VOCs, SVOCs, PAHs, pesticides, PCBs, dioxin and inorganics) were detected in these media. A screening of contaminants was conducted where the maximum detected concentrations were compared to risk-based screening levels (i.e., EPA Region 3 Risk Based Concentrations). Through this process, a large number of contaminants were selected as COPC for the Site.

Not every COPC was detected or selected at every exposure area or in every environmental media sampled at the Site. Consequently, potential health risks and hazards are characterized based on the selected COPCs for each relevant medium at each identified exposure area.

The groundwater data used in the assessment of OU3A was limited to wells located within the core of the plume. In addition, during the COPC screening process for OU3A, the groundwater data were compared to background concentrations as well as the results of the OU2 and OU3B risk assessments. These comparisons assisted in identifying contaminants that are already being addressed under the OU2 ROD. Thus, it is important to note that the cancer risks and non-cancer hazards presented for OU3A do not represent a full characterization of the cancer risks and non-cancer hazards that may exist at OU3A. COPCs for OU3A were only selected if the contaminant was not addressed by the OU2 or OU3B Risk evaluations. Through this methodology, several contaminants were eliminated from this evaluation even though maximum concentrations exceed the risk-based screening levels. The cancer risk and non-cancer hazard associated with these eliminated contaminants were addressed by the remedies selected in the previous RODs.

Tables 1 through 8 present a summary of the contaminants of concern ("COC") and exposure point concentration for each of the COCs in each media. The tables include the arithmetic mean for each COC, the 95% Upper Confidence Level ("UCL") distribution, the maximum concentration, the exposure point concentration ("EPC") and how the EPC was derived for Reasonable Maximum Exposure ("RME"), as well as Central Tendency.

7.1.2 Exposure Assessment

Potential human health effects associated with exposure to the COPCs were estimated quantitatively or qualitatively through the evaluation of several actual or potential exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances at the Site. Local climate, geology, soils, groundwater, and surface water conditions at the Site, as well as, local population statistics, land, and water use were evaluated to assess present and potential future populations working or otherwise spending time at the Site.

The exposure assessment estimates the total intake of COPCs that the key receptor groups are expected to receive over various exposure periods. The three key human receptor groups include worker (adult), trespasser/visitor (pre-adolescent/adolescent) and resident (adult and child).

The Baseline Risk Assessment ("BLRA") studied several contaminant migration pathways including:

- Soil to groundwater
- Soil to surface water
- Soil to sediment
- Soil to air
- Groundwater to surface water; and
- Groundwater to air

The assessment of pathways by which human receptors may be exposed to COPCs at the Site includes an examination of existing (current) exposure routes as well as those that may reasonably be expected to occur in the future. The determination of exposure routes is made by a careful examination of the current extent of affected media and the results of the fate and transport assessment for predicting contaminant migration pathways and estimating exposure point concentrations. The potential exposure routes for human receptors at the Site include ingestion, dermal absorption, and inhalation pathways.

7.1.3 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects that a COPC may potentially cause and to define the relationship between the dose of a compound and the likelihood and magnitude of an adverse effect (response). Adverse effects are characterized by the EPA as carcinogenic or noncarcinogenic. Dose-response relationships are defined by the EPA for oral and inhalation exposures. Oral dose-response values were used to derive appropriate dermal toxicity values.

The dose-response assessment evaluated the available toxicity information and quantitatively described the relationship between the level of exposure (either from animal or human epidemiological studies) and the occurrence of an adverse health effect. This relationship is described by a cancer slope factor ("CSF") or unit risk factor

("URF") for carcinogens and a reference dose ("RfD") or reference concentration ("RfC") for systemic toxicants, collectively called toxicity values.

Toxicity values were obtained from the following hierarchy of sources in accordance with the EPA Office of Superfund Remediation and Technology Innovation ("OSRTI") (EPA, 2003):

- Tier 1 – Integrated Risk Information System ("IRIS")
- Tier 2 – Provisional Peer-Reviewed Toxicity Values ("PPRTVs")
- Tier 3 – Other (Peer-reviewed) Values, including: ATSDR's Minimal Risk Levels ("MRL"); California Environmental Protection Agency ("CalEPA") and Health Effects Assessment Summary Table ("HEAST") values.

The criteria used to evaluate the potential for non-carcinogenic health effects are generally referred to as Reference Doses ("RfDs"). The term RfD was developed by EPA to refer to a daily intake of a chemical to which an individual can be exposed without any expectation of non-carcinogenic adverse health effects occurring (e.g., organ damage, biochemical alterations, birth defects). Other acceptable doses may exist for some chemicals that have been developed by the scientific community and are reported in the literature. However, these criteria are for constituents that the EPA has not yet evaluated.

A summary of the cancer and non-cancer toxicity data relevant to the COPCs in the RA for the Havertown PCP Superfund Site is presented in Table 9 through Table 12.

7.1.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments to derive quantitative estimates and qualitative summaries of the potential cancer risk and non-cancer hazards that may occur due to exposure to contaminants of concern at the Site.

For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

Where: Risk = a unitless probability (e.g., 2×10^{-5}) of an individual's developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period with a reference dose (RfD) derived for a similar exposure period. An RfD represents a toxicity level that is not expected to cause any deleterious effect to an individual exposed. The ratio of exposure to toxicity is called a hazard quotient ("HQ"). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index ("HI") is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ=CDI/RfD

Where: CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

Groundwater

The OU2 groundwater risk assessment identified residential lifetime cancer risk[2] at 5E-01 ($5x10^{-01}$) and non-cancer risk[3], Adult HI, at 5E+03 due to PAHs, PCP and dioxin in the groundwater. The risk identified in the OU2 Risk Assessment provided the rationale for the 1991 ROD, which implemented the interim groundwater pump-and-treat remedy. The OU2 groundwater risk assessment also identified four contaminants (benzene, flouranthene, trichloroethylene and vinyl chloride) which were found in monitoring wells at the Site, but are known to not have been used during the wood treatment process at the NWP facility. These contaminants are thought to originate from sources upgradient of the Site.

The OU3A future groundwater cancer risk is within the EPA acceptable cancer risk management range (1E-04 to 1E-06) and, therefore, does not present an unacceptable cancer risk to future residents at the Site. However, hypothetical future non-cancer

[2] EPA's target risk range for cancer risk is 1E-4 to 1E-6.
[3] A Hazard Index (HI) greater than unity (one) may represent an unacceptable risk.

hazards indexes ("HI") for OU3A groundwater were 1E+01 for the adult resident and 2E+01 for the child resident. These risks are primarily due to 4,6-dinitro-2-methylphenol, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and barium.

For OU3B groundwater, current exposure pathways do not currently exist, therefore risk was not evaluated. However, hypothetical future cancer risks associated with exposure to OU3B groundwater exceed the acceptable risk range (lifetime cancer risk is approaching 1) due primarily to the presence of PAHs, PCP, and total 2,3,7,8-tetrachlorodibenzo-p-dioxin ("TCDD") in the groundwater. The non-cancer HI for OU3B groundwater were 4E+01 for the construction worker, 4E+01 for the adult resident and 6E+01 for the child resident. The contaminants contributing to non-cancer risk include naphthalene, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, PCP, dibenzofuran, phenanthrene, aluminum, chromium, iron, manganese and vanadium.

Soil

Current cancer risks associated with exposures to surface soil, dust and vapor at OU3B exceed the acceptable cancer risk range (lifetime cancer risks = 3.9E-04) due to total 2,3,7,8- TCDD and PAHs. The non-cancer HI were 4.4E+00 and 3E+01 for the adult and child resident, respectively. These risks are due to the presence of aluminum, manganese, and iron in the soil.

Future cancer risks associated with exposure to total soil (surface and subsurface soil combined), dust and vapor at OU3B exceed the acceptable cancer risk range (lifetime cancer risks = 5.3E-04) due to the presence of total 2,3,7,8-TCDD in the soil. The non-cancer HI were 3.3E+00 and 2.3E+01 for the adult and child resident, respectively. These risks are due to the presence of aluminum, manganese, and iron in the soil.

Surface Water and Sediment

No contaminants of potential concern were identified in surface water or sediment at the Source area. Current and future cancer risks associated with exposure to Naylors Run surface water and sediment at OU3B are within the acceptable risk range. Current and future non-cancer hazards also do not pose an unacceptable risk in Naylors Run surface water and sediment at OU3B.

Risk Assessment Summary Tables are presented in Table 13 and Table 14 for all the media, receptors and timeframes assessed in the RA for OU3 which identified risk. The Tables provide both the carcinogenic and non-carcinogenic risk for each COC identified.

7.1.5 Uncertainty in Risk Characterization

Risk assessment provides a systematic means of organizing, analyzing and presenting information on the nature and magnitude of risks posed by chemical exposures. Uncertainties are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information about existing conditions and future circumstances. The goal of an uncertainty analysis in a risk assessment is to provide to the appropriate decision makers (i.e., risk managers) a wide range of information about risk assessment assumptions, their uncertainty and variability, and the effect of uncertainty and variability on the estimate of risk. Risk estimates presented herein are single-point estimates of risk rather than probabilistic estimates. Therefore, it is important to specify the uncertainties inherent in the risk assessment in order to place the risk estimates in proper perspective. Below is a brief discussion of the major uncertainties associated with the Baseline Risk Assessment.

- Additional screening criteria were used to limit the COPCs selected for the OU3A exposure area since a previous risk assessment, which established risk for shallow groundwater, had already been completed for OU2 as presented in the *Final Baseline Risk Assessment: Havertown PCP RI/FS Site* (Tetra Tech, 1991). The additional screening criteria for OU3A included: limiting the groundwater data to deep wells located within the plume; and comparison of the groundwater data to background and the results of the OU2 and OU3B risk assessments. COPCs for OU3A were selected only if the constituent was not addressed by the OU2 or OU3B risk evaluations. Through this methodology, several constituents were eliminated from this evaluation even though maximum concentrations exceed the risk-based screening levels.

- The data set used for the RA was reviewed to identify constituents detected in field and/or laboratory blanks. A large number of sample results were flagged "B" (found in blanks) during the data validation process, and were not used in this risk assessment. These constituents included some common laboratory contaminants [i.e., acetone, methylene chloride, bis(2-ethylhexyl)phthalate] as well as many uncommon contaminants (i.e., some pesticides and inorganics). Many of these uncommon contaminants are typically present in environmental media at low concentrations. The individual sample results that were flagged "B" and not used in the risk assessment were generally detected at low concentrations. By eliminating the low values in the data sets, the resulting exposure point concentrations may have been biased high. This effect is expected to be greatest on some of the smaller data sets and least on the larger data sets.

- A number of tentatively identified compounds ("TICs") were reported in the data set. These constituents generally included unknown straight chain hydrocarbons and other constituents with unknown toxicity. None of the reported TICs are known or suspected carcinogens. When the TICs were reported infrequently and at relatively low concentrations they were generally eliminated from consideration as COPCs in the quantitative RA. Human health risks are not expected to be dominated by these TICs. However, if any of these TICs are actually present at concentrations that may result in health effects, the risk and hazard estimates presented in the RA may have been underestimated. Lower uncertainty is associated with exclusion of TICs.

- Data were not available for several exposure scenarios evaluated. Constituents in air (dust and vapors) were not measured. Models were used to estimate air concentrations in dust and vapors. The use of models and other assumptions to estimate constituent concentrations increases uncertainty. The models used are not always consistently predictive of vapor/gas concentrations thus, the risk can either be over and/or underestimated.

- With the exception of groundwater at OU3A, COPCs were selected and evaluated in the RA without consideration of background concentrations. If concentrations of inorganic constituents at the Site are similar to background concentrations, then the risks associated with exposure to these constituents may not be Site-related. The Site-related risk may have been overestimated due to the presence of some background constituents. Insufficient data were available (too few samples) to conduct statistical testing to determine whether concentrations at the Site were different than background concentrations.

- Data are available for all analyte groups in soil, groundwater, surface water, and sediment. Heterogeneity in the distribution of chemicals could contribute to uncertainties when estimating exposure point concentrations ("EPC"). Use of maximum detected values when particular subsets of data were too small to calculate 95 percent upper confidence levels ("UCLs") may have overestimated or underestimated exposure. The overall uncertainty in the EPCs is generally moderate for soil, groundwater, surface water, and sediment. High uncertainty exists in the EPCs for total 2,3,7,8-TCDD in OU3B surface water and for the inorganics in OU3B groundwater.

- Exposure point concentrations for air (i.e., dust and vapors) were developed based on models because measured data were not available. Concentrations in dust and vapors may have been overestimated. Uncertainty associated with the use of modeled data may be moderate to high.

- Assumptions used to quantify exposure are also a source of uncertainty in the risk assessment. The assessment included site-specific factors and EPA default factors, such as the extent of exposure (i.e., exposure time, frequency, and duration) associated with various receptors. These assumptions were based on information on current land use and reasonable projections on future land use. The uncertainties in the exposure scenario developed for future conditions are moderate because future land use patterns may change.

- The exposure pathways quantified were determined on the basis of the conceptual site model and related characterization data. There is low uncertainty associated with selected pathways. Intake parameters used in the exposure assessment were derived from data in the literature, including EPA guidelines. Because considerable information is available with respect to reasonable assumptions for intake parameters, the related uncertainty is considered to be low for potential exposures to soil, groundwater, surface water and sediment.

- For Havertown's RA, oral toxicity values were adjusted for dermal contact based on oral absorption. The resulting risks may be overestimated or underestimated, but the magnitude of such overestimation or underestimation cannot be quantified.

- Toxicity values (i.e., in the form of RfDs, RfCs, and CSFs) are not available for a number of COPCs. With the exception of lead, there are no alternative methods to evaluate toxicity associated with these constituents. When toxicity values were not available for a COPC it was not possible to quantitatively estimate the cancer risk or non-cancer hazard. Consequently, this lack of available toxicity data may result in an underestimation of risk. The effect of such uncertainty could vary between low and high, however the magnitude cannot be quantified.

- Hexavalent analysis for chromium was not available for the Site. Total chromium was treated as hexavalent chromium. This may or may not be the case, and may have resulted in an overestimate of risk for some exposure areas and media.

- Overall, there is a bias for overestimation of potential human health risks in the Risk Assessment for the Havertown PCP Superfund Site. It is especially high for the Reasonable Maximum Exposure ("RME") through each pathway evaluated. Assumptions regarding exposure were selected to err on the side of overestimation in order to ensure a conservative evaluation of risk. As a result of these conservative assumptions, the potential risk to some human receptors was likely overestimated and there is an overall moderate degree of uncertainty associated with the analysis.

7.1.6 Principal Threat Waste

EPA characterizes waste on-site as either principal threat waste or low-level threat waste. The concept of principal threat waste and low-level threat waste, as developed by EPA in the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), is applied on a site-specific basis when characterizing source material. "Source material" is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, to surface water, to air, or that act as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile, which would present a significant risk to human health or the environment should exposure occur.

The RI confirmed that most of the contaminants in the vicinity of the Havertown PCP Superfund Site originated from the former NWP facility. High concentrations of PCP, dioxin, free-product oil and many other organic contaminants, as well as inorganics, are present in the groundwater. A highly contaminated area with free-product oil exists both northwest and southeast of Eagle Road, at a depth of 20 to 40 feet below the ground surface at a concentration of 7,000-8,000 µg/L of PCP. This source area can be considered a "principal threat waste," which acts as a reservoir for continued migration of contamination to groundwater. There is a dissolved plume which is moving from this source area downgradient to the collection trench, which is part of the groundwater pump-and-treat system, at a depth of 60 to 70 feet below ground surface (see Figure 5).

The National Contingency Plan establishes an expectation that EPA will use treatment to address "principal threats" posed by a site wherever practicable (National Contingency Plan Section 300.430 (a)(1)(iii)(A)). Contaminated groundwater generally is not considered to be a source material; however, non-aqueous-phase liquids ("NAPLs") in groundwater may be viewed as a source material. The decision of whether to treat these wastes is made on a site-specific basis, through a detailed analysis of the alternatives, using the nine remedy selection criteria.

After giving careful consideration to the expectations in the NCP regarding principal threat waste, and to the nine criteria in the NCP, which EPA is required to use to evaluate various possible remedial alternatives; EPA has selected an alternative that uses treatment to address the principal threat waste.

7.2 Summary of Ecological Risk Assessment

A Screening Level Ecological Risk Assessment ("SLERA") was performed for the Havertown PCP Superfund Site. The methodology used in the SLERA was based on, and complies with, the latest guidance from the EPA as described in the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* ("ERAGS")(EPA, 1997). The SLERA is designed to be a conservative assessment. The SLERA is not designed nor intended to provide definitive estimates of actual risk or to generate cleanup goals, and in general it does not use site-specific assumptions. Rather, the purpose of a SLERA is to assess the need, and if necessary, the level of effort required, to conduct a detailed or "baseline" ecological risk assessment for a particular site or facility.

The SLERA indicated that risks to ecological receptors may exist from site-related substances such as the pesticide PCP. The erosion of contaminated soil from the OU3B ROS area, and the seepage of contaminated groundwater from the OU3B ROS area, are the major contaminant migration routes that affect ecological receptors.

As previously described in the Site Background, the Havertown PCP Superfund Site has been impacting the ecological receptors in Naylor's Run for more than 50 years. The potent pesticide PCP severely degraded the water and sediment quality from Eagle Road downstream to the OU3B ROS area, according to multiple studies. However, these impacts, including discharges of free-product oil, groundwater contaminated with free-product oil, and Site surface soils contaminated with arsenic and dioxin, were significantly reduced by the installation of an oil-water separator, the capping of three acres of the Site, the installation of free product recovery wells, the sealing of the storm sewer, and the construction of a groundwater extraction and treatment facility that discharges treated water to Naylors Run in compliance with NPDES effluent limitations. These measures have significantly reduced site-related contaminant exposure in Naylors Run, in the portion running from Eagle Road to the OU3B ROS area. Small fish and ducks are now routinely observed in Naylors Run and downstream, compared to their absence which had been notable in previous field reconnaissance in the 1970s.

Currently, the remaining site-related discharges to Naylors Run result from seepage of groundwater and the erosion of soil contamination at the OU3B ROS area. Based on field reconnaissance, few or no depositional areas for contaminated sediment exist in Naylors Run from the OU3B ROS area to its confluence with Cobbs Creek. The SLERA demonstrated that the majority of potential ecological impacts from this ongoing seepage/erosion are expected to occur in Naylors Run and its un-named tributary from the OU3B ROS area downstream to Manoa Road, where the creek channel is open or only partially walled.

While remediation of the soil and groundwater at the OU3B ROS area will help to alleviate some of the stressors, a substantial increase in viability may be limited by the lack of habitat and other contaminants in the stream, not originating from the former NWP property. Naylor's Run, which originates upstream of the ROS area, is an urban/suburban stream, impacted physically and chemically not only from NWP-site-related substances, but also from the non-site related development within the watershed. Naylor's Run is approximately nine miles long from the NWP property to its confluence with Cobbs Creek, and is dominated by concrete channel for flood mitigation, as well as limited natural channel and underground culvert. Contamination enters Naylors Run and its tributaries from non-point urban runoff unrelated to the Site – this contamination enters Naylors Run from upstream of the Site, from numerous backyard drains along Naylors Run, and from major tributaries at the OU3B ROS area and downstream of it. This background contamination was detected in sediment samples upstream, at, and downstream of the OU3B ROS area, and is discussed in the RI report. Thus, ecological receptors, while exposed to Site contaminants, are also affected by non-site related impacts including the limited natural instream habitat, the lack of riparian habitat (residential and commercial lots abut the majority of Naylors Run), the limited terrestrial habitat surrounding Naylor's Run, and stormwater runoff.

7.3 Conclusion of Risk Assessments

EPA has concluded that current and future potential non-cancer hazards associated with OU3A groundwater (deep groundwater) are a concern to both adult and child residents. The shallow groundwater near the source area was identified as having a residential lifetime cancer risk that exceeds the acceptable cancer risk range and a HI greater than 1 for risks associated with PAHs, PCP and dioxin, as determined in the Human Health Risk Assessment performed for OU2.

A current and future potential cancer risk was established for residents, trespassers/visitors and workers due to OU3B soils. Current and future potential non-cancer hazards are a concern for both residents and workers. Future potential cancer and non-cancer risks associated with exposure to OU3B groundwater exceed the acceptable risk range for residents and workers.

EPA has determined that the remedial actions selected in this ROD are necessary to reduce the risks for these receptors to levels within or below EPA's risk range.

EPA has concluded that, given the limited habitat at the Site, it prefers to remediate soil and groundwater at the OU3B ROS area based on human health risks while monitoring the aquatic ecosystem. Human health risks would be alleviated, while reducing or eliminating the contaminant releases that are the major source of risk to aquatic organisms in the stream. An ecological monitoring program would be used to evaluate incremental improvement in water and sediment quality and aquatic communities. Comparisons would be made over time within Naylor's Run, as well as to a similar urban/suburban tributary in the Darby Creek watershed. Mitigation of OU3B ROS area contamination is therefore expected to relieve the majority of the remaining site-related exposure in Naylors Run. Thus, ecological integrity should improve over time following the OU3B ROS area remediation. The ecological monitoring program will evaluate non-site related stressors by using a similar urban/suburban tributary in the Darby Creek watershed as a reference.

8.0 REMEDIAL ACTION OBJECTIVES

Based on the information relating to the types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives ("RAOs") were developed to aid in the development and screening of remediation alternatives. EPA has established the following RAOs to mitigate and/or prevent existing and future potential threats to human health and the environment:

The RAOs for the Site are:

Groundwater

- Mitigate contamination to Applicable or Relevant and Appropriate Requirements ("ARAR"s) and/or risk-based cleanup levels to protect human health and the environment;

- Discharge treated groundwater to the surface water (Naylors Run) in concentrations that meet NPDES requirements;

- Prevent exposure to contaminated groundwater in the future;

- Prevent discharge of groundwater to surface water at concentrations of contaminants that would result in exceedances of water quality criteria;

- Contain the contamination plume in the source area and the ROS area to prevent further off-site migration and to ensure that downgradient groundwater is not impacted; and

- Restore groundwater quality at the Site.

Soils of ROS area

- Eliminate current exposure of human and ecological receptors to contaminated soils;

- Prevent further migration of contaminants in soil to groundwater;

- Prevent transport of contaminants in surface soils via surface water runoff; and

- Prevent potential future exposure to contaminants through ingestion and dermal contact by human and ecological receptors.

The remediation of the groundwater at the Site will continue until the Maximum Contaminant Levels ("MCLs") or Site-Specific Risk-Based Criteria are attained, and the excess cancer risk associated with potential residential use of the groundwater is reduced to one in ten thousand (1.0E-04) and the HI is reduced to 1. Because groundwater which meets the MCLs or Site-Specific Risk-Based levels for individual contaminants may not meet the cumulative risk standards specified by EPA if multiple contaminants are present, EPA's determination regarding the attainment of treatment objectives would be based on an assessment of the cumulative risk following the achievement of the preliminary standards. (Note: For the Site COCs, Maximum Contaminant Level Goals ("MCLG"s) are either the same as MCLs, have not been developed, or are zero. Non-zero MCLGs are not applicable for Site COCs.)

Consistent with the NCP, EPA will develop and evaluate risk-based chemical specific remediation goals for groundwater (excess cancer risk associated with potential residential use of the groundwater is reduced to one in ten thousand (1.0E-04) and the HI is reduced to 1) that are protective of human health and the environment, to be considered along with the MCLs, and the other ARARs for COCs identified for the Site. Determination of meeting the "protection of human health and the environment" RAO will be performance-based, as part of the CERCLA 5-year review cycle. When preliminary cleanup standards have been attained, EPA will evaluate post-ROD data from the periodic groundwater monitoring, develop a trend analysis and risk assessment to demonstrate the performance of the treatment system, and document compliance with 40 C.F.R. § 300.430(e)(2)(i) of the NCP.

The Table below presents the MCLs and the Site-Specific Risk-Based Remediation Goal Value, if no MCL is available. This Table is included as Table 15 at the end of this ROD.

REMEDIAL GOAL OBJECTIVES FOR GROUNDWATER

COC	Units	MCL	Site-Specific Risk-Based Value
Benzo(a)pyrene	µg/L	0.2	NA
Dieldrin	µg/L	Not Applicable (NA)	3.8E-02
Bis (2-ethylhexyl)phthalate	µg/L	6	NA
Diebenzofuran	µg/L	NA	4.0E+00
2- Methylnaphthalene	µg/L	NA	2.0E+00
Naphthalene[1]	µg/L	NA	3.0E+00
Pentachlorophenol	µg/L	1	NA
Phenanthrene	µg/L	NA	4.1E+01
Total 2,3,7,8-TCDD	µg/L	3.0E-05	NA
1,2,4-Trimethylbenzene	µg/L	NA	1.6E+01
1,3,5-Trimethylbenzene	µg/L	NA	1.6E+01
4,6-Dinitro-2-methylphenol	µg/L	NA	1.7E+00
Aluminum[2]	µg/L	50-200	NA
Arsenic	µg/L	10	NA
Chromium	µg/L	100	NA
Barium	µg/L	2000	NA
Manganese[2]	µg/L	50	NA
Iron[2]	µg/L	300	NA
Vanadium	µg/L	NA	3.1E+00

[1]The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for an adult resident is 1.2E+01 µg/l.
[2]Based on National Secondary Drinking Water Regulations.

Remedial Goal Objectives ("RGOs") for soil were developed through an iterative process. The first step in the process was for EPA to develop the Site-Specific Risk-Based cleanup levels for individual contaminants based on the direct contact pathway. These values were calculated to meet the cumulative risk standards specified by EPA if multiple contaminants are present. The RGOs were established for direct contact with surface and subsurface soils.

The next step in the process was to review EPA's Site-Specific Risk-Based cleanup levels with ARARs and other helpful guidance for chemical specific soil contamination. The first guidance reviewed was EPA's Office of Solid Waste and Emergency Response ("OSWER") Directive 9200.4-26 titled, "The Approach for Addressing Dioxin in Soil at Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") and Resource Conservation and Recovery Act ("RCRA") Sites," which was issued in April 1998. The purpose of the directive is to recommend preliminary remediation goals for dioxin in site soils. The Directive sets the preliminary remediation goals for dioxin for residential surface soil at 1 part per billion ("ppb") (1.0E-03 mg/kg). This level was set based on available information, and using standard default assumptions for reasonable maximum exposure scenarios, which were also used to establish the Site-Specific Risk-Based value for dioxin. The upper-bound excess cancer risk range from residential exposure at this dioxin level (1 ppb) is at the high end of EPA's acceptable range (2.5E-

04). EPA has set this default cleanup level for dioxin because it is currently completing a comprehensive reassessment of the toxicity of dioxin.

The Policy also states, "The levels in this Directive are recommended unless extenuating site-specific circumstances warrant different levels, a more stringent state ARAR establishes a cleanup level at CERCLA sites, or a more stringent state requirement applies at a RCRA site." Therefore, the final step to establish RGOs for soil at the Site was to compare EPA's Site-Specific Risk-Based values to Pennsylvania's Land Recycling and Environmental Remediation Standards Act ("Act 2"), which promulgates Statewide Health Standards for soils. Act 2 establishes direct contact cleanup values as well as soil to groundwater values, and a process to determine which apply at a site. Based on the facts and circumstances of this Site, the Pennsylvania Statewide Health Standards for dioxin, PCP and dieldrin in soils provide more stringent requirements than the EPA's Site-Specific Risk-Based cleanup standards for this Site. Therefore, EPA has incorporated these more stringent requirements as the cleanup standards for this Site. Although Pennsylvania's dioxin cleanup value is more stringent than the EPA Policy value, using Pennsylvania's dioxin cleanup value does not affect the cost or description of the selected remedy. The resulting RGOs for soil are listed in the Table below. This Table is also included as Table 16 in the Table section of this ROD.

REMEDIAL GOAL OBJECTIVES
FOR OU3B SOILS

COC	Units	Remedial Goal Objective	Basis for Remedial Goal Objective
Benzo(a)pyrene	mg/kg	1.3	Site-Specific Risk-Based Value
Dieldrin	mg/kg	1.1E-02[1]	Statewide Health Standards Soil to Groundwater
PCP	mg/kg	0.5[1]	Statewide Health Standards Soil to Groundwater
Total 2,3,7,8-TCDD TEQ	mg/kg	1.2E-04	Statewide Health Standards Direct Contact
Aluminum	mg/kg	6.2E+03	Site-Specific Risk-Based Value
Iron	mg/kg	1.5E+04	Site-Specific Risk-Based Value
Manganese[2]	mg/kg	1.6E+02	Site-Specific Risk-Based Value

[1]Soil to groundwater value based on 1/10 the generic value for saturated soils.
[2]The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for child and adult resident are 5.7E+02 mg/kg and 5.5E+03 mg/kg, respectively.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

9.1 Remedial Alternatives Common Elements

During the Feasibility Study, various alternatives to cleanup contamination at the Site were developed. EPA evaluated a number of alternatives, described in detail below to determine which cleanup methods would be best for both the Source area (OU3A) and the ROS area (OU3B). EPA's preferred alternative for OU3A is Alternative 3A (see page 30) and for OU3B is Alternative 4B (see page 33). Further information may be obtained from the Administrative Record.

Each alternative, except the "No Action" alternative, contains some common elements that were considered in the evaluation process.

OU3A Source Area

The common elements for OU3A Source area include:

Common Elements. An interim remedial action for groundwater has been implemented at the Havertown PCP Superfund Site at OU2 (shallow groundwater). The remedy that is currently being operated is a pump-and-treat system, consisting of groundwater collection via two recovery wells (RW-5 and RW-6) and a collection trench, an ex-situ treatment system, off-site disposal of contaminated sludge, and surface discharge of treated water to Naylors Run. The current pump-and-treat facility, which will become the final remedy for the shallow groundwater in this ROD, is a common element of the alternatives presented, including the "No Action" alternative required to be evaluated under the NCP.

Several of the remedies require institutional controls to limit the use of portions of the Site properties or to ensure that the water is not used for drinking water purposes. Institutional controls (e.g. ordinances, easements, and covenants, titles notices or land use restrictions through orders or agreements with EPA) shall be established to prevent any future use of the groundwater or actions that could compromise the effectiveness or integrity of the remedies in place as well as the Selected Remedy. Institutional controls ("IC"s) are required to protect the integrity of the groundwater pump-and-treat remedy, including the groundwater collection trench, the extraction wells and piping, and the cap. The Township of Haverford has a requirement to obtain a permit prior to drilling any well in the Township. This Township requirement could be modified to become the first level of institutional controls to protect the contaminated groundwater from being used as a drinking water source. The Institutional Controls (for OU3A and OU3B) could consist of a local ordnance to prohibit well drilling in the area of groundwater contamination as well as easements and/or covenants on the properties where components of the remedy are located. An Institutional Control Management Plan will be developed for the Site to draft appropriate institutional controls, implement the controls and monitor the controls to ensure they are viable. None of the alternatives rely exclusively on institutional controls to achieve protectiveness.

OU3B ROS area

The common elements for OU3B ROS area include:

Common Elements. Alternatives 1B through 7B all have one or several common elements. All the alternatives would require monitoring of the soil, groundwater or both. Some type of institutional controls would be required for Alternatives 2B through 7B. All of the alternatives would require institutional controls to protect the integrity of the remedy and to prevent the installation of drinking water wells in the area. Alternative 2B would require ICs to prevent contact with the soil contamination. A fence may be required for Alternatives 2B and 3B.

Biomonitoring, including assessments of macroinvertebrate and fish communities, to examine the efficacy of the prescribed remedy would be required for Alternatives 3B through 7B. Alternatives 1B and 2B do not involve any ecological remediation; they only utilize institutional controls to mitigate potential human exposure. Alternatives 3B through 7B include some level of remediation involving remedies that would prevent the ecological exposure of wildlife to Site contaminants, thus bio-monitoring would be needed to monitor the level of success of any of these alternatives. An initial ecological assessment would be required, followed by biennial assessments of progress, to establish that a positive response to remediation has occurred, as reflected by ecological health. Macroinvertebrate and fish communities would be included in the assessment, as they are directly exposed to site-specific contaminants, and are also indicators of the overall health of the aquatic ecosystem.

Due to the small size and lack of public access to the ROS area, Site accessibility is a major concern for any remedial alternative involving heavy equipment. Two options to access the ROS area have been developed. The first option involves gaining access for heavy equipment through the residential driveways. However, any driveway used for access would need to be repaired/replaced, and a foundation assessment would be required both before and after construction to assess vibration damage. The second option involves gaining access from the vacant property adjacent to the ROS area, on the other side of the tributary of Naylors Run (see Figure 4). This property has open space for staging and good access for heavy equipment. However, its location on the other side of the eastern tributary of Naylors Run would require the construction of a temporary land bridge in order to transport heavy equipment across the tributary of Naylors Run. Long-term access right-of-ways to the ROS area would be required for both access options.

9.2 Remedial Alternatives

This section describes the remedial alternatives that EPA considered. Note that the Total Present Worth Cost for each alternative was calculated using a 7% discount rate and an Operations and Maintenance ("O&M") period of 30 years (unless mentioned otherwise).

OU3A Source area

ALTERNATIVE 1A: No Action

Estimated Capital Cost:	*$0*
Estimated Annual O&M Cost:	*$0*
Estimated Present Worth Cost:	*$0*

The No Action response is retained for consideration as a potential response action at the Site, as required by the NCP, in order to compare it with other remedial alternatives. The No Action alternative for the Source area and deep groundwater includes the continued use of the current groundwater remediation system. It does not utilize additional remedial technologies, but would include monitoring activities already part of previous actions and implementation of institutional controls. Institutional controls are required to protect the integrity of the groundwater pump-and-treat remedy, including the groundwater collection trench, the extraction wells and piping, and the cap.

ALTERNATIVE 2A: Containment Augmented with an Additional Recovery Well

Estimated Capital Cost:	*$555,000*
Estimated Annual O&M Cost	*$50,000*
Estimated Total Present Worth Cost:	*$1,175,000*

In addition to the interim groundwater remediation system already in use at the Site, this alternative includes installation of an additional recovery well to enhance performance of the current groundwater remediation system and to eventually prevent site-related contaminants from migrating further. The new extraction well, with its associated piping, would pump at an approximate rate of 7 gallons per minute ("gpm"). In addition, the pumping rate from the current wells and collection trench would be increased or modified to achieve the optimum capture of contaminated groundwater. This alternative would require an upgrade or retrofit of the existing groundwater remediation plant (upgrade of pre-treatment system) to increase the hydraulic capacity from approximately 35 gallons per minute (gpm) of extracted groundwater into the facility for treatment to about 50 - 55 gpm into the facility[4]. The estimated time for construction of this alternative would be 6 to 12 months after construction is initiated. This alternative would also require that institutional controls be implemented to further prohibit the use of groundwater as a drinking water source and to protect the components of the treatment system. This alternative would take in excess of 30 years to reach cleanup goals.

[4] The upgrade to the treatment facility to increase the plant capacity may be initiated prior to construction of the selected remedies for this ROD.

ALTERNATIVE 3A: Augmented Containment (2A) and Restoration by In-situ Flushing

Estimated Capital Cost:	*$1,062,000*
Estimated Annual O&M Cost:	*$151,000*
Estimated Present Worth Cost:	*$2,936,000*

This alternative would include the components of the groundwater containment remedy, Alternative 2A, and adds in-situ flushing to enhance mobilization of the target compounds. In-situ flushing is the subsurface injection of an aqueous solution followed by downgradient extraction of groundwater and injected fluids, aboveground treatment, and discharge or re-injection. Flushing solutions used for in-situ flushing are contaminant-specific. The flushing solutions to be used for this alternative would be determined during the design phase. For costing purposes, the preliminary design would use the treated effluent to flush the soluble organics and soluble heavy metals. To mobilize low solubility organics, such as chlorinated hydrocarbons, a surfactant (detergent or emulsifiers) would be added to the treated effluent prior to flushing (see Figure 8). The in-situ flushing alternative would assist in reducing the volume of source material, which would enhance the effectiveness of the existing pump-and-treat remedy and accelerate Site cleanup.

In addition to the components identified for Alternative 2A, this alternative would require a flushing solution mixing and holding tank, new injection wells, piping and an upgraded pump at the collection trench sump. The estimated time for construction of this alternative would be 9 to 15 months after construction is initiated. This remedy is expected to operate for at least 30 years before it can reasonably be expected to reach the cleanup goals.

ALTERNATIVE 4A: Augmented Containment (2A) and Restoration by In-situ Chemical Oxidation

Estimated Capital Cost:	*$4,390,000*
Estimated Annual O&M Cost:	*$55,000*
Estimated Present Worth Cost:	*$5,072,000*

This alternative would include the components of the groundwater containment remedy, Alternative 2A, with in-situ chemical oxidation. The in-situ chemical oxidation would address the groundwater plume in the source area, as well as the downgradient portions of the plume in the direction of the groundwater collection trench. In-situ chemical oxidation requires the injection of an oxidant (peroxide, permanganate, persulfate or ozone) into the contaminated areas to provide chemical destruction of the organic contaminants (estimated 3-6 injections within a 1 year to 18 month timeframe). The augmented containment system would capture the groundwater treated in-situ and transfer the water to the treatment facility. This alternative could achieve cleanup goals in the groundwater quicker than other alternatives, but the effectiveness of in-situ chemical oxidation on free-product oil is unknown. This alternative would require an extensive application of institutional controls to protect the injection points, since they would be located on many different properties.

In addition to what was required for Alternative 2A, this alternative would require the fabrication and installation of injectors and a safe mechanism for handling the oxidant. The estimated time for construction of this alternative would be 12 to 18 months after construction is initiated with applications 3 to 6 months apart. This remedy is expected to operate for at least 30 years before it can reasonably be expected to reach the cleanup goals.

ALTERNATIVE 5A: Augmented Containment (2A) and Restoration by In-situ Treatment with Nano-scale Iron

Estimated Capital Cost:	*$6,066,000*
Estimated Annual O&M Cost:	*$55,000*
Estimated Present Worth Cost:	*$6,748,000*

This alternative would include the components of the groundwater containment remedy, Alternative 2A, with additional source restoration with nano-scale iron injection. The nano-scale iron technique is a relatively new method of in-situ groundwater remediation that has been demonstrated for its effectiveness on chlorinated solvents and certain metals. Traditionally, zero-valent iron ("ZVI") is used with permeable reactive barriers which intercept the flow of contaminated groundwater. A reaction occurs as the water flows through the barrier with ZVI. The conditions become favorable for abiotic remediation of chlorinated compounds and the metals tend to precipitate. To treat the source area, which is located 20-40 feet below the water surface in the fractured bedrock, an emerging technology would be used to inject nano-scale (10 to 100 nm) ZVI into the source area. Due to its smaller size, the nano-scale iron should be able to be delivered to the deep contamination. The augmented containment system would capture the groundwater treated in-situ and transfer the water to the treatment facility. The volume and toxicity of the contaminants in the source area should be reduced with this alternative. In-situ treatment with nano-scale iron is a developing technology which has not been fully proven in field applications. This alternative would require an extensive application of institutional controls to protect the injection points, since they would be located on many different properties.

In addition to what was required for Alternative 2A, this alternative would require the fabrication and installation of injectors and two new recovery wells. The estimated time for construction of this alternative would be 12 to 18 months after construction is initiated. This remedy is expected to operate for at least 30 years before it can reasonably be expected to reach the cleanup goals.

OU3B ROS area

ALTERNATIVE 1B: No action.

Estimated Capital Cost:	*$30,000*
Estimated Annual O&M Cost:	*$0*[5]
Estimated Present Worth Cost:	*$30,000*

The No Action response is retained for consideration as a potential response action, as required by the NCP, for comparative purposes with other remedial alternatives. The No Action response would not utilize any additional remedial technologies to reduce contaminants mobility, toxicity, or volume, but would include limited monitoring of soil and groundwater.

ALTERNATIVE 2B: Limited Action – Institutional Controls and Monitoring

Estimated Capital Cost:	*$99,000*
Estimated Annual O&M Cost:	*$88,000*
Estimated Present Worth Cost:	*$1,191,000*

This alternative would include institutional controls to reduce current or potential human exposure at the ROS area by contact with contaminated media. Institutional controls are usually legal/administrative controls designed to prohibit actions. This alternative would require institutional controls for residential properties to prohibit exposure with the contaminated soil and groundwater. This alternative would also include the installation of a fence around the approximate northern perimeter of the ROS area, along the banks of Naylors Run, and the Tributary to Naylors Run, as well as a monitoring program. This alternative does not use any additional remedial technologies to reduce the mobility, toxicity, or volume of contaminants.

ALTERNATIVE 3B: Capping after Limited Excavation Followed by Groundwater Extraction with Recovery Wells, Ex-situ Treatment, and Surface Discharge

Estimated Capital Cost:	*$1,240,000*
Estimated Annual O&M Cost:	*$132,000*
Estimated Present Worth Cost:	*$2,878,000*

This alternative would include limited excavation of soils within the residential property lines and capping the ROS area. Contaminated soils on residential properties which exceed the site-specific risk-based cleanup levels would be excavated and consolidated onto the ROS area, which is owned by the Township. The excavated area would be backfilled with clean soil and the area would be capped. The cap would consist of a typical RCRA subtitle C landfill cap system. The cap would extend from the ROS area, which is Township property, onto a portion of the residential properties. The cap would include, from bottom to top, a layer of bedding soil, compacted clay, a 40-mil High

[5] The O&M cost for groundwater sampling is considered part of OU2 Long-term Remedial Action Costs.

Density Polyethylene ("HDPE") flexible membrane liner, a geonet/geotextile drainage layer followed by native soil, overlain by 6 inches of topsoil, which would be planted with a vegetative cover. The preliminary design for the cap estimates the cap to cover about 0.6 acres. For proper stromwater drainage and slope stability, it is estimated that the resulting height of the cap would be 1.5 feet on the residential properties and 3 feet on the Township property.

This alternative would require the installation of five new monitoring wells, three new groundwater extraction wells and associated piping. The wells would remove contaminated groundwater (approximately 15 gpm) and transport it to the on-site groundwater treatment facility. The wells would be placed on Township property. An upgrade to the interim pump-and-treat facility would also be required to increase its hydraulic capacity. The estimated time for construction of this alternative would be 9 to 12 months after construction is initiated. EPA cannot determine at this time how long the groundwater remediation portion of this alternative will operate before cleanup goals are reached. Institutional controls would also be required to ensure that the engineered remedy, both the cap and the groundwater collection system, would not be compromised.

ALTERNATIVE 4B: Excavation and Off-site Incineration, Followed by Groundwater Extraction with Recovery Wells, Ex-situ Treatment and Surface Discharge

Estimated Capital Cost:	*$4,371,000*
Estimated Annual O&M Cost:	*$128,000*
Estimated Present Worth Cost:	*$5,959,000*

This alternative would include excavating an area of soil along the abandoned sewer line at various depths and a portion of the sewer line that is not currently filled with grout. The area to be excavated was defined by soil sampling results which were above the RGOs derived from all the ROS area soil sampling activities. The excavation area includes an area of about 50 ft. by 50 ft. around SW-8 and SW-9, a narrow zone along the abandoned sewer line (about 200 ft. long by 20 ft. wide) between manhole #7 and the end of the ROS area near SW-8 and SW-9, and soil around the abandoned sewer to the street (see Figure 9). Several minor areas of soil would also be excavated just outside this area to remove soil with higher levels of benzo(a)pyrene, which can be related to oil or tar, but not exclusively associated with the Site. The resulting volume of the excavated soil would be approximately 1,700 cubic yards. Although it is EPA's policy to remove dioxin-contaminated soil to meet a cleanup level of 1 ppb, the removal of the pipe and surrounding soil is expected to remediate all the dioxin contaminated soil. Dewatering of the area would be required during excavation. The excavated soil would be transported off-site for incineration and disposal. The water generated from the dewatering process would be trucked to the on-site treatment facility for processing. The excavated area would be backfilled with clean soil and re-vegetated after it was determined that soil cleanup goals were attained.

This alternative would also include a groundwater remediation component. A hydraulic barrier would be created by configuring a series of extraction wells (Figure 10 and 11) to pump contaminated groundwater, at a combined rate of about 15 gpm. The wells would be placed on Township property. This water would be treated at the on-site pump-and-treat facility. This alternative would require the installation of five new monitoring wells, three new groundwater extraction wells and associated piping. An upgrade to the interim groundwater treatment facility to increase the hydraulic capacity would also be required. Institutional controls would be required to protect the groundwater collection component of the remedy.

The estimated time for construction of this alternative would be 6 to 12 months after construction is initiated. EPA cannot determine at this time how long the groundwater remediation portion of this alternative will operate before cleanup goals are reached.

ALTERNATIVE 5B: Expanded Excavation and Off-site Incineration, Followed by Groundwater Extraction with Recovery Wells, Ex-situ Treatment and Surface Discharge

Estimated Capital Cost:	*$12,538,000*
Estimated Annual O&M Cost:	*$128,000*
Estimated Present Worth Cost:	*$14,126,000*

This alternative would include all the components of Alternative 4B, but the excavation area would be expanded. The area proposed for excavation for this alternative is approximately 0.6 acre with a depth of about 10 feet. The volume of the excavated soil would be approximately 10,000 cubic yards. The excavated area was defined by any soil sampling result which showed a detection of contaminants of concern. There is no regulatory basis for defining the area in this manner. Dewatering of the area would be required during excavation. The water generated from the dewatering process would be more than could be processed by transferring it by trucks to the on-site treatment facility. The water would require storage prior to processing on-site or require transport via trucks to a treatment facility located off-site. This alternative would include the same groundwater remedy described in Alternative 4B. Institutional controls would be required to protect the groundwater collection component of the remedy.

ALTERNATIVE 6B: Excavation and Off-site Incineration Followed by Groundwater Collection with Trenches, Ex-situ Treatment and Surface Discharge

Estimated Capital Cost:	*$4,485,000*
Estimated Annual O&M Cost:	*$128,000*
Estimated Present Worth Cost:	*$6,073,000*

This alternative would include the same excavation component as Alternative 4B, but the groundwater remediation portion would be different. This alternative would require a collection trench embedded with a perforated pipe backfilled with porous media to intercept the flow of contaminated groundwater within the ROS area. The installation of the trench system would require removing additional soil, installing new perforated pipe and backfilling, which would take longer to construct than the extraction wells. A major portion of the trenches would be on residential property, which would require permanent access agreements for operation and maintenance. The groundwater collected in the trenches (approximately 15 gpm) would be transported back to the on-site groundwater treatment facility. Institutional controls would be required to protect the groundwater collection component of the remedy.

ALTERNATIVE 7B: Expanded Excavation and Off-site Incineration Followed by Groundwater Collection with Trenches, Ex-situ Treatment and Surface Discharge

Estimated Capital Cost:	*$12,652,000*
Estimated Annual O&M Cost:	*$128,000*
Estimated Present Worth Cost:	*$14,240,000*

This alternative would be the same soil excavation component as Alternative 5B and the same groundwater remediation component as Alternative 6B.

10.0 EVALUATION OF ALTERNATIVES

The remedial alternatives described above were evaluated in detail to determine which would best meet the requirements of CERCLA, as amended, and the NCP, and achieve the remedial action objectives identified in section 8.0 of this ROD. EPA uses the nine criteria set forth in the NCP, 40 C.F.R. § 300.430(e)(9)(iii), to evaluate remedial alternatives. The first two criteria are threshold criteria: (1) overall protection of human health and the environment, and (2) compliance with applicable or relevant and appropriate requirements ("ARARs"). The selected remedy must meet both of these threshold criteria, except when an ARAR waiver is invoked. The next five criteria are the primary balancing criteria: (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility or volume through treatment; (5) short-term effectiveness; (6) implementability; and (7) cost. The remaining two criteria are referred to as modifying criteria and are taken into account after public comment is received on the Proposed Remedial Action Plan: (8) state and (9) community acceptance.

The following discussion summarizes the evaluation of the remedial alternatives developed for the Site against the nine evaluation criteria.

Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces, to acceptable levels, current and potential risks associated with each exposure pathway at a site.

<u>**OU3A Source Area**</u>

Alternative 1A (No Action) would include continued operation of the existing on-site groundwater remediation facility with the two recently installed deep recovery wells and groundwater monitoring. This alternative would not completely control deep groundwater migration and would allow contamination to migrate off-site. Carcinogenic and non-carcinogenic risks exceeding EPA's target risk ranges would remain for future groundwater use. Because Alternative 1A does not satisfy the threshold criterion of protectiveness, it will not be considered further in this analysis.

Alternatives 2A through 5A, which involve containment and various methods of treatment, would provide adequate protection of human health and the environment by eliminating, reducing or controlling risk through treatment, engineering controls and/or institutional controls. Each of these alternatives would provide an enhanced containment system for both the deep and shallow groundwater. Currently, the groundwater is not used as a source of drinking water and the implementation of institutional controls would prevent future exposure to contaminated groundwater.

Alternatives 3A through 5A would include the components of Alternative 2A and a source restoration component via various in-situ technologies. All three of the alternatives that include a source restoration component would provide for better overall protection of human health and the environment because the remedy would seek to control any on-going release of contaminants from the source area. However, there is some uncertainty associated with all three in-situ technologies proposed to treat the Site contaminants since these technologies are still developing and have not been fully proven in fractured bedrock geology.

OU3B ROS area

Alternative 1B, no action with limited monitoring, would provide no protection to prevent exposure to contamination, and would not be protective of human health and the environment. Alternative 2B would provide protection by prohibiting use of groundwater as potable water and prohibiting access with a fence. Both alternatives would allow for the contaminated soil and groundwater to remain on the Site, which would allow contamination to migrate off-site. Carcinogenic and non-carcinogenic risks exceeding EPA's target risk ranges would remain in the ROS area. Since neither Alternative 1B nor 2B satisfy this threshold criterion, neither will be evaluated further in this comparative analysis.

Alternative 3B would reduce the mobility of the contaminants in the soil and prevent human and environmental receptor exposure. The alternative would contain the groundwater plume and prevent further off-site migration. Human health would be further protected by prohibiting the use of groundwater for potable purposes.

Alternatives 4B through 7B would reduce or eliminate the pathways for human and ecological exposure. For Alternatives 4B through 7B, the contaminated groundwater plume would be contained to prevent further off-site migration and monitored to assess plume concentration and movement. Human health would be further protected by the use of institutional controls to prohibit the use of groundwater for potable purposes.

Compliance with ARARs

This criterion addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements ("ARARs") of federal and state environmental and facility siting laws and/or whether a remedy will provide grounds for invoking a waiver.

Any cleanup alternative selected by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements or, under certain conditions, waive one or more ARAR. Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the Remedial Action to be implemented at a site. Relevant and appropriate requirements, while not being directly applicable, address problems or situations sufficiently similar to those encountered at a site such that their use is well-suited to the particular site. EPA is not waiving any ARARs for this Site.

OU3A Source Area

The Maximum Contaminant Levels ("MCLs") for public drinking water supplies established under the federal Safe Drinking Water Act ("SDWA"), 40 C.F.R. §§ 141.11, 141.61, and 141.62, are considered to be relevant and appropriate standards for groundwater cleanup under the Superfund program. Groundwater at the Site exceeds the MCLs for various contaminants. Pennsylvania's Statewide Health Standards for groundwater are no more stringent than the federal cleanup levels determined for this Site. Alternative 2A, with complete containment of the deep groundwater plume, and Alternatives 3A through 5A, employing both groundwater restoration and containment, would be designed so that groundwater concentrations would meet these statutory requirements over time. Alternatives 3A through 5A are predicted to meet these requirements sooner than Alterative 2A.

The treatment provided in Alternatives 2A through 5A would achieve compliance with the ARARs for groundwater prior to discharge to the nearby surface water under the state and federal National Pollution Discharge Elimination System ("NPDES") requirements. These requirements include the Pennsylvania Clean Streams Law, 25 Pa. Code §§ 16.1, 16.24, 16.31-16.33, 16.41, 16.51 and 16.101-102, the Clean Water Act, 40 C.F.R. §§ 122.2, 122.4, 122.5, 122.21, 122.26, 122.29, 122.41, 122.43-122.45, 122.47, and 122.48 (all of these sections, except for 122.47, are incorporated by reference into Pennsylvania's regulation by 25 Pa. Code § 92.2) and Pennsylvania National Discharge Elimination System Requirements, 25 Pa. Code §§ 92.3, 92.7, 92.31, 92.41, 92.51, 92.55, 92.57, 92.73, 93.6, 93.7 and 95.2.

The waste generated as part of the groundwater treatment process would be disposed of in accordance with the applicable portions of the Resource, Conservation and Recovery Act ("RCRA"), 40 C.F.R. § 262.34 (accumulation time and requirements) and 40 C.F.R. §§ 264.171-175 (containers) and the Pennsylvania Hazardous Waste Management Regulations, 25 Pa. Code §§ 262a.34 (which incorporates by reference 40 CFR § 262.34) and 264a.173.

Alternatives 3A through 5A would include underground injection, which would be designed to comply with the applicable portions of the federal Underground Injection Control Program, 40 C.F.R. §§ 144.82, 144.83, 144.84, 144.85, 144.86, 144.89, and C.F.R. §§ 146.5, 146.6, 146.7, 146.8, 146.10 and 146.51.

<u>OU3B ROS area</u>

Alternative 3B, the capping alternative, would eliminate exposure pathways, thereby eliminating the risk from exposure to the contaminated soil. The groundwater component of this alternative would also achieve compliance with the MCLs promulgated under the SDWA. The cap, provided under Alternative 3B, would also comply with RCRA capping requirements.

For Alternatives 4B through 7B, the MCLs for public drinking water supplies established under the SDWA are considered to be relevant and appropriate standards for this groundwater cleanup. The discharge from the groundwater treatment system will meet the state and federal NPDES requirements (see discussion above for OU3A). In addition, incineration and landfilling of excavated soil would be completed in accordance with the RCRA requirements for hazardous waste.

Alternatives 4B and 6B, which include excavation based on the RGOs for the Site, are predicted to attain site-specific cleanup standards. EPA Directive 9200.4-26, "The Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites," is classified as a "To-Be-Considered" type of ARAR for the soil excavation alternatives. To-Be-Considered documents are non-promulgated advisories or guidance documents that are not legally binding but are used in determining the necessary level of cleanup for protection of health or the environment. The Policy also states that if site-specific circumstances warrant, a more stringent state applicable or relevant and appropriate requirement can apply. Pennsylvania's Land Recycling and Environmental Remediation Standards Act ("Act 2"), promulgates Statewide Health Standards for soils. Based on the facts and circumstances of this Site, the Statewide Health Standards for soils provide more stringent requirements than the site-specific risk-based cleanup standards for dioxin, PCP and dieldrin, but will not require any additional volume of soil to be excavated. Therefore, EPA has incorporated these more stringent requirements as the cleanup standard for these contaminants (Pennsylvania Land and Recycling and Environmental Remediation Standards 25 Pa. Code § 250.305 and § 250.308).

A complete list of ARARs for the selected remedy for the Site is presented in Table 17.

Long-term Effectiveness and Permanence

This criterion considers the ability of an alternative to maintain protection of human health and the environment over time. The evaluation takes into account the residual risk remaining from untreated waste at the conclusion of remedial activities, as well as the adequacy and reliability of containment systems and institutional controls.

OU3A Source Area

Alternative 2A, with its augmented containment features, will provide better efficiency in containing deep groundwater than the current groundwater remediation system. This alternative may offer long-term effectiveness in containing deep groundwater and preventing it from migrating off-site. However, its long-term effectiveness in extracting contaminants in bedrock fractures over the long-term will be limited.

Under Alternatives 3A, 4A and 5A, which contain in-situ actions, source reduction together with groundwater containment, would significantly reduce risks from contaminant migration of deep groundwater to fractured bedrock. Alternatives 3A and 4A could have some adverse effects on the ecosystem as a result of introducing chemicals into the subsurface. Therefore, long-term monitoring of the groundwater would be required. In the case of Alternative 3A, use of non-toxic reagents can minimize these concerns. Alternative 5A has the least potential impact on the ecosystem.

Alternative 4A may cause naturally occurring dissolved minerals (e.g., iron and manganese) to precipitate, which could reduce the aquifer permeability in the long-term.

The effectiveness of Alternative 5A to treat some site-related compounds, such as PCP, fuel-related VOCs, and dioxins, has not been proven.

OU3B ROS area

Alternative 3B would prevent a direct exposure risk related to surface soil, but would require continued maintenance of the cap, fence and institutional controls to prevent disturbance of the cap integrity. Alternative 3B would minimize the migration of contaminants from the soil into the groundwater. Alternatives 3B through 7B would also provide groundwater containment. Alternatives 6B and 7B have a passive collection system (trenches), which would require less long-term maintenance than the active systems (extraction wells) of Alternatives 3B, 4B and 5B.

Alternatives 5B and 7B might afford a higher degree of long-term effectiveness and permanence than Alternatives 4B and 6B, since the expanded excavation would remove additional soil. Alternatives 4B and 6B are designed to meet RGOs and ARARs.

Institutional controls will be used with all OU3A and OU3B alternatives to ensure that groundwater will not be used as drinking water until cleanup criteria are met. Institutional controls will also protect the engineered remedies (i.e., capped area, wells, piping and groundwater treatment facility).

Reduction of Toxicity, Mobility or Volume of Contaminants through Treatment

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site.

OU3A Source area

Alternative 2A would meet the goal of preventing further migration of contaminants in deep groundwater. The shallow and deep groundwater would be effectively contained, which would reduce the mobility of the groundwater contamination. However, the Principal Threat Waste of the Source area would not be treated to reduce toxicity or volume. Without treatment, it would take an exceedingly long time to reduce the toxicity, mobility, or volume of contaminants in the deep groundwater.

Alternatives 3A, 4A and 5A would provide greater reduction in toxicity, mobility, and volume of contaminants in the deep groundwater, within the zone of treatment by the in-situ treatment portion of the alternatives. These alternatives would also satisfy the statutory preference for using treatment as a primary element of remediation, since the contaminants in the fractured bedrock and deep groundwater posing the principal threat would be addressed.

Alternative 3A has been pilot-tested at the Site and has shown positive results in reducing the toxicity of the Source area. Alternative 4A has shown some positive results in a bench-scale test with certain oxidants, but its success on a large-scale has not been proven. Alternative 5A has also been through a bench scale test and the results for reducing the majority of Site contaminants were not as favorable as the other treatment alternatives.

OU3B ROS area

Alternative 3B would offer no reduction in toxicity or volume of contaminants in the soil, but it would reduce the mobility of the contaminants by capping the contaminated soil.

Alternatives 3B through 7B would generally provide reduction in toxicity, mobility, and volume of contaminants in groundwater, within the general zone of capture. They would also meet the statutory preference for using treatment as a primary element for groundwater contamination.

For soil, Alternatives 4B through 7B would meet the statutory preference for using treatment as a primary element.

Short-term Effectiveness

This evaluation criterion addresses the effects of the alternative, during the construction and implementation phase until remedial action objectives are met. It considers risk to the community and on-site workers and available mitigation measures, as well as the time frame for attainment of the response objectives.

OU3A Source area

Alternative 2A, with augmented containment, will be effective in the short-term in containing the deep groundwater and preventing off-site migration of deep groundwater by adding an additional recovery well to enhance performance of the current groundwater containment features. There would be minimal short-term impacts to remedial construction workers, the community, or the environment. This alternative would take the least time to implement (6 to 12 months after construction begins). This alternative, if implemented alone, will take a very long time to reach cleanup standards for groundwater.

Although none of the technologies have been fully demonstrated in fractured bedrock, Alternatives 3A through 5A should be more effective in removing or directly treating contaminants in soil pores and small rock fractures below the water table. Alternative 3A is estimated to take 9 to 15 months to implement once construction begins. Alternative 3A is estimated to have a shorter construction period than Alternatives 4A and 5A, because it only requires the installation of two new injection wells and the conversion of one existing well into an injection well, as compared to installing many injection points on various properties. All of these alternatives would subject workers and the community to manageable risks.

OU3B ROS area

Alternative 3B, the capping alternative, would eliminate the risk of exposure to the soils and would contain the off-site migration of the groundwater, which would provide short-term effectiveness. It is estimated that the construction period for this alternative would be for 9-12 months after access has been obtained. This alternative would not subject workers or the community to unacceptable risks.

Alternatives 4B through 7B, which include excavation, would reduce or eliminate the current risk posed by contaminated soil in a relatively short timeframe. These alternatives would not subject workers or the community to unacceptable or unmanageable risks. These alternatives would require the off-site transportation of contaminated materials and, therefore, may have a risk of contaminant release in the event of an accident or spill. Alternatives 6B and 7B would take the longest to construct (12-18 months after access has been obtained), due to the installation of a trench system for groundwater recovery. Alternative 5B will take longer to construct than Alternative 4B due to the expanded excavation.

Implementability

The evaluation of alternatives under this criterion considers the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation.

OU3A Source area

Alternative 2A, which includes the installation of an additional recovery well, has no technical constrains, and the engineering services and materials are available; therefore, it could be implemented easily. Access agreements are already in-place to enable construction to begin.

Alternatives 3A through 5A would require an amendment to the existing NPDES equivalency and the current monitoring program to address the chemicals being injected into the groundwater. Alternative 3A can initially be implemented with flushing of plain water (e.g. effluent from treatment plant), while adapting the current monitoring program and modifying the current NPDES equivalency to meet the requirements of injecting the treated water mixed with an emulsifier.

Access agreements are already in-place to enable construction to begin for Alternative 3A. Implementation of Alternatives 4A and 5A may encounter some access issues for potential injection points due to existing obstructions within the treatment zone and due to the fact that the injection points would be located on multiple properties.

No significant regulatory issues are expected for Alternatives 3A through 5A since the State regulatory agency does not have a direct prohibition on injection technologies for treating contaminated aquifers. Conventional construction techniques and equipment would be used for the installation of injection/recovery wells and modification of the existing groundwater treatment plant.

OU3B ROS area

The soil component of Alternatives 3B through 7B could be implemented using conventional construction techniques and equipment. One issue that would need to be addressed for all of these alternatives is accessibility. The ROS area is located in an area that is difficult to access with heavy equipment. These alternatives would likely cause substantial surficial disturbance through the removal of existing vegetation.

Alternative 3B would require a RCRA subtitle C landfill cap system to be installed on 0.6 acres. For proper stormwater drainage and slope stability, it is estimated that the resulting height of the cap would be 1.5 feet on the residential properties and 3 feet on the Township property. It has not been determined whether the existing soil and stream banks could support this type of cap system.

Alternatives 5B and 7B are more complex to implement than the other excavation alternatives because the excavation would be deeper and more extensive. These alternatives would include excavation of soils to 10 feet, which would require constant dewatering of the area. The groundwater is at approximately 4-6 feet below ground surface in this area, so it is unknown whether the excavation could be completed to 10 feet.

Cost

The Alternative Cost Summary Table (see Table 18) summarizes the capital, annual operation and maintenance ("O&M"), and total present worth costs for each alternative. Capital costs include engineering design, construction, construction management, administration, and contingency. Annual O&M costs include the estimated annual operation and maintenance costs of the remedy throughout the life of the project. Note that those O&M costs that are related to the OU2 Long-term Remedial Action were not included. In order to best compare the varying costs of the different alternatives, a present worth analysis was performed. This analysis included the present worth of annual O&M costs with a discount rate of 7% over the life of the project (estimated to be 30 years for comparison purposes) and the one-time capital costs. For further details on the cost estimate, see the Administrative Record.

The alternatives that have a groundwater extraction component would require a redesign of the existing pump-and-treat facility to increase its flow capacity. The cost for this upgrade is included in the cost estimates for the alternatives. EPA is exploring options to complete this upgrade prior to the implementation of the remedy selected in this ROD.

State Acceptance

PADEP has reviewed comments from the public and the Record of Decision, and concurs with the selected remedy in a letter dated April 8, 2008.

Community Acceptance

From August 22, 2007 through October 21, 2007, EPA held a 60-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study and the Proposed Plan and the other documents contained within the Administrative Record for the Site. On September 11, 2007, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision.

11.0 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comments, EPA has selected the following as the remedy for the Havertown PCP Superfund Site: Alternatives 3A, Augmented Containment and Restoration by In-Situ Flushing and 4B, Excavation and Off-Site Incineration of Soils followed by Groundwater Extraction with Recovery Wells, Ex-Situ Treatment and Surface Discharge.

11.1 Summary of the Rationale for the Selected Remedy

EPA's preferred alternatives meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs. Based on the information currently available, EPA (the lead agency) believes Alternatives 3A and 4B provide the best balance of advantages and disadvantages among the alternatives, when evaluating them using the balancing criteria. EPA's preferred alternative for OU3A Source area:

1) will be protective of both human health and the environment;

2) will contain the shallow and deep groundwater and will treat the principal threat waste;

3) can be easily implemented and will be effective in the short-term; and,

4) is the second least costly of the alternatives that provide overall protection to human health and the environment.

EPA's preferred alternative for the OU3B ROS area:

1) will be protective of both human health and the environment;

2) will be the easiest to implement of the OU3B alternatives that are protective of human health and the environment; and

3) will provide long-term effectiveness and permanence for the soil portion and long-term effectiveness for the groundwater portion.

Overall, EPA's preferred alternatives satisfy the statutory requirements of CERCLA §121 and the NCP by being protective of human health and the environment; complying with ARARs; being cost-effective; utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable; and satisfying the preference for treatment as a principal element.

11.2 Description of the Selected Remedy and Performance Standards

Based on the comparison of the nine criteria, EPA's preferred alternative for OU3A (Source area) is Alternative 3A and for OU3B (ROS area) is Alternative 4B. The total present worth cost of EPA's selected remedy is $8,895,000. In addition to the common elements described on pages 27-28(e.g., bio-monitoring and institutional controls), the major components of the Selected Remedies (as discussed in detail on pages 30 and 33) are:

1) Installation of an additional deep recovery well and associated piping to enhance performance of the current groundwater remediation system to prevent the migration of site-related contaminants in both the shallow and deep aquifers.

2) Operate and maintain the existing groundwater treatment facility. Upgrade or retrofit the existing groundwater treatment facility to increase the capacity of the facility to 60-70 gpm.

3) Treat collected groundwater as necessary to meet discharge requirements.

4) In-situ flushing in the source area, with treated water from the groundwater treatment facility mixed with an emulsifier, to enhance mobilization of the principal threat waste. Construction and installation of the in-situ flushing

system would include a tank for mixing and holding the flushing solution, new injection wells, piping and an upgraded pump at the collection trench sump.

5) Excavation of an area approximately 50 ft. by 50 ft. around wells SW-8 and SW-9 in the ROS area, and a narrow zone along the abandoned sewer line about 200 ft. long and 20 ft. wide. The portion of the abandoned sewer line which has not been sealed (between manhole #7 and the end of the ROS area) will be removed. All the excavated material will be disposed of properly.

6) Backfilling of the excavated area with clean fill, restoration of sidewalks, curbs, utilities, etc., and planting of appropriate vegetation.

7) Installation of three recovery wells and associated piping in the ROS area to extract groundwater and transport it to the Site's groundwater treatment facility for remediation.

8) Demonstrate recovery of benthic macroinvertibrate and fish communities, to examine the efficacy of the ROS area excavation and groundwater treatment to reduce or eliminate the contaminant releases that are the major source of risk to aquatic organisms in Naylors Run. This ecological monitoring program would be used to evaluate incremental improvement in water and sediment quality and aquatic communities.

9) Perform groundwater monitoring to ensure effectiveness of the groundwater remedy.

10) Institutional controls to protect the integrity of the remedy and to prevent the installation of groundwater wells, through groundwater use restrictions for the Site and surrounding area (as appropriate). An Institutional Control Implementation and Assurance Plan (ICIAP) will be developed for the Site during the remedial design to ensure appropriate institutional controls are drafted, implemented and monitored.

The selected remedy shall meet all applicable or relevant and appropriate requirements contained in Table 17.

11.2.1 Operate and Maintain a Groundwater Collection and Treatment System, Install Additional Recovery Well

Prevent the migration of contaminated groundwater in both the shallow and deep aquifers through the operation and maintenance of the groundwater collection and treatment system. The system is currently supplied with groundwater from two extraction wells and a groundwater collection trench. Add an additional deep recovery well and associated piping. Upgrade or retrofit the treatment facility to increase the capacity to 60-70 gpm (additional capacity required because of additional recovery wells).

Groundwater shall be contained, collected and treated as necessary on-site, by using the recovery system already in place to achieve the following performance standards. The groundwater collection and treatment system consists of a pre-treatment system, ultra-violet oxidation and granulated activated carbon.

Performance Standards for Groundwater Collection and Treatment System

1. Prevent the migration of contaminated groundwater from the Source area and the deep and shallow groundwater through the operation and maintenance of the on-site groundwater collection and treatment system.

2. Operate and maintain the groundwater collection and treatment system. Operation will continue until groundwater contamination levels throughout the plume meet MCLs (40 C.F.R. §§ 141.11, 141.61 and 141.62) or the site-specific risk based values specified as cleanup criteria of section 8.0 of this ROD, and a risk assessment confirms that the excess cancer risk associated with potential residential use of the groundwater is reduced to one in ten thousand (1.0 E-04) and the HI is reduced to 1.0. The points at which the compliance with the cleanup levels will be measured shall include all well locations included in the monitoring program discussed below (11.2.8).

11.2.2 Treat Collected Groundwater as Necessary to Meet Discharge Requirements

Collected groundwater shall continue to be treated to achieve NPDES discharge requirements. The treated groundwater shall continue to be discharged to Naylors Run

Performance Standards for Treating Collected Groundwater as Necessary to Meet Discharge Requirements

1. Collected groundwater shall be treated prior to discharge to comply with the substantive requirements of the National Pollutant Discharge Elimination System ("NPDES") program (40 C.F.R. §§ 122.2, 122.4, 122.5, 122.21, 122.26, 122.29, 122.41, 122.43-122.45, 122.47, and 122.48 (all of these sections, except for 122.47, are incorporated by reference into Pennsylvania's regulation by 25 Pa. Code § 92.2), the Pennsylvania National Pollutant Discharge Elimination System Requirements (25 Pa. Code §§ 92.3, 92.7, 92.31, 92.41, 92.51, 92.55, 92.57, 92.73, 93.6, 93.7 and 95.2.).

2. Treated collected groundwater shall be discharged to Naylors Run to comply with the substantive requirements of the Pennsylvania Clean Streams Law (25 Pa. Code §§ 16.1, 16.24, 16.31-16.33, 16.41, 16.51 and 16.101-102).

3. Treatment system components shall be maintained and replaced, as necessary, to minimize downtime and equipment leaks, and to maximize treatment performance.

4. Monitoring reports shall be submitted to EPA and PADEP at such frequency and in such detail to allow EPA to determine whether or not the groundwater treatment systems are in compliance with this ROD and, in particular, whether

performance standards 1 through 3 above have been achieved and are being maintained.

5. On-site handling and off-site disposal of hazardous waste and solid waste, resulting from the operation of the groundwater treatment plant, shall be in accordance 40 C.F.R. § 262.34 (accumulation time and requirements) and 40 C.F.R. §§ 264.171-175 (containers) and 25 Pa. Code §§ 262a.34 (which incorporates by reference 40 C.F.R. § 262.34 and 264a.173).

11.2.3 Perform In-Situ Flushing of the Source Area

Perform in-situ flushing in the source area with treated water (possibly mixed with other additives) from the groundwater treatment facility, to enhance mobilization of the principal threat waste. Construction and installation of the in-situ flushing system would include a tank for mixing and holding the flushing solution, new injection wells, piping and an upgraded pump at the collection trench sump.

Performance Standards for In-Situ Flushing of the Source Area

1. Inject effluent from groundwater pump-and-treat system into wells around source area (principal threat waste). Injection shall be conducted in accordance with the substantive requirements of the Underground Injection Control Program (40 C.F.R. §§ 144.82, 144.83, 144.84, 144.85, 144.86, 144.89, and 40 C.F.R. §§ 146.5, 146.6, 146.7, 146.8, 146.10, 146.51).

2. Monitor groundwater plume in Source area to determine if there is plume movement. Adjust injection program if plume of principal threat waste expands or moves.

3. Discontinue the in-situ flushing of the Source area when EPA determines that cleanup goals are met or that the flushing is no longer effective in treating the principal threat waste.

11.2.4 Excavation of ROS Area

All the soil from the ROS area that is above the soil cleanup criteria set forth in section 8.0 of this ROD shall be excavated. The excavation will consist of an area approximately 50 ft. by 50 ft. around wells SW-8 and SW-9 in the ROS area, and a narrow zone along the abandoned sewer line that consists of an area approximately 200 ft. long and 20 ft. wide. The portion of the abandoned sewer line which has not been sealed (between manhole #7 and the end of the ROS area) will be removed. To facilitate excavation below the water table, sheeting and shoring will likely be required.

Performance Standards for Excavation of ROS Area

1. All the soil from the ROS area that is above the soil cleanup criteria (25 Pa. Code § 250.305 and § 250.308) or site-specific risk-based criteria, as set forth in section 8.0 of this ROD, shall be excavated.

2. Water will be removed from the excavation and transported to the existing groundwater treatment facility for processing. The water may need to be staged in holding tanks prior to treatment. The holding tanks will allow settling of solids and will provide a means to regulate the flow through the treatment facility. Details will be determined during the remedial design.

3. On-site handling and off-site disposal of hazardous waste and solid waste, resulting from the excavation, shall be in accordance with 40 C.F.R. § 262.34 (accumulation time and requirements) and 40 C.F.R. §§ 264.171-175 (containers) and 25 Pa. Code §§ 262a.34 (which incorporates by reference 40 C.F.R. § 262.34 and 264a.173). Staging of the soil may be required if the soil is too wet for transport. Details will be determined during the remedial design.

4. Excavation will be conducted in accordance with the substantive portions of the Pennsylvania Storm Water Management Act (32 P.S. § 680.13).

5. Air monitoring will be conducted during excavation activities. Remediation activities will be temporarily shut down, and additional emission controls shall be put in place if necessary in order to comply with federal and state regulations governing air quality (25 Pa. Code §§ 123.1-123.2, 40 CFR §§ 50.6-50.7 and 25 Pa. Code § 123.41).

6. Post-excavation soil sampling shall be conducted in order to ensure that all of the material that exceeds the action levels has been removed.

11.2.5 Backfill the Excavated ROS Area with Clean Fill, Restoration of Sidewalks, Curbs, Utilities, etc., and Appropriate Plantings

Backfill the excavated areas with clean fill and at least six inches of top soil. A stable, vegetative cover shall be established over the backfilled areas and, as determined to be necessary by EPA, over other areas of the Site. Grade appropriately to manage stormwater. Restore sidewalks, curbs, utilities, etc. that were damaged during the excavation. Provide appropriate plantings to replace those that were removed during the excavation.

11.2.6 Install Three Recovery Wells and Associated Piping in the ROS Area

Prevent the further migration of contaminated groundwater and facilitate the recovery of the ROS area groundwater through the installation, operation and maintenance of groundwater recovery wells collectively pumping at approximately 15 gpm and associated piping. The extraction wells will be placed on Township property and the associated piping will connect the extraction wells to the existing recovery well trench. Easements from individual property owners will be required to install and maintain the wells and equipment.

Performance Standards for Installation of Three Recovery Wells and Associated Piping in the ROS Area

1. Operate and maintain the groundwater collection from the additional recovery wells in the ROS area with treatment at the operating groundwater treatment facility. Operation of the recovery wells will continue until groundwater contamination levels throughout the ROS area plume meet MCLs (40 C.F.R. §§ 141.11, 141.61 and 141.62) or the site-specific risk based values specified as cleanup criteria of section 8.0 of this ROD, and a risk assessment confirms that the excess cancer risk associated with potential residential use of the groundwater is reduced to one in ten thousand (1.0 E-04) and the HI is reduced to 1.0. The recovery wells will be operated until EPA determines that these cleanup standards have been met or EPA determines that the wells no longer provide adequate capture of the contamination and the remedy needs to be modified.

11.2.7 Demonstrate Recovery of Benthic Macroinvertibrate and Fish Communities

An initial ecological assessment will be required, followed by biennial assessments of conditions to establish that a positive response to the OU3B remediation has occurred, as reflected by ecological health. Benthic macroinvertebrate and fish communities would be included in the assessment, as they are directly exposed to site-specific contaminants, and are also indicators of the overall health of the aquatic ecosystem.

Performance Standards for Recovery of Benthic Macroinvertibrate and Fish Communities

1. Biennial assessments of benthic macroinvertibrate and fish would track changes in conditions from initial assessment conditions by comparison to a reference location with similar habitat within the watershed. Broad Run, located in Chester County Pennsylvania, is the reference stream previously used. The assessment should survey 40 channel widths or the daylighted section (which ever is shorter), and it should include portions of the tributaries that join the creek adjacent to the contaminated soil area. When scores for benthic macroinvertibrate and fish indices of biotic integrity (calculated using the results of the fish survey) are comparable to those of the reference location, as determined by EPA, recovery will be complete and monitoring can be terminated.

11.2.8 Monitor Groundwater to Ensure the Effectiveness of the Remedy

Collect and analyze data from the groundwater within and surrounding the contaminant plume using existing monitoring wells to determine whether the containment and groundwater treatment systems are operating effectively. Follow the current groundwater monitoring plan, and revise as necessary based on the remedial design.

Performance Standards for Monitoring Groundwater to Ensure the Effectiveness of the Remedy

1. Collect and analyze groundwater samples for Site contaminants from multiple locations on-site, monitor water levels in the wells and perform capture zone analysis; the specific locations and frequency of sampling shall be as determined in the Operations and Maintenance Monitoring Plan, which will be updated as necessary as a part of the remedial design, and finalized following implementation of the remedy.

2. Update the monitoring plan every five years, coinciding with EPA's five year reviews, unless EPA accepts an alternate schedule.

11.2.9 Land and Groundwater Use Restrictions for the Site and Surrounding Area (as appropriate)

An Institutional Control Implementation and Assurance Plan (ICIAP) shall be developed during the remedial design to address institutional controls, including land and groundwater use restrictions, for the Site. The requirements for institutional controls contained in this ROD are based on current, reasonably anticipated uses of the Site and areas in the vicinity of the Site. The purpose of the institutional controls shall be to prevent exposure to unacceptable risks associated with remaining Site-related contaminants and to protect the components of the selected remedy. The required Institutional Controls may include property use controls (such as easements and restrictive covenants) and governmental controls (such as zoning ordinances and local permits). The ICIAP shall identify parties responsible (i.e., federal, State or local authorities or private entities) for implementation, enforcement, and monitoring and long-term assurance of each institutional control including costs, both short-term and long-term, and methods to fund the costs and responsibilities for each step. The ICIAP shall include maps, which shall describe coordinates of the restricted areas depicting all areas that do not allow unlimited use/unrestricted exposure and areas where ICs have been implemented along with a schedule for implementation of the remaining ICs. The maps and information about the ICs shall be made available to the public in several ways, including being posted on the internet and in the Information Repository for the Site. In addition, the ICIAP shall identify reporting requirements associated with each institutional control which shall include at a minimum an annual review of the status and effectiveness of the institutional controls.

Performance Standards for Land and Groundwater Use Restrictions for the Site and Surrounding Area

1. Maintain and protect the integrity of the engineered remedy including, but not limited to, monitoring wells, extraction wells, associated piping for the wells, the in-situ flushing equipment, the groundwater treatment facility, and the capped portion of the Site.

2. Prohibit exposure to contaminated groundwater. Use of and/or contact with contaminated groundwater at the Site, via ingestion, vapor inhalation or dermal contact shall be prohibited to avoid unacceptable exposure to contaminants in groundwater.

11.3 Summary of the Estimated Remedy Costs

The estimated present worth costs of the selected remedies is $8,895,000. See Table 19 for a detailed cost summary.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the response action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Minor changes may be documented in the form of a memorandum in the Administrative Record. Changes that are significant, but not fundamental, may be documented in an Explanation of Significant Differences. Any fundamental changes would be documented in a ROD amendment.

11.4 Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy in terms of resulting land and groundwater uses and risk reduction achieved as a result of the response actions. Following the completion of the soil excavation in the ROS area, there should no longer be an unacceptable health risk to residents or workers due to exposure to soil.

The groundwater remedies put in place at the Site are expected to contain and remediate the groundwater. The treatment of the Source area groundwater, which represents a principal threat, should reduce the volume of source strength material and should reduce the time required to meet MCLs or site-specific cleanup standards for the entire plume of contamination. The groundwater remedy will continue to operate until the cleanup standards are met and the excess lifetime cancer risk for use of the groundwater, as drinking water, is below 1.0E-04 and the Hazard Index is reduced to 1. The groundwater remedy is expected to operate for at least 30 years before it can reasonably be expected to reach the cleanup goals.

The selected remedy is expected to reduce or eliminate the contaminant releases that are the major source of aquatic risk in Naylors Run. Soil extraction and groundwater treatment in the ROS area should relieve the majority of the remaining site-related exposure in Naylors Run. This should result in the improvement of the ecological integrity of the area.

The selected remedy should allow for the continued use of the Site as a residential and light industrial area. Some limitations may occur due to the required institutional controls which will restrict any use of groundwater within the Site and activities that could interfere with any of the engineered components of the remedies (i.e., capped area, wells, piping and groundwater treatment facility).

12.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element. The following sections discuss how the selected remedy for OU3 of the Havertown PCP Superfund Site meets these statutory requirements.

12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by eliminating exposure or the potential for exposure to Site-related contaminants through the excavation of contaminated soils. In addition, the additional groundwater recovery wells and the groundwater treatment system will prevent the further migration of the contaminated groundwater plume and will treat the contaminated groundwater. The in-situ flushing of the Source area will provide treatment for the principal threat waste which will reduce the volume of the source area contamination.

Treated groundwater that will be discharged to Naylors Run will meet all appropriate water quality standards and NPDES limitations in order to prevent any adverse human health and environmental effects.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain all applicable or relevant and appropriate requirements, which are identified as a performance standard in Section 11.2 and specified in Table 17 of this ROD.

12.3 Cost Effectiveness

The selected remedy is cost effective in that it eliminates or mitigates the risks posed by the contaminants at the Site, meets all requirements of CERCLA and the NCP, and its overall effectiveness in meeting the remedial action objectives is proportional to its cost. In fact, the selected remedies are nearly the lowest in cost (see Table 18), yet rank the best in terms of long-term effectiveness and permanence; reduction in toxicity, mobility or volume; and short-term effectiveness, as compared to the other alternatives.

12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes long-term solutions and treatment technologies to the maximum extent practicable through the use of containment, collection, and treatment of contaminants of concern from groundwater, and the excavation of contaminants from soil. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedies provide the best balance of advantages and disadvantages, in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element, and State and community acceptance.

12.5 Preference for Treatment as a Principal Element

The selected remedy will meet the statutory preference for treatment as a principal element, since it treats both the groundwater contamination and the principal threat waste present at the Site. The groundwater pump-and-treat system with in-situ flushing of the Source area will contain and treat the principal threat waste. This in-situ element of the selected remedy has been successful in reducing the Source area plume during pilot testing at the Site.

12.6 Five-Year Review Requirements

Because the Site remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will continue to be conducted every five years to ensure that the remedy is, or will be, protective of human health and the environment pursuant to CERCLA Section 121 (c) and the NCP, 40 C.F.R. § 300.430(f)(5)(iii)(C). Such reviews have been conducted every five years since the initiation of remedial actions, and will continue every five years.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant or fundamental changes to the proposed remedy as a result of public comments.

III. RESPONSIVENESS SUMMARY

HAVERTOWN PCP
SUPERFUND SITE
OPERABLE UNIT 3

HAVERTOWN, DELAWARE COUNTY, PENNSYLVANIA

HAVERTOWN PCP SUPERFUND SITE,
OPERABLE UNIT 3
HAVERTOWN, DELAWARE COUNTY, PENNSYLVANIA

RESPONSIVENESS SUMMARY

This Responsiveness Summary documents public participation in the remedy selection process for OU3 of the Havertown PCP Superfund Site. It contains a summary of the major comments received by EPA during the public comment period on the Proposed Plan for OU3 at the Site and EPA's responses to those comments.

A. Summary of Significant Comments from the Public Meeting on September 11, 2007 and EPA's Responses

EPA held a Public Meeting on September 11, 2007 to accept public comment on EPA's Proposed Plan for OU3. The significant comments received regarding the plan for OU3 are summarized here, along with EPA's responses to these comments. The entire transcript of the meeting, including all comments received and EPA's responses, is included in the publicly available portion of the Administrative Record for anyone who wants to view them.

1. **Comment:** How deep is the deep water?

Response to comment: The deep aquifer begins approximately 20 – 30 feet below ground surface. It has been determined that the shallow and deep aquifer can be considered a single hydrogeologic system with interconnecting flow between the shallow and the deep.

2. **Comment:** What area makes up the ROS area? Was there soil sampling beyond the ROS area?

Response to comment: The "ROS area" is an acronym for the Recreation and Open Space area. ROS is a zoning classification for the Township, which in this case is made up of remnant pieces of property from when Washington Avenue was extended to its current configuration. EPA first identified contamination on the ROS property owned by the Township and shown on Figure 4 of this ROD. EPA has defined the ROS area to include all the areas with contamination that are near or adjacent to the Township's ROS property. A complete description of the ROS area investigation and sampling is included as part of the Remedial Investigation Report, which is part of the Administrative Record. The ROS area was sampled to define the areas of contamination. Clean samples were identified around the area of soil contamination. Figure 9 of this ROD identifies the area that contains soil contamination above action levels.

3. **Comment:** Do gardens pose a risk in the ROS area? What is an acceptable risk?

Response to comment: No, gardens do not pose a risk currently and they will not after the excavation is complete. The soil excavation required under this ROD will remove all of the soil contamination above action levels in the ROS area. The groundwater would not come into contact with a vegetable garden, because the water level is deeper than the root system and groundwater is not a source of potable water.

EPA's acceptable target cancer risk range is from one in 10,000 to one in 1,000,000 additional cases of cancer than normally would be expected from all other causes. For non-cancer health effects, EPA calculates a Hazard Index. The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

4. **Comment:** What are the logistics of the ROS area excavation? Will soil be stored? Will there be a health issue for the residents during excavation?

Response to comment: Due to the small size and lack of public access to the ROS area, Site accessibility is a major concern for any remedial alternative that would involve heavy equipment. Two options to access the ROS area have been developed. The first option would involve gaining access with heavy equipment through the residential driveways. However, the driveway used for access would need to be repaired/replaced, and a foundation assessment would be required both before and after construction to assess vibration damage. The second option would involve gaining access from the vacant property adjacent to the ROS area, on the other side of the tributary of Naylors Run (see Figure 4). This property has open space that could be used for maneuvering heavy equipment and for staging the excavated soil. However, its location on the other side of the eastern tributary of Naylors Run would require the construction of a temporary land bridge in order to transport heavy equipment across the tributary of Naylors Run. Long-term access rights-of-way to the ROS area would be required for both access options. EPA will further assess both options during the remedial design. It is not anticipated that soil will be stored for either option, the goal will be to excavate and haul the soil.

A Health and Safety Plan will also be developed as part of the remedial design. The Health and Safety Plan will provide details on how residential and worker safety will be ensured during the excavation process. EPA will hold an information session prior to finalizing the Health and Safety Plan to discuss the details of excavation.

5. **Comment:** The Proposed Plan discusses contaminants that are not associated with the Site. Can you discuss what happens with these contaminants?

Response to comment: Although there are contaminants that did not originate from the NWP property, the current array of wells and collection trench do capture the various contaminants and effectively treat the contaminants in the groundwater treatment facility. EPA's Site Assessment Branch of the Hazardous Site Cleanup Division is currently investigating the trichloroethylene ("TCE") identified upgradient of the NWP property.

The soil excavation in the ROS area will remove contaminated soils that are above the cleanup criteria established for this Site.

6. **Comment:** Do you really believe that only one additional well is required for the Source area and how deep will it be?

Response to comment: Yes. Groundwater modeling of the Source area shows that with the well selected in this ROD, and the wells already operating, when pumped at their optimum capacity, there is significant capture of the shallow and deep groundwater plume. The additional well selected would be approximately 40 – 60 feet deep. The success of the pump-and-treat technology depends on an upgrade to the treatment facility to increase hydraulic capacity.

7. **Comment:** Is EPA using slant drilling?

Response to comment: Conventional drilling techniques for both monitoring and extraction wells have been successful at this Site. Slant drilling is usually used when there is a need to drill beneath something (i.e., a river). At this Site, conventional drilling techniques can be used to capture and monitor the groundwater contamination. Also, slant drilling would be impractical because the Site is so close to Eagle Road that it would not allow sufficient space to start any horizontal drilling technique and there are numerous underground utilities along the road that would interfere with such a pathway.

8. **Comment:** You are not using the nano iron?

Response to comment: At this stage of the cleanup, EPA will not use the nano iron technology. EPA did not have success using this technology in bench scale tests using contaminated groundwater from the Site.

9. **Comment:** Would the proposed Source area pumping pull all the contamination back?

Response to comment: The selected well configuration for the Source area and deep groundwater will contain the Source area contamination, but some of the deep groundwater that has already traveled under the groundwater collection trench will not be drawn back into the capture zone, but will naturally attenuate.

10. **Comment:** Who are you putting institutional controls on?

Institutional controls will be placed on both public and private properties to ensure the integrity of the remedy put in place and to ensure that groundwater is not used as a source of potable or non-potable water. An Institutional Control Implementation and Assurance Plan will be drafted for the Site.

11. **Comment:** Will there be an OU4?

Response to comment: This ROD is expected to be the final ROD for the Site. Unless additional information comes to light, this will be the final operable unit ("OU").

12. **Comment:** When are you going to terminate the State's Superfund Contract?

A State Superfund Contract ("SSC) is an agreement between EPA and the state environmental agency, in this case PADEP, which establishes cost sharing arrangements, provides certain assurances, and establishes responsibility for long-term Operation and Maintenance. EPA has entered into an SSC with PADEP for Operable Unit 2 and EPA will negotiate another SSC with PADEP for OU3. Given that SSCs cover long-term Operation and Maintenance responsibilities, EPA does not anticipate terminating the SSC for Operable Unit 2 for many years.

Comment: What about the soil and sediment in Naylors Run? Was there some concern there?

Response to comment: Soils and sediments do not currently contain site-related contaminants exceeding EPA Region 3 Risk-Based Concentrations.

B. Comments from Local Residents

As with the comments from the Public Meeting, this Responsiveness Summary focuses on comments received from local residents during the public comment period that are significant and that deal with OU3. The full text of the resident's comments is included in the publicly available portion of the Administrative Record.

1. **Comment:** Why is only one new extraction well being recommended?

Response to Comment: EPA constructed a groundwater pump-and-treat facility as part of the OU2 remedy. The facility originally treated water from four shallow extraction wells along Eagle Road and a collection trench located behind the Philadelphia Chewing Gum ("PCG") facility. In early 2006, EPA installed two new deep extraction wells to capture deep groundwater which was flowing under the collection trench. Groundwater modeling of the groundwater contamination plume has indicated that the two new wells and the continued use of the groundwater collection trench provide adequate capture of the plume. The additional well that was proposed will ensure more complete capture of the shallow and deep groundwater plume.

2. **Comment:** Why is a slurry wall with an outlet not being recommended?

Response to Comment: The remedy being implemented for OU2, including the existing collection trench and two recovery wells, already address the shallow groundwater. In order to determine the best way to address deep groundwater in competent crystalline bedrock (OU3), groundwater modeling was conducted. The modeling determined that an additional extraction well near CW-18D would provide optimal containment of the plume (see Figure 8 of this ROD). Although a slurry wall may be able to provide containment, due to its location (in the residential area) and the depth required, putting a new vertical well is the most effective and economical way to recover deep groundwater.

3. **Comment:** When would slant drilling and emplacement of a perforated pipe be used in this water treatment application?

Response to Comment: Conventional drilling techniques for both monitoring and extraction wells have been successful at this Site. Slant drilling is usually used when there is a need to drill beneath something (i.e., a river, or building). At this Site, EPA has successfully captured the groundwater plume of contamination with conventional extraction wells.

4. **Comment:** What kind of upgrade and retrofit of the treatment plant is required and what will it do that is not being done now? What is the dollar amount associated with the upgrade? Is this routine maintenance or capital improvement?

Response to Comment: The upgrade to the existing groundwater pump-and–treat facility would be done to increase the hydraulic capacity of the plant to approximately 70 gallons per minute ("gpm"). Currently, the plant can only process between 30-35 gpm of extracted groundwater. EPA has determined that to effectively capture the groundwater contamination emanating from the Source area (OU3A), in both the shallow and deep groundwater, a pumping rate of approximately 55 gpm would be required. Also, the additional pumping from the ROS area (OU3B) is estimated to require a pumping rate of 15 gpm.

The pre-treatment portion of the groundwater pump-and-treat facility is the limiting factor in how much water can be processed at the facility. The current pre-treatment system was not designed to accommodate the present hydraulic loadings. A redesign of the pre-treatment system will increase the hydraulic capacity, while reducing the operation and maintenance costs.

The cost for increasing the hydraulic capacity of the current pump-and-treat facility was considered to be a capital cost for this ROD (see Table 19). The capital cost is estimated to be $190,000. These costs could also be considered routine operation costs because components of the pre-treatment system are at the end of their useful life, and must be replaced in order for the system to continue to operate reliably. Thus, EPA is investigating possibility of completing this upgrade as part of the Long-term Remedial Action prior to construction associated with the ROD. However, these costs remain in the ROD, since EPA has not determined when the upgrade will be conducted.

5. **Comment:** What's in the "aqueous solution"? Where's the proof that this measure is cost effective?

Response to Comment: The treated groundwater from the current pump-and-treat facility will be mixed with an emulsifier to enhance its ability to flush the highly contaminated material in the Source area. The exact "aqueous solution" will be determined during the remedial design. Bench-scale tests of various emulsifiers will be conducted to select those that are suitable for the Site.

EPA believes that this is a cost effective method of treating the principal threat waste since it only requires the installation of a few injection wells and uses the existing groundwater facility. EPA will monitor the remedy's success during operation and maintenance.

6. **Comment:** Extract all groundwater and the injected fluids? What is in the fluids? What is the turnover rate for the groundwater?

Response to Comment: A portion of the treated groundwater mixed with the emulsifiers will be injected around the Source area (see Figure 8 of this ROD). The injected water will be extracted by the new extraction well near CW-18D and other existing structures such as the RW-5 and RW-6 wells, and the collection trench. A prediction of turnover rate cannot be made, but will be determined during the remedial design phase. See response to comment regarding the emulsifiers.

7. **Comment:** What is the treatment of the extracted water; is this fitting the treatment plant so that it has greater capacity? If the capacity was/is inadequate for 7 years how much will this treatment speed up the cleanup?

Response to Comment: The groundwater extraction and treatment system consists of six recovery wells, one collection trench, and an on-site treatment system. Four of the six recovery wells (RW-1, RW-2, RW-3, and RW-4) have been offline since RW-5 and RW-6 were installed in February 2006. The treatment system consists of two major parts—a pretreatment system (for breaking the oil-water emulsion, removal of metals, and removal of suspended solids) to prepare the groundwater for removal of the contaminants and an organics removal/treatment system that treats the groundwater contamination. The pretreatment system consists of an emulsion tank, an oxidation tank, a secondary oxidation tank, an inclined plate clarifier and a gravity sand filter. The organic treatment system includes three 30 Kilowatt Ultra Violet/Oxidation lamps followed by a peroxide destruction unit (PDU) and two granular activated carbon (GAC) units. A detailed system description, process flow diagram and recovery wells & pumps details are provided in the 2006 Technical Assessment and Operations & Maintenance Report as Attachment A.

Currently, the pre-treatment portion of the treatment does not have any excess storage or treatment capacity and therefore cannot operate with a greater hydraulic flow. The current pre-treatment system was designed to treat the shallow groundwater at a maximum rate of 30-35 gallons per minute (gpm). Since additional wells (RW-5 and RW-6) were added to extract the deep groundwater and additional wells are part of this remedy, the inflow into the plant needs to increase to approximately 70 gpm.

The increased capacity of the plant will aid in containing the groundwater plume of contamination. The Source area in-situ flushing should be effective in accelerating the cleanup. At this point in time, EPA cannot estimate the cleanup timeframe.

8. **Comment:** How much water will be discharged from the treatment plant? What concentrating effect of contaminants because of contact with soil or sediment would occur because water is discharged into an intermittent stream?

Response to Comment: The discharge of the treatment plant is approximately equal to the amount of groundwater processed. Once the remedial action for OU3A is implemented, the discharge will be equal to the groundwater processed minus the groundwater used for in-situ flushing, which will be determined during the remedial design. The discharged water has been treated to remove contamination. The discharged water meets all the substantive requirements of the Pennsylvania National Pollution Discharge Elimination System Program. These discharge limitations were developed by taking into account the flow conditions in the stream. The discharge is through a pipe onto the surface of Naylors Run. The sediment of Naylors Run is not contaminated above any action levels.

9. **Comment:** Why excavate an area of 200' by 20 ft and how deep will it be expected to be?

Response to Comment: The area to be excavated is defined based on sampling results that are above the Remedial Goal Objectives set for the Site soil (Table 16 of this ROD). The excavation is expected to be from 4 to 6 feet deep. The excavation will remove the soil that has contamination above the Performance Standards established in section 11.2.4 of this ROD.

10. **Comment:** How much of an excavation of the abandoned sewer will be made and what testing of soil will be undertaken in the vicinity of the sewer?

Response to Comment: The abandoned sewer line will be removed in the area to be excavated. The portion of sewer line between the groundwater collection trench and the area to be excavated has been sealed. Post excavation sampling will be conducted to ensure that all soil contamination above the Performance Standards established in section 11.2.4 of this ROD is removed.

11. **Comment:** Product could have leaked out or moved into an abandoned sewer pipe or other utilities.

Response to Comment: To the best of EPA's knowledge, there are no other abandoned sewer lines or utilities buried in the area that have not been accounted for in EPA's decision making for the Site. EPA does recognize the preference of the contamination to travel in the bedding layer of the sewer and/or the bed of old Naylors Run. Because of this, EPA installed an extraction well (RW-6) in the bed of old Naylors Run to capture the contamination in this area.

12. **Comment:** When and how will the excavation pit be refilled?

Response to Comment: The excavation will be filled immediately after confirmation sampling indicates that the excavation is complete and leaves no soil above action levels. The excavation will be filled with clean fill and then at least a six inch layer of topsoil. If required, sidewalks, curbs, utilities, etc. will be restored. The area will be properly planted with vegetation and landscaping, as appropriate.

13. **Comment:** Why are three more extraction wells needed downgradient?

Response to Comment: It was determined through modeling that an extraction of approximately 15 gpm using three wells would be appropriate to remediate the groundwater contamination in the ROS area. If the groundwater is not contained in this area, it may migrate off-site.

14. **Comment:** Explain what kind of "institutional controls" will landowners receive and how will they affect landowners, municipal authorities, future uses, utilities workers and future land uses? Are these agreements to run with the land and not able to be cancelled?

Response to Comment: The excavation at the ROS area will leave no soil above action levels on the residential or Township properties. Institutional controls will be needed to ensure that the wells and piping on both private and public properties for the groundwater extraction component of the remedy are protected. Another institutional control will be required to ensure the groundwater is not used for drinking water. These institutional controls will be developed with the Township and may take the form of an ordinance or permitting restriction. The Institutional Control to prevent groundwater use and protect the integrity of the groundwater collection and treatment system will have to remain in place for many years until the groundwater performance standards established in section 11.2.1 of the ROD have been achieved.

15. **Comment:** After 20 years of evaluation, it is my professional opinion that there is no justification, whatsoever, for proceeding with any part of the Proposed Plan as described.........It appears that an arbitrary value of $25 million has been assigned to total remedy at the Havertown PCP Superfund Site after which EPA will transfer the property to the State of Pennsylvania. It is believed that this project should be completely rethought and reevaluated right now before this happens.

Response to Comment: The Human Health Risk Assessment for OU3 identified unacceptable risk for both OU3A and OU3B. The remedies that have been selected will provide protection of human health and the environment, which will eliminate or reduce the risk to acceptable levels.

The OU3 cost estimates for the selected remedy are independent of previous costs, with the exception of certain operation and maintenance costs associated with operating the groundwater treatment facility. The transfer of operations and maintenance of the Havertown Site toPADEP is required under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and the National Oil and Hazardous Substances Pollution Contingency Plan. It is consistent with the terms of Superfund State Contracts that EPA has entered into with PADEP which establishes cost sharing arrangements, provides certain assurances, and establishes responsibility for long-term Operation and Maintenance.

16. **Comment:** The additional recovery wells are insufficient to remedy the contamination.

Response to Comment: EPA has used groundwater modeling to determine whether the additional wells will adequately capture the plume of groundwater contamination. EPA acknowledges that it will take many years to clean the groundwater using only the pump-and-treat remedy and therefore EPA has selected the in-situ flushing component of the remedy to reduce the level of principal threat material in the groundwater. EPA will continue to monitor the plume and assess other remedial options as they become available.

17. **Comment:** Modern methods such as slant drilling, slurry walls and biodegradation are not considered.

Response to comment: EPA did consider some of these methods. Please see response to comments B.2 and B.3, above and the Focused Feasibility Studies for OU3A and OU3B which are part of the Administrative Record for the Site.

18. **Comment:** The experience of other project managers has not been sought from EPA's Wood Preserver Working Group of over 100 Wood Preserver Superfund Sites, consequently, neither state of the art remedy nor commonality of experience remedying similar Superfund Sites is included or even mentioned.

Response to comment: The Focused Feasibility Studies for OU3A and OU3B did consider the presumptive remedies suggested by EPA for Wood Treatment Facilities. Many of the presumptive remedies do not work if dioxin, which is present at the Site, is a contaminant of concern. The fractured rock geology is also another factor that limits the effectiveness and appropriateness of certain remedies.

19. **Comment:** No proof is offered, whatsoever, that the current inadequate treatment plant could be upgraded to treat the amounts of contaminated waste at the Site.

Response to comment: The current pump-and-treat facility is operated at its maximum hydraulic capacity. The part of the facility which limits the hydraulic capacity is the pre-treatment, which can be upgraded to double the flow (approximately 70 gpm).

20. **Comment:** There is no explanation offered that the aqueous solution to be re-injected is a cost-effective procedure or that there is any balancing of benefit to cost. Additionally, there is no quality control of substances in the re-injected water.

Response to comment: The in-situ flushing of the selected remedy is the least costly of the in-situ remedies examined (alternatives 3A, 4A, and 5A). All of the remedies are expected to meet the threshold criteria of protection of human health and the environment and meet applicable or relevant and appropriate requirements. As stated in the Proposed Plan and this ROD, none of the in-situ remedies have been proven in the fractured bedrock geology of the Site. The in-situ flushing has had positive results during the pilot test at the Site and is least costly.

The type of emulsifier added to the treated groundwater will be determined during the remedial design and pre-design investigation. One goal of the pre-design investigation will be to determine the most effective emulsifier. The remedy will meet the performance standards set in this ROD and established during the remedial design. The water to be discharged from the treatment plant will continue to meet the effluent limitations set by PADEP.

21. **Comment:** As proposed, not all contaminated groundwater originating at the Site will be treated, and the extraction of groundwater could be a never-ending and duplicative.

Response to comment: Currently, groundwater extraction and treatment is the best method to treat the groundwater contamination at the Site. Containment is the first objective, with cleanup being second. EPA cannot estimate how long the cleanup will take at this time, but it is estimated to be in excess of 30 years. The risk for exposure to groundwater is low, since it is not used for drinking water purposes.

22. **Comment:** There is no reference to any concentrating or chemical effect or other soils effect upon re-injected water that may contain contaminants and treatment products from the wood preserver site.

Response to comment: Only treated groundwater will be re-injected. The re-injected water will mobilize the source strength material to allow more highly contaminated water to be extracted for treatment. The only negative effect of the re-injected water may be to extract metals from the rock and soil and put them also into the groundwater. Then the more highly contaminated water that would be extracted would also contain more metals. The metals would be removed by the pre-treatment process. A monitoring plan will be included as part of the remedial design to ensure there are no adverse effects from the re-injected water.

23. **Comment:** Soils analyses have not been undertaken for soils physical, chemical or even morphological properties thus it is not possible to understand the effects or limitations of subsequent soil washing.

Response to comment: EPA determined that in-situ flushing would be appropriate, based on the aquifer characteristics (including hydraulic conductivity and transmissivity), pumping tests, groundwater modeling results, and subsurface lithology found during the well construction process (Appendix A of the RI report).

These hydrogeologic characteristics provide more practical information to justify the use of this technology than physical properties of soil, such as porosity. In addition, during the design and construction phase, EPA will have the opportunity to collect additional information on soil characteristics.

24. **Comment:** The boundaries of the Recreation and Open Space area conform to straight lines, as shown on maps; it appears that boundaries of the capped area conform to some subjective judgment rather than detailed soils analysis. Excavation in the vicinity of the abandoned sewer is, once again, mapped subjectively and not based on testing.

Response to comment: The Recreation and Open Space area is a Township designation for the property, and is delineated on Figure 4 of this ROD by the dashed line. The soil to be excavated encompasses all soil sample locations that were analyzed as being above the EPA cleanup criteria. This excavation area is shown as the shaded portion of Figure 9 (and takes the shape of a club). The sampling locations in the ROS area (which include properties adjacent to the Township property) and the analytical results are included in the Remedial Investigation Report for the Havertown PCP Superfund Site, which is part of the Administrative Record.

25. **Comment:** All of the options would impose "institutional controls," such as restrictive covenants, ordinances, etc., upon privately owned and public lands alike. There is no reason to expect these owners will agree to such measures for monetary reasons either at this time or in the future.

Response to comment: The excavation at the ROS will leave no soil above action levels on the residential or Township properties. Institutional controls will be needed to identify and protect piping associated with the groundwater extraction on both private and public properties. These institutional controls will be needed to ensure that the wells and piping for the groundwater extraction system remedy are protected. Also see response to B 14 above.

26. **Comment:** EPA seems to have judgmentally "settled" the boundaries of the Havertown PCP Site by internal memorandum or agreement and/or internal discussion as the "plume of contamination." There is no reference to the "plume"

being deep groundwater, shallow groundwater, soil contamination or all of these........

Response to comment: Figures 3 and 5 of this ROD, which were also included with the Proposed Plan, illustrate the groundwater plume that has been interpreted to exist, using the groundwater monitoring data that EPA has collected over many years. Section 5 of this ROD provides a discussion of the hydrogeology of the Site. Typically EPA defines a Superfund Site as the area to which the contaminates of concern have migrated or have come to be located.

27. **Comment:** This comment was relating to the Philadelphia Chewing Gum Company ("PCG") and what type of institutional controls would be placed upon the property. Other portions of the comment do no relate to this ROD.

Response to comment: The groundwater contaminant plume extends under the PCG property. The property also contains infrastructure for the groundwater pump-and-treat facility. Currently, EPA has an agreement with the property owners in which they agree not to interfere with or damage the infrastructure associated with the Superfund remedy. EPA anticipates maintaining this type of agreement with the owner or any new owner of the property. Engineering controls can be utilized to reuse or develop the property further without disturbing or contributing to the contamination.

28. **Comment:** It appears that at least 60+ properties are affected by contamination from wood processing waste from the National Wood Preservers site that travels downgradient in shallow and deep groundwater from the Superfund Site and because remedial action may be unable to return either groundwater or soils to an acceptable state of land health satisfactory for both private and public landowners alike, the possibility exists that a government buyout of contaminated properties may or should, be considered......

Response to comment: The selected remedy in this ROD includes excavation of all soils in the ROS area that are above action levels. Other soil contamination that has been identified earlier in the Site's history has been capped. Groundwater contamination does underlie many properties in the area. The threat of contact with the contaminated groundwater is low due to the depth of the contamination, and the fact that the groundwater is not used for drinking water purposes. EPA can implement the remedy outlined in the ROD without property buyouts. Once the remedy has been implemented, the Site will be protective of human health and the environment.

C. Comments from the Township of Haverford Environmental Advisory Committee

1. **Comment:** ....Given EPA's reference to the OU2 pump and treat system as an interim remedy, and its apparent function of containing, rather than treating shallow groundwater, it is unclear from the proposed plan whether the OU2 remedy will be modified, and if so what the substance and effect of such

modification would be. While the proposed plan acknowledges an interconnection between the shallow and deep groundwater near the source area of the Site, and proposes to address deep groundwater through the installation of deep recovery wells, the long-term future of OU2 is unclear.

Response to comment: The remedy that is currently being operated for OU2 is a pump-and-treat system, consisting of groundwater collection via two recovery wells (RW-5 and RW-6) and a collection trench, a groundwater treatment system, off-site disposal of contaminated sludge and the discharge of treated water to Naylors Run. While the current pump-and-treat facility is effective in treating and containing the plume some modifications are being made to enhance the performance of the system. The current facility will be upgraded to increase the hydraulic flow from the wells that have been selected as part of this ROD. In this ROD, EPA is selecting the current pump-and-treat facility, as modified herein, as the final remedy for the shallow groundwater.

2. **Comment:** EPA's proposed plan notes that certain contaminants not known to be associated with the National Wood Preservers site operation have been identified in groundwater, soils within the site area and in soils and sediments in Naylors Run........summarize the sampling data...please summarize the current status and/or future likelihood of those efforts.

Response to comment: The sampling data for major contaminants in the monitoring wells can be found in Attachment E of the Site's Operation and Maintenance Annual Reports, which are part of the Site File Repository. Copies of the Site File can be found at the EPA offices at 1650 Arch Street, Philadelphia, PA 19103 (215-814-3157) or at the Township of Haverford Municipal Building. More sampling data can be found in the Remedial Investigation Report, which is part of the Administrative Record.

EPA's Site Assessment Branch of the Hazardous Site Cleanup Division is currently investigating the trichloroethylene ("TCE") identified upgradient of the NWP property.

The groundwater contains contaminants that are not designated as contaminants of concern for the Site (e.g. TCE). The current array of wells and collection trench do capture the various contaminants and effectively treat them in the groundwater treatment facility.

3. **Comment:** EPA has divided OU3 into two parts, consisting of OU3A, deep groundwater in the source area of the NWP site and OU3B for contaminated soil and sediment in the Recreation and Open Space ("ROS") area. For OU3A, EPA's selected remedies includes installation of an additional recovery well, along with in-situ flushing, using effluent from the pump and treat system in conjunction with flushing solutions. Although EPA represents that such in-situ treatment will provide greater reductions in the toxicity, mobility and volume of the contaminants, the proposed plan does not specify what flushing solutions will be used for these purposes or how such solutions will be selected to maximize the

effectiveness of treatment while minimizing any risk associated with the introduction of additional chemicals into groundwater at the Site. Further, EPA does not offer any perspective as to the relative risks or benefits of the chosen alternative. Finally, it is unclear from the proposed plan whether in-situ flushing will be used to treat deep groundwater exclusively, or will be used as an additional treatment method for shallow groundwater in conjunction with the OU2 remedy.

Response to comment: The treated groundwater from the current pump-and-treat facility will be mixed with an emulsifier to enhance its ability to flush the highly contaminated material in the Source area, which is located in the deeper portion of the aquifer. The exact "aqueous solution" will be determined during the remedial design. Bench-scale tests of various emulsifiers will be conducted to determine which one performs best while minimizing impacts to the environment. The emulsifiers may cause natural metals to dissolve into the groundwater, but they will be taken out of the groundwater by the pre-treatment system.

EPA believes that this is a cost effective method of treating the principal threat waste because it only requires the installation of a few injection wells and uses the existing groundwater remedial structures. The treated water will be re-injected into the Source area where there is containment of the plume. EPA will monitor the remedy's success during operation and maintenance.

4. **Comment:** .....It is not apparent from the proposed plan the extent to which EPA's prior sampling activities have adequately characterized soils areas along the entire length of the abandoned sewer line, much of which appears to traverse residential properties. Please summarize such sampling results and explain how EPA determined that no continuing risk may have resulted from contaminant seepage in other areas along the abandoned sewer line.

Response to comment: The Remedial Investigation Report, which is part of the Administrative Record, contains a complete report of the investigation of the abandoned sewer line, including all sampling locations and results. When the line was completely identified and the manholes were made accessible, a video tape investigation of the entire line was completed. The tape showed that the line was intact for the majority of its length. The area near the shallow groundwater collection trench was compromised and allowed contaminated groundwater to seep into the line. The only other area which showed major fractures was near MW-7 (see Figure 9 of this ROD). The entire line between the two major faults was sealed with grout. Subsequent sampling of the monitoring wells in that area have not showed any increases in contamination or any results that are not consistent with what would be predicted. EPA installed the extraction well RW-6 into the bed of the old Naylors Run, which ran along the approximate path of the abandoned sewer line. EPA predicts that the new well will act as a drain to capture any contamination that may have traveled either in the old stream bed or along the abandoned sewer line.

Samples were taken in the ROS area and adjacent properties until soil and groundwater samples were identified that were below the EPA action levels. These sample locations were both upgradient and downgradient of the sewer line break in the ROS area.

5. **Comment:** ...EPA's proposed plan does not identify the depths of the planned monitoring and extraction wells, or explain the effect these wells may have (if any) on the existing wells located in and around the source area of the Site.

Response to comment: The three wells to be installed in the ROS area are expected to be shallow extraction wells. The deep groundwater contamination has not reached the ROS area and the groundwater contamination present is residual contamination from the discharge of contaminated water from the abandoned sewer line. The wells will work independently from the current wells and the additional well to be installed in the Source area, but the extracted water will be treated at the existing pump-and-treat facility. Figure 8 of this ROD identifies the current extraction wells that are pumping the deeper groundwater (RW-5 and RW-6), the shallow groundwater collection trench and the well to be added as part of the Source area portion of this remedial action. The Site's Operation and Maintenance Annual Reports identifies the location and depth of all the monitoring wells on Site.

6. **Comment:** EPA's selected alternatives for both OU3A and OU3B rely on institutional controls as an important aspect of the long-term maintenance of the remedy. While EPA notes that a restriction on use of groundwater for drinking water purposes will be necessary, other potential institutional controls are not identified. To the extent that institutional controls other than groundwater use restrictions may be required for any aspect of the site remediation, please identify such controls, their location, and likely impact on Township and residential properties.

Response to comment: The excavation at the ROS will leave no soil above action levels on the residential or Township properties. Institutional controls willbe needed to identify and protect wells and piping associated with the groundwater extraction system on both private and public properties. The primary impact the Institutional Controls would have would be to 1) make people aware of the existence of all components of the groundwater extraction conveyance and treatment system, and 2) prevent activities which would interfere with any of the components of this system.

Table 1
EXPOSURE POINT CONCENTRATION SUMARY
Havertown PCP Site

Scenario Timeframe Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	Dieldrin	ug/L	0.224	0.286 (N)	0.35	0.286	UCL-N	(1)	0.224	Mean	(2)
	Total 2,3,7,8-TCDD TEQ	pg/L	2.04	NC (S)	4.66	4.66	Max	(3)	2.04	Mean	(2)
	Aluminum (Total)	ug/L	174	394 (N)	452	394	UCL-N	(1)	174	Mean	(2)
	Arsenic	ug/L	4.94	5.06 (NP-Mt)	4.7 K[]	4.7	Max	(4)	4.7	Max	(5)

Notes:

EPC = Exposure Point Concentration
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
[] = Analyte present. As values approach the Instrument Detection Limit (IDL), the quantitation may not be accurate.
NC = not calculated (too few observations)

pg/L = picograms per liter
UCL = upper confidence limit
ug/L = micrograms per liter

(1) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(2) The arithmetic mean concentration was used for the Central Tendency EPC.
(3) Maximum concentration used because too few observations to calculate a UCL.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) Maximum concentration used because the calculated mean exceeds maximum detected concentration.

(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(S) Unknown distribution (too few observations).

Table 2
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe Current/Future
Medium: Sediment
Exposure Medium. Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	Aroclor 1254 (PCB-1254)	ug/kg	142	1260 (NP-C_{99})	2500	1260	UCL-C_{99}	(1)	142	Mean	(2)
	Benzo(a)pyrene	ug/kg	2790	3440 (N)	6400	3440	UCL-N	(3)	2790	Mean	(2)
	Dibenzo(a,h)anthracene	ug/kg	1600	2170 (G)	1500	1500	Max	(4)	1500	Max	(5)
	Dibenzofuran	ug/kg	1430	2080 (G)	530 J	530	Max	(4)	530	Max	(5)
	Total 2,3,7,8-TCDD TEQ	pg/g	15.9	23.7 (N)	22.7	22.7	Max	(4)	15.9	Mean	(2)
	Aluminum	ug/kg	6810000	8210000 (G)	17100000	8210000	UCL-G	(6)	6810000	Mean	(2)
	Arsenic	ug/kg	2330	2840 (G)	4500	2840	UCL-G	(6)	2330	Mean	(2)
	Chromium	ug/kg	52600	157000 (NP-C_{95})	550000	157000	UCL-C_{95}	(7)	52600	Mean	(2)
	Cobalt	ug/kg	6220	7050 (N)	10200[]	7050	UCL-N	(3)	6220	Mean	(2)
	Iron	ug/kg	15700000	17400000 (N)	29100000	17400000	UCL-N	(3)	15700000	Mean	(2)
	Manganese	ug/kg	488000	644000 (G)	2010000	644000	UCL-G	(6)	488000	Mean	(2)
	Vanadium	ug/kg	29600	35500 (G)	85100	35500	UCL-G	(6)	29600	Mean	(2)

Notes:
EPC = Exposure Point Concentration
J = estimated value
[] = Analyte present. As values approach the Instrument Detection Limit (IDL), the quantitation may not be accurate.

pg/g = picograms per gram
UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on nonparametric data using EPA's ProUCL 99% Chebyshev method.
(2) The arithmetic mean concentration was used for the Central Tendency EPC.
(3) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) Maximum concentration used because the calculated mean exceeds maximum detected concentration.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on nonparametric data using EPA's ProUCL 95% Chebyshev method.

(N) The data are normal at 5% significance level
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software
(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma

Table 3
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe Current
Medium. Surface Soil
Exposure Medium Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	Aldrin	ug/kg	11.1	77.8 (NP-C_{99})	84 J	77.8	UCL-C_{99}	(1)	11 1	Mean	(2)
	Dieldrin	ug/kg	37.5	223 (NP-C_{99})	220	220	Max	(3)	37.5	Mean	(2)
	Benzo(a)anthracene	ug/kg	1740	13200 (NP-C_{99})	19000	13200	UCL-C_{99}	(1)	1740	Mean	(2)
	Benzo(a)pyrene	ug/kg	1460	2620 (T-C_{95})	14000	2620	UCL-C_{95}	(4)	1460	Mean	(2)
	Benzo(b)fluoranthene	ug/kg	1430	2710 (T-C_{95})	14000	2710	UCL-C_{95}	(4)	1430	Mean	(2)
	Dibenzo(a,h)anthracene	ug/kg	524	937 (T-H)	2000 J	937	UCL-H	(5)	524	Mean	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	732	1260 (G)	5100 J	1260	UCL-G	(6)	732	Mean	(2)
	Pentachlorophenol	ug/kg	2590	12700 (NP-C_{99})	12000	12000	Max	(3)	2590	Mean	(2)
	Total 2,3,7,8-TCDD TEQ	pg/g	667	1120 (N)	1667 7	1120	UCL-N	(7)	667	Mean	(2)
	Aluminum	ug/kg	13600000	15000000 (N)	20000000	15000000	UCL-N	(7)	13600000	Mean	(2)
	Arsenic	ug/kg	5380	8260 (T-H)	14000 []	8260	UCL-H	(5)	5380	Mean	(2)
	Chromium	ug/kg	33500	43300 (NP-Mt)	81600	43300	UCL-Mt	(8)	33500	Mean	(2)
	Cobalt	ug/kg	28000	167000 (NP-C_{99})	176000	167000	UCL-C_{99}	(1)	28000	Mean	(2)
	Iron	ug/kg	31100000	63800000 (NP-C_{95})	105000000 J	63800000	UCL-C_{95}	(9)	31100000	Mean	(2)
	Manganese	ug/kg	3170000	24000000 (NP-C_{99})	25500000 J	24000000	UCL-C_{99}	(1)	3170000	Mean	(2)
	Vanadium	ug/kg	41900	46700 (N)	63600 []	46700	UCL-N	(7)	41900	Mean	(2)

Notes
EPC = Exposure Point Concentration
J = estimated value
[] = Analyte present. As values approach the Instrument Detection Limit (IDL), the quantitation may not be accurate.

pg/g = picograms per gram
UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 99% Chebyshev method.
(2) The arithmetic mean concentration was used for the Central Tendency EPC.
(3) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(4) 95% UCL computed based on lognormal data using EPA's ProUCL 95% Chebyshev method.
(5) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(8) 95% UCL computed based on non-parametric data using EPA's ProUCL Modified t.
(9) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.

(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(T) The log-transformed data conform to a normal distribution as determined by the Lilliefors or Shapiro-Wilk normality test.

Table 4
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Future
Medium: Total Soil (Surface + Subsurface combined)
Exposure Medium: Total Soil at OU3B

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	Aldrin	ug/kg	6.92	46.5 (NP-C_{99})	84 J	46.5	UCL-C_{99}	(1)	6.92	Mean	(2)
	Dieldrin	ug/kg	26	139 (NP-C_{99})	220	139	UCL-C_{99}	(1)	26	Mean	(2)
	Aroclor 1254 (PCB-1254)	ug/kg	44.1	103 (NP-C_{95})	340	103	UCL-C_{95}	(3)	44.1	Mean	(2)
	Methylcyclohexane	ug/kg	9.6	12 (NP-Mt)	4 J	4	Max	(4)	4	Max	(5)
	Benzo(a)anthracene	ug/kg	1330	3870 (NP-$C_{97.5}$)	19000	3870	UCL-$C_{97.5}$	(6)	1330	Mean	(2)
	Benzo(a)pyrene	ug/kg	1250	3600 (NP-$C_{97.5}$)	14000	3600	UCL-$C_{97.5}$	(6)	1250	Mean	(2)
	Benzo(b)fluoranthene	ug/kg	1360	3850 (NP-$C_{97.5}$)	14000	3850	UCL-$C_{97.5}$	(6)	1360	Mean	(2)
	Dibenzo(a,h)anthracene	ug/kg	705	2030 (NP-C_{95})	2000	2000	Max	(4)	705	Mean	(2)
	Dibenzofuran	ug/kg	697	2030 (NP-C_{95})	610 J	610	Max	(4)	610	Max	(5)
	Di-n-octylphthalate	ug/kg	716	2050 (NP-C_{95})	460 J	460	Max	(4)	460	Max	(5)
	Indeno(1,2,3-cd)pyrene	ug/kg	919	2900 (NP-$C_{97.5}$)	5100 J	2900	UCL-$C_{97.5}$	(6)	919	Mean	(2)
	Pentachlorophenol	ug/kg	1950	4820 (NP-$C_{97.5}$)	21000	4820	UCL-$C_{97.5}$	(6)	1950	Mean	(2)
	Total 2,3,7,8-TCDD TEQ	pg/g	172	3610 (T-$C_{97.5}$)	1667.7	1667.7	Max	(4)	172	Mean	(2)
	Aluminum	ug/kg	13000000	14300000 (N)	20000000	14300000	UCL-N	(7)	13000000	Mean	(2)
	Arsenic	ug/kg	4560	6070 (G)	14000 []	6070	UCL-G	(8)	4560	Mean	(2)
	Chromium	ug/kg	31100	38100 (NP-Mt)	81600	38100	UCL-Mt	(9)	31100	Mean	(2)
	Cobalt	ug/kg	22600	66000 (NP-C_{95})	176000	66000	UCL-C_{95}	(3)	22600	Mean	(2)
	Iron	ug/kg	28000000	51800000 (NP-C_{95})	105000000	51800000	UCL-C_{95}	(3)	28000000	Mean	(2)
	Manganese	ug/kg	2360000	17200000 (NP-C_{99})	25500000 J	17200000	UCL-C_{99}	(1)	2360000	Mean	(2)
	Vanadium	ug/kg	40200	44100 (N)	63600 []	44100	UCL-N	(7)	40200	Mean	(2)

Notes

EPC = Exposure Point Concentration
J = estimated value
[] = Analyte present. As values approach the Instrument Detection Limit (IDL), the quantitation may not be accurate.

pg/g = picograms per gram
UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 99% Chebyshev method.
(2) The arithmetic mean concentration was used for the Central Tendency EPC.
(3) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) Maximum concentration used because the calculated mean exceeds maximum detected concentration.
(6) 95% UCL computed based on non-parametric data using EPA's ProUCL 97.5% Chebyshev method.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(8) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(9) 95% UCL computed based on non-parametric data using EPA's ProUCL Modified t.

(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software
(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(T) The log-transformed data conform to a normal distribution as determined by the Shapiro-Wilk normality test.

Table 5
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Current/Future
Medium Groundwater
Exposure Medium Groundwater OU3A Plume

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3A	1,2-Dichloroethane	ug/L	1.19	3.89 (NP-C_{99})	7.2	3.89	UCL-C_{99}	(1)	1.19	Mean	(2)
	1,2-Dichloropropane	ug/L	0 882	1.82 (NP-C_{95})	0.41 J	0.41	Max	(3)	0 41	Max	(4)
	1,3,5-Trimethylbenzene (Mesitylene)	ug/L	34.9	75.9 (G)	140	75.9	UCL-G	(5)	34.9	Mean	(2)
	1,4-Dichlorobenzene	ug/L	0.875	3.02 (NP-C_{99})	0.49 J	0.49	Max	(3)	0.49	Max	(4)
	Azulene	ug/L	2 26	NC (S)	4.1	4.1	Max	(3)	2 26	Mean	(2)
	Chloroform	ug/L	0.911	1.84 (NP-C_{95})	0.63	0.63	Max	(3)	0.63	Max	(4)
	Ethylbenzene	ug/L	19	92.3 (NP-C_{99})	260	92.3	UCL-C_{99}	(1)	19	Mean	(2)
	Xylenes (total)	ug/L	78.3	128 (G_{adj})	620	128	UCL-G_{adj}	(6)	78.3	Mean	(2)
	1,2,4-Trimethylbenzene	ug/L	44 6	93.3 (G)	240	93.3	UCL-G	(5)	44 6	Mean	(2)
	1-Methylnaphthalene	ug/L	19.6	34 6 (N)	51	34.6	UCL-N	(7)	19.6	Mean	(2)
	2,4,6-Trichlorophenol	ug/L	5.15	8.59 (NP-C_{95})	23	8 59	UCL-C_{95}	(8)	5.15	Mean	(2)
	4,6-Dinitro-2-Methylphenol	ug/L	10 2	10.3 (NP-Mt)	12 J	10.3	UCL-Mt	(9)	10.2	Mean	(2)
	4-Chloro-3-Methylphenol	ug/L	2 59	2.74 (NP-Mt)	1.2 J	1.2	Max	(9)	1 2	Max	(4)
	Bis(2-chloroethoxy) methane	ug/L	2.68	2.86 (NP-Mt)	4.9 J	2 86	UCL-Mt	(9)	2.68	Mean	(2)
	Dimethyl Phthalate	ug/L	2 59	2 74 (NP-Mt)	1.1 J	1 1	Max	(9)	1.1	Max	(4)
	Indene	ug/L	11.4	19 (N)	26	19	UCL-N	(7)	11.4	Mean	(2)
	Barium (total)	ug/L	402	3230 (NP-C_{99})	9780	3230	UCL-C_{99}	(1)	402	Mean	(2)
	Beryllium (total)	ug/L	2.33	3 73 (NP-C_{95})	10.4	3.73	UCL-C_{95}	(8)	2.33	Mean	(2)
	Cadmium (total)	ug/L	3 5	4 39 (NP-Mt)	12.6	4.39	UCL-Mt	(9)	3.5	Mean	(2)
	Copper (total)	ug/L	76 3	736 (NP-C_{99})	1270	736	UCL-C_{99}	(1)	76.3	Mean	(2)
	Mercury (dissolved)	ug/L	0 113	0 134 (NP-Mt)	0.43	0 134	UCL-Mt	(9)	0.113	Mean	(2)
	Nickel (total)	ug/L	20.4	28.9 (T-H)	238	28 9	UCL-H	(10)	20.4	Mean	(2)
	Zinc (total)	ug/L	233	477 (T-C_{95})	1760 J	477	UCL-C_{95}	(11)	233	Mean	(2)

Table 5
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium: Groundwater OU3A Plume

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale

Notes

EPC = Exposure Point Concentration

J = estimated value

NC = Not Calculated (too few observations)

UCL = upper confidence limit

ug/L = micrograms per liter

(1) 95% UCL computed based on nonparametric data using EPA's ProUCL 99% Chebyshev method.
(2) The arithmetic mean concentration was used for the Central Tendency EPC
(3) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(4) Maximum concentration used because the calculated mean exceeds maximum detected concentration.
(5) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(6) UCL computed based on gamma distribution using EPA's ProUCL Adjusted Gamma.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t
(8) 95% UCL computed based on nonparametric data using EPA's ProUCL 95% Chebyshev method.
(9) UCL computed based on non-parametric data using EPA's ProUCL Modified-t method.
(10) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(11) UCL computed based on lognormal data using EPA's ProUCL 95% Chebyshev method.

(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal A nonparametric UCL was computed using EPA's ProUCL software
(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(G_{adj}) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Adjusted Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(S) Unknown distribution (too few observations)
(T) The data follow the Lognormal Distribution.

Table 6
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	alpha-BHC	ug/L	0.00603	0.0075 (NP-Mt)	0.015 J	0.0075	UCL-Mt	(1)	0.00603	Mean	(2)
	beta-BHC	ug/L	0.00917	0.0204 (NP-C_{95})	0.038 J	0.0204	UCL-C_{95}	(3)	0.00917	Mean	(2)
	Aldrin	ug/L	0.00632	0.00781 (NP-Mt)	0.0086 J	0.00781	UCL-Mt	(1)	0.00632	Mean	(2)
	Dieldrin	ug/L	0.0646	0.321 (NP-C_{99})	0.34	0.321	UCL-C_{99}	(4)	0.0646	Mean	(2)
	Heptachlor Epoxide	ug/L	0.00627	0.00819 (NP-Mt)	0.018 J	0.00819	UCL-Mt	(1)	0.00627	Mean	(2)
	Benzene	ug/L	2.86	7.48 (NP-C_{99})	0.49 J	0.49	Max	(5)	0.49	Max	(6)
	Methyl tert-butyl ether (MTBE)	ug/L	2.46	6.18 (NP-C_{99})	4 J	4	Max	(5)	2.46	Mean	(2)
	1,1,2,2-Tetrachloroethane	ug/L	2.23	6.45 (NP-C_{99})	6 J	6	Max	(5)	2.23	Mean	(2)
	Tetrachloroethylene (PCE)	ug/L	2.67	7.31 (NP-C_{99})	1 J	1	Max	(5)	1	Max	(6)
	Trichloroethylene (TCE)	ug/L	2.35	6.54 (NP-C_{99})	0.17 J	0.17	Max	(5)	0.17	Max	(6)
	2-Methylnaphthalene	ug/L	60.8	360 (NP-$C_{97.5}$)	2400	360	UCL-$C_{97.5}$	(7)	60.8	Mean	(2)
	Acenaphthene	ug/L	15.9	53.3 (NP-C_{95})	420 J	53.3	UCL-C_{95}	(3)	15.9	Mean	(2)
	Acetophenone	ug/L	17.8	62 (NP-C_{95})	120 J	62	UCL-C_{95}	(3)	17.8	Mean	(2)
	Anthracene	ug/L	13	42.8 (NP-C_{95})	340 J	42.8	UCL-C_{95}	(3)	13	Mean	(2)
	Benzo(a)anthracene	ug/L	18.3	82.6 (NP-$C_{97.5}$)	0.99 J	0.99	Max	(5)	0.99	Max	(6)
	Benzo(a)pyrene	ug/L	21.2	143 (NP-C_{99})	1.1 J	1.1	Max	(5)	1.1	Max	(6)
	Benzo(b)fluoranthene	ug/L	21.2	143 (NP-C_{99})	1.7 J	1.7	Max	(5)	1.7	Max	(6)
	Biphenyl	ug/L	14.2	44.8 (NP-C_{95})	340 J	44.8	UCL-C_{95}	(3)	14.2	Mean	(2)
	Bis(2-ethylhexyl)phthalate	ug/L	25.9	195 (NP-C_{99})	130 J	130	Max	(5)	25.9	Mean	(2)
	Dibenzofuran	ug/L	16.6	40.3 (NP-$C_{97.5}$)	180 J	40.3	UCL-$C_{97.5}$	(7)	16.6	Mean	(2)
	Fluorene	ug/L	17.7	80.9 (NP-$C_{97.5}$)	490 J	80.9	UCL-$C_{97.5}$	(7)	17.7	Mean	(2)
	Indeno(1,2,3-cd)pyrene	ug/L	21.6	146 (NP-C_{99})	0.66 J	0.66	Max	(5)	0.66	Max	(6)
	Naphthalene	ug/L	39.7	239 (NP-$C_{97.5}$)	1600	239	UCL-$C_{97.5}$	(7)	39.7	Mean	(2)
	Pentachlorophenol	ug/L	120	572 (NP-$C_{97.5}$)	3500	572	UCL-$C_{97.5}$	(7)	120	Mean	(2)
	Phenanthrene	ug/L	43.1	223 (NP-$C_{97.5}$)	1400	223	UCL-$C_{97.5}$	(7)	43.1	Mean	(2)
	Pyrene	ug/L	11	33.1 (NP-C_{95})	250 J	33.1	UCL-C_{95}	(3)	11	Mean	(2)
	Total 2,3,7,8-TCDD TEQ	pg/L	97000	496000 (G_{adj})	1181770	496000	UCL-G_{adj}	(8)	97000	Mean	(2)

Table 6
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Median EPC Value	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Median EPC Statistic	Median EPC Rationale
OU3B	Aluminum (Total)	ug/L	16800	NC (S)	42000	42000	Max	(5)	16800	Mean	(2)
	Antimony (Dissolved)	ug/L	21.1	NC (S)	3.3 J	3	Max	(5)	3.3	Max	(6)
	Arsenic (Dissolved)	ug/L	4.3	NC (S)	2.9 J	3	Max	(5)	2.9	Max	(6)
	Chromium (Total)	ug/L	25.6	NC (S)	56.1	56.1	Max	(5)	25.6	Mean	(2)
	Cobalt (Total)	ug/L	16.4	NC (S)	37.7 J	38	Max	(5)	16.4	Mean	(2)
	Iron (Total)	ug/L	24900	NC (S)	52900	52900	Max	(5)	24900	Mean	(2)
	Lead (Total)	ug/L	19.3	NC (S)	27.1	27.1	Max	(5)	19.3	Mean	(2)
	Manganese (Total)	ug/L	1570	NC (S)	2770	2770	Max	(5)	1570	Mean	(2)
	Vanadium (Total)	ug/L	51.3	NC (S)	102	102	Max	(5)	51.3	Mean	(2)

Notes.

EPC = Exposure Point Concentration
J = estimated value
NC = not calculated (too few observations)

pg/L = picograms per liter
UCL = upper confidence limit
ug/L = micrograms per liter

(1) UCL computed based on non-parametric data using EPA's ProUCL Modified t.
(2) The arithmetic mean concentration was used for the Central Tendency EPC.
(3) 95% UCL computed based on nonparametric data using EPA's ProUCL 95% Chebyshev method.
(4) 95% UCL computed based on nonparametric data using EPA's ProUCL 99% Chebyshev method.
(5) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(6) Maximum concentration used because the calculated mean exceeds maximum detected concentration.
(7) 95% UCL computed based on nonparametric data using EPA's ProUCL 97.5% Chebyshev method.
(8) UCL computed based on gamma distribution using EPA's ProUCL Adjusted Gamma.

(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G_{adj}) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Adjusted Gamma
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(S) Unknown distribution (too few observations).

Table 7
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Current/Future

Medium. Groundwater

Exposure Medium: Indoor Air (Vapor Intrusion) OU3A

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure				Central Tendency			
						Median EPC Value	Units	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Units	Median EPC Statistic	Median EPC Rationale
OU3A	1,2-Dichloroethane	ug/L	1.19	3.89 (NP-C_{99})	7.2	8.23E-02	ug/m^3	UCL-C_{99}	(1)	2.52E-02	ug/m^3	Mean	(2)
	1,3,5-Trimethylbenzene	ug/L	34.9	75.9 (G)	140	4.76E+00	ug/m^3	UCL-G	(3)	2.19E+00	ug/m^3	Mean	(2)
	Azulene	ug/L	2.26	NC (S)	4.1	9.70E-01	ug/m^3	Max	(4)	5.35E-01	ug/m^3	Mean	(2)
	Benzene	ug/L	23	35.7 (G_{adj})	210	3.84E+00	ug/m^3	UCL-G_{adj}	(5)	2.47E+00	ug/m^3	Mean	(2)
	Isopropylbenzene (cumene)	ug/L	7.16	9.84 (G)	37	1.17E+02	ug/m^3	UCL-G	(3)	8.51E+01	ug/m^3	Mean	(2)
	Xylenes (Total)	ug/L	78.3	128 (G_{adj})	620	1.27E+01	ug/m^3	UCL-G_{adj}	(5)	7.77E+00	ug/m^3	Mean	(2)
	1,2,4-Trimethylbenzene	ug/L	44.6	93.3 (G)	240	6.14E+00	ug/m^3	UCL-G	(3)	2.94E+00	ug/m^3	Mean	(2)
	Indene	ug/L	11.4	19 (N)	26	4.00E-01	ug/m^3	UCL-N	(6)	2.40E-01	ug/m^3	Mean	(2)

Notes:

EPC = Exposure Point Concentration

UCL = upper confidence limit

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

(1) Modeled value from maximum groundwater concentration using Johnson-Ettinger Model (See Appendix)

(1) Modeled value from maximum groundwater concentration using Johnson-Ettinger Model (See Appendix)

(2) Modeled value from mean groundwater concentration using Johnson-Ettinger Model (See Appendix)

(3) Modeled value from calculated UCL groundwater concentration using Johnson-Ettinger Model (See Appendix)

(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.

($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.

(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.

Table 8
EXPOSURE POINT CONCENTRATION SUMMARY
Havertown PCP Site

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Indoor Air (Vapor Intrusion) OU3B

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure				Central Tendency			
						Median EPC Value	Units	Median EPC Statistic	Median EPC Rationale	Median EPC Value	Units	Median EPC Statistic	Median EPC Rationale
OU3B	1,1,2,2-Tetrachloroethane	ug/L	2.23	6.45 (NP-C_{99})	6 J	3.14E-02	ug/m^3	Max	(1)	1.17E-02	ug/m^3	Mean	(2)
	Tetrachloroethylene (PCE)	ug/L	2.67	7.31 (NP-C_{99})	1 J	2.69E-01	ug/m^3	Max	(1)	2.69E-01	ug/m^3	Max	(1)
	Trichloroethylene (TCE)	ug/L	2.35	6.54 (NP-C_{99})	0.17 J	3.01E-02	ug/m^3	Max	(1)	3.01E-02	ug/m^3	Max	(1)
	2-Methylnaphthalene	ug/L	60.8	360 (NP-$C_{97.5}$)	2400	1.43E+00	ug/m^3	UCL-$C_{97.5}$	(3)	2.42E-01	ug/m^3	Mean	(2)
	Naphthalene	ug/L	39.7	239 (NP-$C_{97.5}$)	1600	1.24E+00	ug/m^3	UCL-$C_{97.5}$	(3)	2.06E-01	ug/m^3	Mean	(2)
	Phenanthrene	ug/L	43.1	223 (NP-$C_{97.5}$)	1400	1.49E+02	ug/m^3	UCL-$C_{97.5}$	(3)	2.87E+01	ug/m^3	Mean	(2)

Notes:

EPC = Exposure Point Concentration
J = estimated value
UCL = upper confidence limit

ug/L = micrograms per liter
ug/m^3 = micrograms per cubic meter

(1) Modeled value from maximum groundwater concentration using Johnson-Ettinger Model (See Appendix)
(2) Modeled value from mean groundwater concentration using Johnson-Ettinger Model (See Appendix)
(3) Modeled value from calculated UCL groundwater concentration using Johnson-Ettinger Model (See Appendix)

(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.

TABLE 9
CANCER TOXICITY DATA -- ORAL/DERMAL
Havertown PCP Site

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	1.7E+01	(mg/kg-day)$^{-1}$	1	1.7E+01	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
alpha-BHC	6.3E+00	(mg/kg-day)$^{-1}$	1	6.3E+00	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
beta-BHC	1.8E+00	(mg/kg-day)$^{-1}$	1	1.8E+00	(mg/kg-day)$^{-1}$	C	IRIS	6/20/2006
Dieldrin	1.6E+01	(mg/kg-day)$^{-1}$	1	1.6E+01	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
Heptachlor Epoxide	9.1E+00	(mg/kg-day)$^{-1}$	1	9.1E+00	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
PCBs (soil, food, sediment, dust)	2.0E+00	(mg/kg-day)$^{-1}$	1	2.0E+00	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
PCBs (water)	4.0E-01	(mg/kg-day)$^{-1}$	1	4.0E-01	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
Azulene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Benzene	5.5E-02	(mg/kg-day)$^{-1}$	1	5.5E-02	(mg/kg-day)$^{-1}$	A	IRIS	6/20/2006
Chloroform	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	6/20/2006
1,4-Dichlorobenzene	2.4E-02	(mg/kg-day)$^{-1}$	1	2.4E-02	(mg/kg-day)$^{-1}$	C	HEAST	07/31/1997
1,2-Dichloroethane	9.1E-02	(mg/kg-day)$^{-1}$	1	9.1E-02	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
1,2-Dichloropropane	6.8E-02	(mg/kg-day)$^{-1}$	1	6.8E-02	(mg/kg-day)$^{-1}$	B2	HEAST	07/31/1997
Ethylbenzene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Indene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Isopropylbenzene (cumene)	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
methylcyclohexane	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Methyl tert-butyl ether	4.0E-03	(mg/kg-day)$^{-1}$	1	4.0E-03	(mg/kg-day)$^{-1}$	Unknown	EPA Region 3	10/25/2005
1,1,2,2-Tetrachloroethane	2.00E-01	(mg/kg-day)$^{-1}$	1	2.0E-01	(mg/kg-day)$^{-1}$	C	IRIS	6/20/2006
Tetrachloroethylene (PCE)	5.40E-01	(mg/kg-day)$^{-1}$	1	5.40E-01	(mg/kg-day)$^{-1}$	B2	CalEPA	11/10/2005
Trichloroethylene (TCE)	4.0E-01	(mg/kg-day)$^{-1}$	1	4.0E-01	(mg/kg-day)$^{-1}$	B2	NCEA	08/01/2001
1,2,4-Trimethylbenzene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
1,3,5-Trimethylbenzene (mesitylene)	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Xylenes (Total)	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	Inadequate	IRIS	6/20/2006
Acenaphthene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Acetophenone	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Anthracene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Benzo(a)anthracene	7.3E-01	(mg/kg-day)$^{-1}$	1	7.3E-01	(mg/kg-day)$^{-1}$	B2	NCEA	11/10/2005
Benzo(a)pyrene	7.3E+00	(mg/kg-day)$^{-1}$	1	7.3E+00	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
Benzo(b)fluoranthene	7.3E-01	(mg/kg-day)$^{-1}$	1	7.3E-01	(mg/kg-day)$^{-1}$	B2	NCEA	11/10/2005
Biphenyl	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Bis(2-chloroethoxy)methane	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Bis(2-ethylhexyl)phthalate	1.4E-02	(mg/kg-day)$^{-1}$	0.55	2.5E-02	(mg/kg-day)$^{-1}$	B2	IRIS	6/20/2006
Dibenzo(a,h)anthracene	7.3E+00	(mg/kg-day)$^{-1}$	1	7.3E+00	(mg/kg-day)$^{-1}$	B2	NCEA	11/10/2005
Dibenzofuran	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Dimethyl Phthalate	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Di-n-octylphthalate	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A
Fluorene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	D	IRIS	6/20/2006
Indeno(1,2,3-cd)pyrene	7.3E-01	(mg/kg-day)$^{-1}$	1	7.3E-01	(mg/kg-day)$^{-1}$	B2	NCEA	2/13/2006
1-Methylnaphthalene	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	(mg/kg-day)$^{-1}$	N/A	N/A	N/A

TABLE 9
CANCER TOXICITY DATA – ORAL/DERMAL
Havertown PCP Site

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
2-Methylnaphthalene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
4,6-Dinitro-2-Methylphenol	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
4-Chloro-3-Methylphenol	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Naphthalene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Pentachlorophenol	1.2E-01	$(mg/kg\text{-}day)^{-1}$	1	1.2E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	6/20/2006
Phenanthrene (7)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Pyrene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
2,4,6-Trichlorophenol	1.1E-02	$(mg/kg\text{-}day)^{-1}$	1	1.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	6/20/2006
Total 2,3,7,8-TCDD TEQ	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1	1.5E+05	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	07/31/1997
Aluminum	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Antimony	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	6/20/2006
Barium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Beryllium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Cadmium (Food)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Cadmium (Water)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Chromium III	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Chromium VI	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Cobalt	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	PPRTV	09/02/2004
Copper	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Iron	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	6/20/2006
Manganese (Food)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Manganese (NonFood)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Mercuric Chloride	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	6/20/2006
Mercury (Elemental)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006
Mercury (Methyl)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	6/20/2006
Nickel (Soluble Salts)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Zinc	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	6/20/2006

CSF - Cancer Slope Factor
N/A - Not Available
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
mg/kg-day - milligrams per kilogram per day
NCEA - National Center for Environmental Assessment
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

EPA Group
A - Human carcinogen
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D -Not Classified

(1) RAGS A (1989); RAGS E (2004), see explanation of derivation provided in the text. Note: Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS E 2004
(2) Adjusted Dermal Slope Factor (1/mg/kg/day) = Oral Cancer Slope Factor (1/mg/kg/day) divided by Oral to Dermal Adjustment Factor
(3) IRIS values obtained from the IRIS database (Date Indicated). HEAST values obtained from HEAST, July 1997; NCEA values obtained from NCEA (Date Indicated)

TABLE 10
CANCER TOXICITY DATA – INHALATION
Havertown PCP Site

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s) (2)	Date(s) (MM/DD/YYYY)
Aldrin	4.9E-03	(ug/m^3)$^{-1}$	1.7E+01	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
alpha-BHC	1.8E-03	(ug/m^3)$^{-1}$	6.3E+00	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
beta-BHC	5.3E-04	(ug/m^3)$^{-1}$	1.8E+00	(mg/kg/-day/)$^{-1}$	C	IRIS	6/20/2006
Dieldrin	4.6E-03	(ug/m^3)$^{-1}$	1.6E+01	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
Heptachlor Epoxide	2.6E-03	(ug/m^3)$^{-1}$	9.1E+00	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
PCBs (dust)	5.5E-04	(ug/m^3)$^{-1}$	2.0E+00	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
PCBs (vapor)	1.0E-04	(ug/m^3)$^{-1}$	4.0E-01	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
Azulene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	N/A	N/A
Benzene	7.8E-06	(ug/m^3)$^{-1}$	2.7E-02	(mg/kg/-day/)$^{-1}$	A	IRIS	6/20/2006
Chloroform	2.3E-05	(ug/m^3)$^{-1}$	8.1E-02	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
1,4-Dichlorobenzene	6.3E-06	(ug/m^3)$^{-1}$	2.2E-02	(mg/kg/-day/)$^{-1}$	C	NCEA	provisional
1,2-Dichloroethane	2.6E-05	(ug/m^3)$^{-1}$	9.1E-02	(mg/kg/-day/)$^{-1}$	B2	IRIS	6/20/2006
1,2-Dichloropropane	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
Ethylbenzene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Indene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	N/A	N/A
Isopropylbenzene (cumene)	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
methylcyclohexane	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	N/A	N/A
Methyl tert-butyl ether	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
1,1,2,2-Tetrachloroethane	5.80E-05	(ug/m^3)$^{-1}$	2.0E-01	(mg/kg/-day/)$^{-1}$	C	IRIS	6/20/2006
Tetrachloroethylene (PCE)	5.9E-06	(ug/m^3)$^{-1}$	2.1E-02	(mg/kg/-day/)$^{-1}$	B2	CalEPA	11/10/2005
Trichloroethylene (TCE)	1.1E-04	(ug/m^3)$^{-1}$	4.0E-01	(mg/kg/-day/)$^{-1}$	B2	NCEA	08/01/2001
1,2,4-Trimethylbenzene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
1,3,5-Trimethylbenzene (mesitylene)	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
Xylenes (Total)	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	Inadequate	IRIS	6/20/2006
Acenaphthene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
Acetophenone	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Anthracene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Benzo(a)anthracene	8.8E-05	(ug/m^3)$^{-1}$	3.1E-01	(mg/kg/-day/)$^{-1}$	B2	NCEA	11/10/2005
Benzo(a)pyrene	8.8E-04	(ug/m^3)$^{-1}$	3.1E+00	(mg/kg/-day/)$^{-1}$	B2	NCEA	11/10/2005
Benzo(b)fluoranthene	8.8E-05	(ug/m^3)$^{-1}$	3.1E-01	(mg/kg/-day/)$^{-1}$	B2	NCEA	11/10/2005
Biphenyl	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Bis(2-chloroethoxy)methane	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
Bis(2-ethylhexyl)phthalate	4.0E-06	(ug/m^3)$^{-1}$	1.4E-02	(mg/kg/-day/)$^{-1}$	B2	NCEA	11/10/2005
Dibenzo(a,h)anthracene	8.8E-04	(ug/m^3)$^{-1}$	3.1E+00	(mg/kg/-day/)$^{-1}$	B2	NCEA	11/10/2005
Dibenzofuran	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Dimethyl Phthalate	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Di-n-octylphthalate	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A
Fluorene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	D	IRIS	6/20/2006
Indeno(1,2,3-cd)pyrene	8.8E-05	(ug/m^3)$^{-1}$	3.1E-01	(mg/kg/-day/)$^{-1}$	B2	NCEA	2/13/2006
1-Methylnaphthalene	N/A	(ug/m^3)$^{-1}$	N/A	(mg/kg/-day/)$^{-1}$	N/A	NA	N/A

TABLE 10
CANCER TOXICITY DATA -- INHALATION
Havertown PCP Site

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk, Inhalation CSF	
	Value	Units	Value	Units		Source(s) (2)	Date(s) (MM/DD/YYYY)
2-Methylnaphthalene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
4,6-Dinitro-2-Methylphenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
4-Chloro-3-Methylphenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
Naphthalene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Pentachlorophenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Phenanthrene (7)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Pyrene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
2,4,6-Trichlorophenol	3.1E-06	$(ug/m^3)^{-1}$	1E-02	$(mg/kg/-day/)^{-1}$	B2	IRIS	6/20/2006
Total 2,3,7,8-TCDD TEQ	3.3E+01	$(ug/m^3)^{-1}$	1.5E+05	$(mg/kg/-day/)^{-1}$	B2	HEAST	07/31/1997
Aluminum	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Antimony	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg/-day/)^{-1}$	A	IRIS	6/20/2006
Barium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Beryllium	2.4E-03	$(ug/m^3)^{-1}$	8.4E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	6/20/2006
Cadmium (Food)	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	6/20/2006
Cadmium (Water)	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	6/20/2006
Chromium III	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Chromium VI	1.2E-02	$(ug/m^3)^{-1}$	4.1E+01	$(mg/kg/-day/)^{-1}$	A	IRIS	6/20/2006
Cobalt	2.8E-03	$(ug/m^3)^{-1}$	9.8E+00	$(mg/kg/-day/)^{-1}$	B1	PPRTV	09/02/2004
Copper	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Iron	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Lead	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	B2	IRIS	6/20/2006
Manganese (Food)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Manganese (NonFood)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Mercuric Chloride	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	C	IRIS	6/20/2006
Mercury (Elemental)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006
Mercury (Methyl)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	C	IRIS	6/20/2006
Nickel (Soluble Salts)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Zinc	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	6/20/2006

CSF - Cancer Slope Factor
N/A - Not Available
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
mg/kg-day - milligrams per kilogram per day
NCEA - National Center for Environmental Assessment
ug/m^3 - micrograms per cubic meter
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

EPA Group
A - Human carcinogen
B1 - Probable human carcinogen - Indicates limited human data are available
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans

(1) RAGS A (1989), RAGS E (2001), see explanation of derivation provided in the text.
(2) IRIS values obtained from the IRIS database (Date Indicated), NCEA values obtained from NCEA (Date Indicated)

TABLE 11

NON-CANCER TOXICITY DATA – ORAL/DERMAL

Havertown PCP Site

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD Target Organ(s)	
		Value	Units		Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	Chronic	3E-05	mg/kg-day	1	3E-05	mg/kg-day	Liver	1000	IRIS	6/20/2006
alpha-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
beta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dieldrin	Chronic	5E-05	mg/kg-day	1	5E-05	mg/kg-day	Liver	100	IRIS	6/20/2006
Heptachlor Epoxide	Chronic	1.3E-05	mg/kg-day	1	1.3E-05	mg/kg-day	Increased Liver Weight	1000	IRIS	6/20/2006
PCB-1254 (aroclor 1254)	Chronic	2E-05	mg/kg-day	1	2.0E-05	mg/kg-day	Eyes, nails, blood	300	IRIS	6/20/2006
Azulene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	4E-03	mg/kg-day	1	4E-03	mg/kg-day	Blood/Immune	300	IRIS	6/20/2006
Chloroform	Chronic	1E-02	mg/kg-day	1	1E-02	mg/kg-day	Liver	1000	IRIS	6/20/2006
1,4-Dichlorobenzene	Chronic	3E-02	mg/kg-day	1	3E-02	mg/kg-day	Unknown	Unknown	NCEA	provisional
1,2-Dichloroethane	Chronic	2E-02	mg/kg-day	1	2E-02	mg/kg-day	Kidney	3000	NCEA	PPRTV
1,2-Dichloropropane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ethylbenzene	Chronic	1E-01	mg/kg-day	1	1E-01	mg/kg-day	Liver/Kidney	1000	IRIS	6/20/2006
Indene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Isopropylbenzene (cumene)	Chronic	1E-01	mg/kg-day	1	1E-01	mg/kg-day	Kidney	1000	IRIS	6/20/2006
methylcyclohexane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Methyl tert-butyl ether	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	Chronic	4E-02	mg/kg-day	1	4E-02	mg/kg-day	Respiratory System	1000	ATSDR	6/20/2006
Tetrachloroethylene (PCE)	Chronic	1E-02	mg/kg-day	1	1E-02	mg/kg-day	Liver/Body Weight	1000	IRIS	6/20/2006
Trichloroethylene (TCE)	Chronic	3E-04	mg/kg-day	1	3E-04	mg/kg-day	Liver/Kidneys/Fetus	3000	NCEA	08/01/2001
1,2,4-Trimethylbenzene	Chronic	5E-02	mg/kg-day	1	5E-02	mg/kg-day	Body Weight	3000	NCEA	06/09/2006
1,3,5-Trimethylbenzene (mesitylene)	Chronic	5E-02	mg/kg-day	1	5E-02	mg/kg-day	Body Weight	3000	NCEA	06/09/2006
Xylenes (Total)	Chronic	2E-01	mg/kg-day	1	2E-01	mg/kg-day	Decreased Body Weight/Increased Mortality	1000	IRIS	6/20/2006
Acenaphthene	Chronic	6E-02	mg/kg-day	1	6E-02	mg/kg-day	Liver	3000	IRIS	6/20/2006
Acetophenone	Chronic	1E-01	mg/kg-day	1	1E-01	mg/kg-day	General Toxicity	3000	IRIS	6/20/2006
Anthracene	Chronic	3E-01	mg/kg-day	1	3E-01	mg/kg-day	None	3000	IRIS	6/20/2006
Benzo(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biphenyl	Chronic	5E-02	mg/kg-day	1	5E-02	mg/kg-day	Kidney	1000	IRIS	6/20/2006
Bis(2-chloroethoxy)methane	Chronic	3E-03	mg/kg-day	1	3E-03	mg/kg-day	Liver	3000	NCEA	06/09/2006
Bis(2-ethylhexyl)phthalate	Chronic	2E-02	mg/kg-day	0.55	1E-02	mg/kg-day	Increased Liver Weight	1000	IRIS	6/20/2006
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzofuran	Chronic	2E-03	mg/kg-day	1	2E-03	mg/kg-day	Kidney	10000	EPA Region 3	05/25/2004
Dimethyl Phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	Chronic	2E-02	mg/kg-day	1	2E-02	mg/kg-day	Liver, Kidney	1000	HEAST	07/31/1997
Fluorene	Chronic	4E-02	mg/kg-day	1	4E-02	mg/kg-day	Blood	3000	IRIS	6/20/2006
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-Methylnaphthalene	Chronic	7E-02	mg/kg-day	1	7E-02	mg/kg-day	Respiratory System	1000	ATSDR	6/20/2006
2-Methylnaphthalene	Chronic	4E-03	mg/kg-day	1	4E-03	mg/kg-day	Respiratory System	1000	IRIS	6/20/2006
4,6-Dinitro-2-Methylphenol	Chronic	1E-04	mg/kg-day	1	1E-04	mg/kg-day	Eye	3000	NCEA	PPRTV
4-Chloro-3-Methylphenol	Subchronic	7E-01	mg/kg-day	1	7E-01	mg/kg-day	Body Weight	300	NCEA	PPRTV
4-Chloro-3-Methylphenol	Chronic	7E-02	mg/kg-day	1	7E-02	mg/kg-day	Body Weight	3000	NCEA	PPRTV

TABLE 11

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Havertown PCP Site

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Adjustment Factor	Adjusted Dermal RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD Target Organ(s)	
		Value	Units	(1)	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Naphthalene	Chronic	2E-02	mg/kg-day	1	2E-02	mg/kg-day	Decreased Body Weight	3000	IRIS	6/20/2006
Pentachlorophenol	Chronic	3E-02	mg/kg-day	1	3E-02	mg/kg-day	Liver, Kidney	100	IRIS	6/20/2006
Phenanthrene (4)	Chronic	3E-02	mg/kg-day	1	3E-02	mg/kg-day	Kidney	3000	IRIS	6/20/2006
Pyrene	Chronic	3E-02	mg/kg-day	1	3E-02	mg/kg-day	Kidney	3000	IRIS	6/20/2006
2,4,6-Trichlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total 2,3,7,8-TCDD TEQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum	Chronic	1E+00	mg/kg-day	0.005	5.0E-03	mg/kg-day	CNS-(Developmental)	100	PPRTV	06/10/2004
Antimony	Chronic	4E-04	mg/kg-day	0.15	6E-05	mg/kg-day	Blood / Liver	1000	IRIS	6/20/2006
Arsenic	Chronic	3E-04	mg/kg-day	1	3E-04	mg/kg-day	Skin, Vascular	3	IRIS	6/20/2006
Barium	Chronic	2E-01	mg/kg-day	0.07	1.4E-02	mg/kg-day	Kidney	300	IRIS	6/20/2006
Beryllium	Chronic	2E-03	mg/kg-day	0.007	1E-05	mg/kg-day	GI Tract	300	IRIS	6/20/2006
Cadmium (Food)	Chronic	1E-03	mg/kg-day	0.025	2.5E-05	mg/kg-day	Proteinuria	10	IRIS	6/20/2006
Cadmium (Water)	Chronic	5E-04	mg/kg-day	0.05	2.5E-05	mg/kg-day	Proteinuria	10	IRIS	6/20/2006
Chromium III	Chronic	1 5E+00	mg/kg-day	0.013	2.0E-02	mg/kg-day	Liver / Spleen	1000	IRIS	6/20/2006
Chromium VI	Chronic	3 0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	Fetus (Developmental) / Gastrointestinal	900	IRIS	6/20/2006
Cobalt	Chronic	2 0E-02	mg/kg-day	0 3	6.0E-03	mg/kg-day	Blood	10	PPRTV	09/02/2004
Copper	Chronic	4E-02	mg/kg-day	1	4E-02	mg/kg-day	GI Tract	N/A	HEAST	07//31/1997
Iron	Chronic	3E-01	mg/kg-day	1	3E-01	mg/kg-day	Blood / Liver / GI	1	NCEA	11/14/2001
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (Food)	Chronic	1.4E-01	mg/kg-day	0.04	5.6E-03	mg/kg-day	CNS Effects	1	IRIS	6/20/2006
Manganese (NonFood)	Chronic	2E-02	mg/kg-day	0.04	8E-04	mg/kg-day	CNS Effects	3	EPA Region 3	10/25/2005
Mercuric Chloride	Chronic	3E-04	mg/kg-day	0.07	2.1E-05	mg/kg-day	Autoimmune Effects	1000	IRIS	6/20/2006
Mercury (Elemental)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (Methyl)	Chronic	1E-04	mg/kg-day	1	1E-04	mg/kg-day	Developmental, neuropsychological impairment	10	IRIS	6/20/2006
Nickel (Soluble Salts)	Chronic	2E-02	mg/kg-day	0.04	8E-04	mg/kg-day	Decreased Body Weight/Organ Weight	300	IRIS	6/20/2006
Vanadium	Chronic	1E-03	mg/kg-day	0.026	2.6E-05	mg/kg-day	Kidney	300	NCEA	06/10/2004
Zinc	Chronic	3E-01	mg/kg-day	1	3E-01	mg/kg-day	ESOD (Blood)	3	IRIS	6/20/2006

N/A - Not Available

IRIS - Integrated Risk Information System

HEAST - Health Effects Assessment Summary Tables

NCEA - National Center for Environmental Assessment

PPRTV - Provisional Peer Reviewed Toxicity Value

ESOD - Erythrocyte Superoxide Dismutase

CNS - Central Nervous System

GI - Gastrointestinal

mg/kg-day - milligrams per killogram per day

RfD - Reference Dose

2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

(1) Refer to RAGS Part E (2004) and text for explanation. Note Oral to Dermal Adjustment Factors from Exhibit 4-1, RAGS Part E 2004

(2) See RAGS Part E (2004), Page 4-3. Note Dermal RfD (mg/kg) = Oral RfD (mg/kg) x Oral to Dermal Adjustment Factor

(3) IRIS values obtained from the IRIS database (Date Indicated), HEAST values obtained from HEAST, July 1997, NCEA values obtained from NCEA (Date Indicated)

(4) Used pyrene as a surrogate

TABLE 12
NON-CANCER TOXICITY DATA – INHALATION
Havertown PCP Site

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC Target Organ(s)	
		Value	Units	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
alpha-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
beta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dieldrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heptachlor Epoxide	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1254 (aroclor 1254)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Azulene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	3E-02	mg/m^3	8.6E-03	mg/kg-day	Blood / Immune	300	IRIS	6/20/2006
Chloroform	Chronic	5E-02	mg/m^3	1.4E-02	mg/kg-day	Unknown	Unknown	NCEA	provisional
1,4-Dichlorobenzene	Chronic	8E-01	mg/m^3	2 3E-01	mg/kg-day	Increased Liver Weight	100	IRIS	6/20/2006
1,2-Dichloroethane	Chronic	2E+00	mg/m^3	7 0E-01	mg/kg-day	Liver	90	ATSDR	9//2001
1 2-Dichloropropane	Chronic	4E-03	mg/m^3	1.1E-03	mg/kg-day	Hyperplasia of the nasal mucosa	300	IRIS	6/20/2006
Ethylbenzene	Chronic	1E+00	mg/m^3	2 9E-01	mg/kg-day	Developmental	300	IRIS	6/20/2006
Indene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Isopropylbenzene (cumene)	Chronic	4E-01	mg/m^3	1.1E-01	mg/kg-day	Kidney / Adrenal	1000	IRIS	6/20/2006
methylcyclohexane	Chronic	3E+00	mg/m^3	8.6E-01	mg/kg-day	Kidney	100	HEAST	07/31/1997
Methyl tert-butyl ether	Chronic	3E+00	mg/m^3	8 6E-01	mg/kg-day	Liver/Kidney	100	IRIS	6/20/2006
1,1,2,2-Tetrachloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene (PCE)	Chronic	3E-01	mg/m^3	7.7E-02	mg/kg-day	Neurologic Effects	100	ATSDR	9//1997
Trichloroethylene (TCE)	Chronic	4E-02	mg/m^3	1.1E-02	mg/kg-day	CNS/Liver/Endocrine System	1000	NCEA	08/01/2001
1,2,4-Trimethylbenzene	Chronic	6E-03	mg/m^3	1.7E-03	mg/kg-day	CNS, Respiratory, Blood	3000	NCEA	06/09/2006
1,3,5-Trimethylbenzene (mesitylene)	Chronic	6E-03	mg/m^3	1.7E-03	mg/kg-day	CNS Respiratory Blood	3000	NCEA	06/09/2006
Xylenes (Total)	Chronic	1E-01	mg/m^3	2.9E-02	mg/kg-day	Impaired Motor Coordination	300	IRIS	6/20/2006
Acenaphthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acetophenone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biphenyl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroethoxy)methane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NCEA	06/09/2006
Bis(2-ethylhexyl)phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzofuran	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimethyl Phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluorene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1-Methylnaphthalene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4 6-Dinitro-2-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Chloro-3-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 12
NON-CANCER TOXICITY DATA -- INHALATION
Havertown PCP Site

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC Target Organ(s)	
		Value	Units	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Naphthalene	Chronic	3E-03	mg/m^3	8 6E-04	mg/kg-day	Nasal Effects	3000	IRIS	6/20/2006
Pentachlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenanthrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total 2,3,7,8-TCDD TEQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum	Chronic	5E-03	mg/m^3	1.4E-03	mg/kg-day	CNS	300	PPRTV	6/10/2004
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barium	Chronic	5E-04	mg/m^3	1 4E-04	mg/kg-day	Reproduction	1000	HEAST	07//31/1997
Beryllium	Chronic	2E-05	mg/m^3	5.7E-06	mg/kg-day	Lung, Immune System	10	IRIS	6/20/2006
Cadmium (Food)	Chronic	2E-04	mg/m^3	5.7E-05	mg/kg-day	Kidney	N/A	NCEA	12/18/1998
Cadmium (Water)	Chronic	2E-04	mg/m^3	5 7E-05	mg/kg-day	Kidney	N/A	NCEA	12/18/1998
Chromium III	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium VI	Chronic	1E-04	mg/m^3	3E-05	mg/kg-day	Respiratory System	300	IRIS	6/20/2006
Cobalt	Chronic	2E-05	mg/m^3	5.7E-06	mg/kg-day	Respiratory System	100	PPRTV	09/02/04
Copper	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (Food)	Chronic	5.E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1	IRIS	6/20/2006
Manganese (NonFood)	Chronic	5.E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1	IRIS	6/20/2006
Mercuric Chloride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (Elemental)	Chronic	3E-04	mg/m^3	8.6E-05	mg/kg-day	CNS/Autonomic Dysfunction	30	IRIS	6/20/2006
Mercury (Methyl)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel (Soluble Salts)	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	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A - Not Available
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment
PPRTV - Provisional Peer Reviewed Toxicity Value
CNS - Central Nervous System
RfC - Reference Concentration
RfD - Reference Dose
mg/m^3 - milligrams per cubic meter
mg/kg-day - milligrams per kilogram per day
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

(1) Refer to RAGS, Part A and text for an explanation
(2) Adjusted Inhalation RfD (mg/kg/day) = Inhalation RfC (mg/m3) x 20 (m3/day) / 70 kg
(3) IRIS values obtained from the IRIS database (Date Indicated), HEAST values obtained from HEAST, July 1997 NCEA values obtained from NCEA (Date Indicated)

Table 13 Adult Resident RME OU3B Surface Water
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Surface Water
Exposure Medium Surface Water
Exposure Point: OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0 286	µg/L	0 286	µg/L	M	5.8E-09	mg/kg-day	5 00E-05	mg/kg-day	NA	NA	1.2E-04
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0 00000466	µg/L	M	9.5E-14	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	8.0E-06	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	8.0E-06
	Arsenic	4.7	µg/L	4.7	µg/L	M	9.6E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.2E-04
	(Total)												4.4E-04
Dermal	Dieldrin	0 286	µg/L	0.286	µg/L	M	2.1E-07	mg/kg-day	5.00E-05	mg/kg-day	NA	NA	4.1E-03
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0.00000466	µg/L	M	9.6E-11	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	3.6E-06	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	7.2E-04
	Arsenic	4.7	µg/L	4 7	µg/L	M	4.3E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.4E-04
	(Total)												5.0E-03
												Total Hazard Index Across All Exposure Routes/Pathways	5.4E-03

Notes
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Hazard Calculation: (M) Medium Specific, (R) Route Specific.
Ingestion Route EPC Value = Medium EPC Value.
Dermal Route EPC Value = Medium EPC Value
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Child Resident RME OU3B Surface Water
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Surface Water
Exposure Medium Surface Water
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0 286	µg/L	0.286	µg/L	M	2 5E-08	mg/kg-day	5 00E-05	mg/kg-day	NA	NA	4 9E-04
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0 00000466	µg/L	M	4 0E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	3 4E-05	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	3 4E-05
	Arsenic	4.7	µg/L	4 7	µg/L	M	4 0E-07	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	1 3E-03
	(Total)												1 9E-03
Dermal	Dieldrin	0 286	µg/L	0.286	µg/L	M	3 6E-07	mg/kg-day	5 00E-05	mg/kg-day	NA	NA	7 2E-03
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0.00000466	µg/L	M	1.7E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	6 3E-06	mg/kg-day	5 0E-03	mg/kg-day	NA	NA	1 3E-03
	Arsenic	4 7	µg/L	4 7	µg/L	M	7.5E-08	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	2.5E-04
	(Total)												8 7E-03
												Total Hazard Index Across All Exposure Routes/Pathways	1 1E-02

Notes:
Dermal intake calculations use values for DAevent from Appendix
EPC Selected for Hazard Calculation. (M) Medium Specific, (R) Route Specific.
Ingestion and Dermal Route EPC Value = Medium EPC Value
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Trespasser/Visitor RME OU3B Surface Water
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium: Surface Water
Exposure Medium Surface Water
Exposure Point. OU3B
Receptor Population Trespasser/Visitor
Receptor Age: Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0.286	µg/L	0.286	µg/L	M	8.7E-09	mg/kg-day	5.00E-05	mg/kg-day	NA	NA	1.7E-04
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	1.4E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	1.2E-05	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.2E-05
	Arsenic	4.7	µg/L	4.7	µg/L	M	1.4E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.7E-04
	(Total)												6.6E-04
Dermal	Dieldrin	0.286	µg/L	0.286	µg/L	M	2.2E-07	mg/kg-day	5.00E-05	mg/kg-day	NA	NA	4.4E-03
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	1.0E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	3.9E-06	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	7.8E-04
	Arsenic	4.7	µg/L	4.7	µg/L	M	4.6E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.5E-04
	(Total)												5.4E-03
												Total Hazard Index Across All Exposure Routes/Pathways	6.0E-03

Notes
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific.
Ingestion and Dermal Route EPC Value = Medium EPC Value.
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Worker RME OU3B Surface Water
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Surface Water
Exposure Medium Surface Water
Exposure Point OU3B
Receptor Population 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0.286	µg/L	0.286	µg/L	M	1.9E-09	mg/kg-day	5.00E-05	mg/kg-day	NA	NA	3 8E-05
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	3 1E-14	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	2 6E-06	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2 6E-06
	Arsenic	4.7	µg/L	4.7	µg/L	M	3 2E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1 1E-04
	(Total)												1.5E-04
Dermal	Dieldrin	0.286	µg/L	0.286	µg/L	M	1 8E-07	mg/kg-day	5.00E-05	mg/kg-day	NA	NA	3 7E-03
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	8.8E-11	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	394	µg/L	394	µg/L	M	1.3E-06	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.6E-04
	Arsenic	4.7	µg/L	4.7	µg/L	M	1.6E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5 4E-05
	(Total)												4 0E-03
												Total Hazard Index Across All Exposure Routes/Pathways	4 1E-03

Notes

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific.

Ingestion Route EPC Value = Medium EPC Value,

Dermal Route EPC Value = Medium EPC Value

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 13 Adult Resident RME OU3B Sediment
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium: Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1 26	mg/kg	M	3.2E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.6E-03
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	8.8E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1 5	mg/kg	1 5	mg/kg	M	3.8E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0 53	mg/kg	M	1.3E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	6.7E-06
	Total 2,3,7,8-TCDD TEQ	0 0000227	mg/kg	0 0000227	mg/kg	M	5.8E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	2 1E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.1E-04
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	7.2E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.4E-04
	Chromium	157	mg/kg	157	mg/kg	M	4.0E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.3E-03
	Cobalt	7.05	mg/kg	7 05	mg/kg	M	1.8E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	9.0E-06
	Iron	17400	mg/kg	17400	mg/kg	M	4.4E-04	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.5E-03
	Manganese	644	mg/kg	644	mg/kg	M	1 6E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	8.2E-04
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	9.0E-07	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	9.0E-04
	(Total)												6.6E-03
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1 26	mg/kg	M	5.7E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	2.8E-03
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	1.4E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	6.2E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0 53	mg/kg	M	1.7E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	8.5E-06
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	2.2E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	2.6E-05	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	5.3E-03
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	2.9E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.7E-05
	Chromium	157	mg/kg	157	mg/kg	M	5.0E-07	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	6.7E-03
	Cobalt	7.05	mg/kg	7 05	mg/kg	M	2.3E-08	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	3.8E-06
	Iron	17400	mg/kg	17400	mg/kg	M	5.6E-05	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	1.9E-04
	Manganese	644	mg/kg	644	mg/kg	M	2.1E-06	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	2.6E-03
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	1.1E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	4.4E-03
	(Total)												2.2E-02
	Total Hazard Index Across All Exposure Routes/Pathways												2.9E-02

Notes
EPC Selected for Hazard Calculation (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day

Table 13 Child Resident RME OU3B Sediment
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	2.7E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.4E-02
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	7.4E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a h)anthracene	1.5	mg/kg	1.5	mg/kg	M	3.2E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	1.1E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	5.7E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	4.9E-12	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.8E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.8E-03
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	6.1E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.0E-03
	Chromium	157	mg/kg	157	mg/kg	M	3.4E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.1E-02
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.5E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.6E-05
	Iron	17400	mg/kg	17400	mg/kg	M	3.7E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.2E-02
	Manganese	644	mg/kg	644	mg/kg	M	1.4E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	6.9E-03
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	7.6E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	7.6E-03
	(Total)												5.6E-02
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	2.8E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.4E-02
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	7.1E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a h)anthracene	1.5	mg/kg	1.5	mg/kg	M	3.1E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	8.4E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	4.2E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	1.1E-12	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.3E-04	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.6E-02
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.4E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.8E-04
	Chromium	157	mg/kg	157	mg/kg	M	2.5E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	3.3E-02
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.1E-07	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	1.9E-05
	Iron	17400	mg/kg	17400	mg/kg	M	2.8E-04	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	9.2E-04
	Manganese	644	mg/kg	644	mg/kg	M	1.0E-05	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	1.3E-02
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	5.6E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	2.2E-02
	(Total)												1.1E-01
												Total Hazard Index Across All Exposure Routes/Pathways	1.6E-01

Notes
EPC Selected for Hazard Calculation (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day

Table 13 Trespasser/Visitor RME OU3B Sediment
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium: Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
Receptor Population Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	4.8E-08	mg/kg-day	2 0E-05	mg/kg-day	NA	NA	2.4E-03
	Benzo(a)pyrene	3.44	mg/kg	3 44	mg/kg	M	1.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	5 7E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	2 0E-08	mg/kg-day	2 0E-03	mg/kg-day	NA	NA	1.0E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	8.6E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	3 1E-04	mg/kg-day	1 0E+00	mg/kg-day	NA	NA	3.1E-04
	Arsenic	2 84	mg/kg	2.84	mg/kg	M	1.1E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.6E-04
	Chromium	157	mg/kg	157	mg/kg	M	5.9E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.0E-03
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	2.7E-07	mg/kg-day	2 0E-02	mg/kg-day	NA	NA	1.3E-05
	Iron	17400	mg/kg	17400	mg/kg	M	6.6E-04	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	2.2E-03
	Manganese	644	mg/kg	644	mg/kg	M	2 4E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.2E-03
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	1 3E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.3E-03
	(Total)												9.8E-03
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	1.7E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	8.7E-03
	Benzo(a)pyrene	3 44	mg/kg	3.44	mg/kg	M	4.4E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	1.9E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	5.2E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	2.6E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	6.7E-13	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	8.1E-05	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	1.6E-02
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	9 0E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.0E-04
	Chromium	157	mg/kg	157	mg/kg	M	1.6E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	2.1E-02
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	7.0E-08	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	1.2E-05
	Iron	17400	mg/kg	17400	mg/kg	M	1 7E-04	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	5.7E-04
	Manganese	644	mg/kg	644	mg/kg	M	6.4E-06	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	8.0E-03
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	3.5E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	1.3E-02
	(Total)												6.8E-02
												Total Hazard Index Across All Exposure Routes/Pathways	7.8E-02

Notes:

EPC Selected for Hazard Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

Table 13 Worker RME OU3B Sediment
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
Receptor Population 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	2.1E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.1E-02
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	5.8E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	2.5E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	8.9E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	4.4E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	3.8E-12	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.4E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.4E-03
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	4.8E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.6E-03
	Chromium	157	mg/kg	157	mg/kg	M	2.6E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	8.8E-03
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.2E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	5.9E-05
	Iron	17400	mg/kg	17400	mg/kg	M	2.9E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	9.7E-03
	Manganese	644	mg/kg	644	mg/kg	M	1.1E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	5.4E-03
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	6.0E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.0E-03
	(Total)												4.4E-02
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	3.6E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.8E-02
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	9.1E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	4.0E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	1.1E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	5.4E-05
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	1.4E-12	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.7E-04	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	3.3E-02
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.8E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.2E-04
	Chromium	157	mg/kg	157	mg/kg	M	3.2E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	4.3E-02
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.4E-07	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	2.4E-05
	Iron	17400	mg/kg	17400	mg/kg	M	3.5E-04	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.2E-03
	Manganese	644	mg/kg	644	mg/kg	M	1.3E-05	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	1.6E-02
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	7.2E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	2.8E-02
	(Total)												1.4E-01
												Total Hazard Index Across All Exposure Routes/Pathways	1.8E-01

Notes:

EPC Selected for Hazard Calculation. (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

Table 13 Adult Resident RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	1.1E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	3.6E-03
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	3.0E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	6.0E-03
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	1.8E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	3.6E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	3.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	1.3E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	1.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.6E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	5.5E-04
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	1.5E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	2.1E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.1E-02
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.8E-02
	Chromium	43.3	mg/kg	43.3	mg/kg	M	5.9E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.0E-02
	Cobalt	167	mg/kg	167	mg/kg	M	2.3E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-02
	Iron	63800	mg/kg	63800	mg/kg	M	8.7E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	2.9E-01
	Manganese	24000	mg/kg	24000	mg/kg	M	3.3E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.6E+00
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	6.4E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.4E-02
	(Total)												2.1E+00
Dermal	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	4.3E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1.4E-03
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	1.2E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	2.4E-03
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	9.4E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	1.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	1.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	6.7E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	9.0E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.6E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	5.5E-04
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	1.8E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	8.2E-04	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	1.6E-01
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.8E-03
	Chromium	43.3	mg/kg	43.3	mg/kg	M	2.4E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	3.2E-02
	Cobalt	167	mg/kg	167	mg/kg	M	9.1E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	1.5E-03
	Iron	63800	mg/kg	63800	mg/kg	M	3.5E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.2E-02
	Manganese	24000	mg/kg	24000	mg/kg	M	1.3E-03	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	1.6E+00
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	2.6E-06	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	9.8E-02
	(Total)												2.0E+00

Table 13 Adult Resident RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point. OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0.0778	mg/kg	6.13E-08	ug/m^3	R	1 7E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0.22	mg/kg	1 73E-07	ug/m^3	R	4.7E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)anthracene	13.2	mg/kg	1.04E-05	ug/m^3	R	2 8E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	2 62	mg/kg	2.06E-06	ug/m^3	R	5 7E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	2.71	mg/kg	2 13E-06	ug/m^3	R	5.8E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	0.937	mg/kg	7.38E-07	ug/m^3	R	2 0E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	1 26	mg/kg	9.92E-07	ug/m^3	R	2 7E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	12	mg/kg	9.45E-06	ug/m^3	R	2.6E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	8.82E-10	ug/m^3	R	2.4E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	15000	mg/kg	1 18E-02	ug/m^3	R	3.2E-06	mg/kg-day	1.4E-03	mg/kg-day	5.00E-03	mg/m^3	2.3E-03
	Arsenic	8.26	mg/kg	6.50E-06	ug/m^3	R	1.8E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	43 3	mg/kg	3.41E-05	ug/m^3	R	9 3E-09	mg/kg-day	3 0E-05	mg/kg-day	1.00E-04	mg/m^3	3.1E-04
	Cobalt	167	mg/kg	1.31E-04	ug/m^3	R	3.6E-08	mg/kg-day	5.7E-06	mg/kg-day	2.00E-05	mg/m^3	6.3E-03
	Iron	63800	mg/kg	5.02E-02	ug/m^3	R	1.4E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	24000	mg/kg	1.89E-02	ug/m^3	R	5.2E-06	mg/kg-day	1.4E-05	mg/kg-day	5.00E-05	mg/m^3	3.7E-01
	Vanadium	46.7	mg/kg	3.68E-05	ug/m^3	R	1.0E-06	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												3.8E-01
												Total Hazard Index Across All Exposure Routes/Pathways	4.4E+00

Notes:

EPC Selected for Hazard Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 13 Child Resident RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe. Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0 0778	mg/kg	0 0778	mg/kg	M	9 0E-07	mg/kg-day	3 0E-05	mg/kg-day	NA	NA	3 0E-02
	Dieldrin	0.22	mg/kg	0 22	mg/kg	M	2 5E-06	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	5 1E-02
	Benzo(a)anthracene	13 2	mg/kg	13 2	mg/kg	M	1 5E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2 62	mg/kg	2 62	mg/kg	M	3 0E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2 71	mg/kg	M	3.1E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0 937	mg/kg	0 937	mg/kg	M	1 1E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1 26	mg/kg	1 26	mg/kg	M	1 5E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.4E-04	mg/kg-day	3 0E-02	mg/kg-day	NA	NA	4.6E-03
	Total 2,3,7,8-TCDD TEQ	0 00112	mg/kg	0 00112	mg/kg	M	1.3E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	1 7E-01	mg/kg-day	1 0E+00	mg/kg-day	NA	NA	1 7E-01
	Arsenic	8 26	mg/kg	8 26	mg/kg	M	9 5E-05	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	3 2E-01
	Chromium	43.3	mg/kg	43 3	mg/kg	M	5.0E-04	mg/kg-day	3 0E-03	mg/kg-day	NA	NA	1.7E-01
	Cobalt	167	mg/kg	167	mg/kg	M	1.9E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	9.6E-02
	Iron	63800	mg/kg	63800	mg/kg	M	7.4E-01	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	2.5E+00
	Manganese	24000	mg/kg	24000	mg/kg	M	2 8E-01	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1 4E+01
	Vanadium	46 7	mg/kg	46 7	mg/kg	M	5 4E-04	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5 4E-01
	(Total)												1 8E+01
Dermal	Aldrin	0 0778	mg/kg	0 0778	mg/kg	M	2 5E-07	mg/kg-day	3 0E-05	mg/kg-day	NA	NA	8 4E-03
	Dieldrin	0 22	mg/kg	0 22	mg/kg	M	7.1E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.4E-02
	Benzo(a)anthracene	13 2	mg/kg	13 2	mg/kg	M	5.6E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	1.1E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2.71	mg/kg	M	1 1E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0 937	mg/kg	0 937	mg/kg	M	3.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1 26	mg/kg	M	5.3E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	9 7E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	3.2E-03
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0 00112	mg/kg	M	1 1E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	4.9E-03	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	9.7E-01
	Arsenic	8 26	mg/kg	8 26	mg/kg	M	8.6E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.9E-02
	Chromium	43.3	mg/kg	43.3	mg/kg	M	1 4E-05	mg/kg-day	7 5E-05	mg/kg-day	NA	NA	1.9E-01
	Cobalt	167	mg/kg	167	mg/kg	M	5.4E-05	mg/kg-day	6 0E-03	mg/kg-day	NA	NA	9.0E-03
	Iron	63800	mg/kg	63800	mg/kg	M	2.1E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	6.9E-02
	Manganese	24000	mg/kg	24000	mg/kg	M	7 8E-03	mg/kg-day	8 0E-04	mg/kg-day	NA	NA	9 7E+00
	Vanadium	46 7	mg/kg	46.7	mg/kg	M	1.5E-05	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	5.8E-01
	(Total)												1 2E+01

Table 13 Child Resident RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0 0778	mg/kg	6.13E-08	ug/m^3	R	4 2E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0 22	mg/kg	1.73E-07	ug/m^3	R	1 2E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)anthracene	13 2	mg/kg	1 04E-05	ug/m^3	R	7 2E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	2 62	mg/kg	2 06E-06	ug/m^3	R	1 4E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2 13E-06	ug/m^3	R	1 5E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	0.937	mg/kg	7 38E-07	ug/m^3	R	5 1E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	9 92E-07	ug/m^3	R	6 9E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	12	mg/kg	9.45E-06	ug/m^3	R	6.5E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0 00112	mg/kg	8.82E-10	ug/m^3	R	6.1E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	15000	mg/kg	1 18E-02	ug/m^3	R	8 2E-06	mg/kg-day	1 4E-03	mg/kg-day	5 00E-03	mg/m^3	5 8E-03
	Arsenic	8 26	mg/kg	6.50E-06	ug/m^3	R	4 5E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	43 3	mg/kg	3.41E-05	ug/m^3	R	2.4E-08	mg/kg-day	3.0E-05	mg/kg-day	1 00E-04	mg/m^3	7.9E-04
	Cobalt	167	mg/kg	1.31E-04	ug/m^3	R	9.1E-08	mg/kg-day	5 7E-06	mg/kg-day	2.00E-05	mg/m^3	1 6E-02
	Iron	63800	mg/kg	5.02E-02	ug/m^3	R	3.5E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	24000	mg/kg	1 89E-02	ug/m^3	R	1 3E-05	mg/kg-day	1 4E-05	mg/kg-day	5 00E-05	mg/m^3	9 4E-01
	Vanadium	46 7	mg/kg	3 68E-05	ug/m^3	R	2 5E-08	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												9 6E-01
												Total Hazard Index Across All Exposure Routes/Pathways	3 0E+01

Notes:
EPC Selected for Hazard Calculation (M) Medium Specific
Route EPC Value = Medium EPC Value
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day
mg/m^3 = milligrams per cubic meter
ug/m^3 = micrograms per cubic meter

Table 13 Trespasser/Visitor RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point OU3B
Receptor Population Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0 0778	mg/kg	0 0778	mg/kg	M	4 7E-09	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1 6E-04
	Dieldrin	0 22	mg/kg	0.22	mg/kg	M	1.3E-08	mg/kg-day	5 0E-05	mg/kg-day	NA	NA	2 7E-04
	Benzo(a)anthracene	13 2	mg/kg	13 2	mg/kg	M	8 0E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2.62	mg/kg	2 62	mg/kg	M	1.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2 71	mg/kg	M	1.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0 937	mg/kg	0 937	mg/kg	M	5 7E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1 26	mg/kg	1 26	mg/kg	M	7 6E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	7.3E-07	mg/kg-day	3 0E-02	mg/kg-day	NA	NA	2 4E-05
	Total 2,3,7,8-TCDD TEQ	0 00112	mg/kg	0 00112	mg/kg	M	6 8E-11	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	9.1E-04	mg/kg-day	1 0E+00	mg/kg-day	NA	NA	9 1E-04
	Arsenic	8 26	mg/kg	8 26	mg/kg	M	5 0E-07	mg/kg-day	3 0E-04	mg/kg-day	NA	NA	1.7E-03
	Chromium	43.3	mg/kg	43.3	mg/kg	M	2.6E-06	mg/kg-day	3 0E-03	mg/kg-day	NA	NA	8 8E-04
	Cobalt	167	mg/kg	167	mg/kg	M	1 0E-05	mg/kg-day	2 0E-02	mg/kg-day	NA	NA	5.1E-04
	Iron	63800	mg/kg	63800	mg/kg	M	3 9E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.3E-02
	Manganese	24000	mg/kg	24000	mg/kg	M	1.5E-03	mg/kg-day	2 0E-02	mg/kg-day	NA	NA	7 3E-02
	Vanadium	46 7	mg/kg	46 7	mg/kg	M	2 8E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	2.8E-03
	(Total)												9 3E-02
Dermal	Aldrin	0.0778	mg/kg	0 0778	mg/kg	M	1 7E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	5.5E-04
	Dieldrin	0 22	mg/kg	0 22	mg/kg	M	4.7E-08	mg/kg-day	5 0E-05	mg/kg-day	NA	NA	9 4E-04
	Benzo(a)anthracene	13.2	mg/kg	13 2	mg/kg	M	3.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	2 62	mg/kg	2 62	mg/kg	M	7 3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2 71	mg/kg	M	7 5E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	0 937	mg/kg	0 937	mg/kg	M	2.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1 26	mg/kg	M	3.5E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	6.4E-06	mg/kg-day	3 0E-02	mg/kg-day	NA	NA	2 1E-04
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0 00112	mg/kg	M	7 2E-11	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	15000	mg/kg	15000	mg/kg	M	3 2E-04	mg/kg-day	5 0E-03	mg/kg-day	NA	NA	6.4E-02
	Arsenic	8.26	mg/kg	8 26	mg/kg	M	5.6E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.9E-03
	Chromium	43 3	mg/kg	43.3	mg/kg	M	9.2E-07	mg/kg-day	7 5E-05	mg/kg-day	NA	NA	1.2E-02
	Cobalt	167	mg/kg	167	mg/kg	M	3.6E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	5 9E-04
	Iron	63800	mg/kg	63800	mg/kg	M	1.4E-03	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	4.5E-03
	Manganese	24000	mg/kg	24000	mg/kg	M	5.1E-04	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	6.4E-01
	Vanadium	46 7	mg/kg	46.7	mg/kg	M	1.0E-06	mg/kg-day	2 6E-05	mg/kg-day	NA	NA	3.8E-02
	(Total)												7 6E-01

Table 13 Trespasser/Visitor RME OU3B Surface Soil
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium Surface Soil
Exposure Medium Surface Soil
Exposure Point OU3B
Receptor Population Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0 0778	mg/kg	6.13E-08	ug/m^3	R	3 1E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0 22	mg/kg	1.73E-07	ug/m^3	R	8 7E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)anthracene	13 2	mg/kg	1.04E-05	ug/m^3	R	5 2E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	2 62	mg/kg	2 06E-06	ug/m^3	R	1 0E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	2 71	mg/kg	2 13E-06	ug/m^3	R	1 1E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	0 937	mg/kg	7.38E-07	ug/m^3	R	3 7E-12	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	9 92E-07	ug/m^3	R	5 0E-12	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	12	mg/kg	9 45E-06	ug/m^3	R	4 8E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0 00112	mg/kg	8.82E-10	ug/m^3	R	4 4E-15	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	15000	mg/kg	1 18E-02	ug/m^3	R	5 9E-08	mg/kg-day	1 4E-03	mg/kg-day	5 00E-03	mg/m^3	4 2E-05
	Arsenic	8 26	mg/kg	6 50E-06	ug/m^3	R	3 3E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	43 3	mg/kg	3 41E-05	ug/m^3	R	1 7E-10	mg/kg-day	3 0E-05	mg/kg-day	1.00E-04	mg/m^3	5 7E-06
	Cobalt	167	mg/kg	1 31E-04	ug/m^3	R	6 6E-10	mg/kg-day	5 7E-06	mg/kg-day	2 00E-05	mg/m^3	1 2E-04
	Iron	63800	mg/kg	5 02E-02	ug/m^3	R	2 5E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	24000	mg/kg	1.89E-02	ug/m^3	R	9 5E-08	mg/kg-day	1.4E-05	mg/kg-day	5 00E-05	mg/m^3	6 8E-03
	Vanadium	46 7	mg/kg	3 68E-05	ug/m^3	R	1 9E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												7 0E-03
												Total Hazard Index Across All Exposure Routes/Pathways	8 6E-01

Notes:
EPC Selected for Hazard Calculation. (M) Medium Specific.
Route EPC Value = Medium EPC Value
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day
mg/m^3 = milligrams per cubic meter
ug/m^3 = micrograms per cubic meter

Table 13 Adult Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	6.4E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	2.1E-03
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.9E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	3.8E-03
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	1.4E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	7.1E-03
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	5.5E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	5.3E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	4.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	5.3E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	2.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	8.4E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	4.2E-04
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	6.3E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.2E-05
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	4.0E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	6.6E-06	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	2.2E-04
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	2.3E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	2.0E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.0E-02
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	8.3E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.8E-02
	Chromium	38.1	mg/kg	38.1	mg/kg	M	5.2E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.7E-02
	Cobalt	66	mg/kg	66	mg/kg	M	9.0E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.5E-03
	Iron	51800	mg/kg	51800	mg/kg	M	7.1E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	2.4E-01
	Manganese	17200	mg/kg	17200	mg/kg	M	2.4E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.2E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	6.0E-05	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.0E-02
	(Total)												1.6E+00
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	2.5E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	8.5E-04
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	7.6E-08	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.5E-03
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	7.9E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.9E-03
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	6.6E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	2.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	2.6E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	2.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	1.4E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	3.3E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.7E-04
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	2.5E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.3E-05
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	2.1E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	6.6E-06	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	2.2E-04
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	2.7E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	7.8E-04	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	1.6E-01
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.5E-03
	Chromium	38.1	mg/kg	38.1	mg/kg	M	2.1E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	2.8E-02
	Cobalt	66	mg/kg	66	mg/kg	M	3.6E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	6.0E-04
	Iron	51800	mg/kg	51800	mg/kg	M	2.8E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	9.4E-03
	Manganese	17200	mg/kg	17200	mg/kg	M	9.4E-04	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	1.2E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	2.4E-06	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	9.3E-02
	(Total)												1.5E+00

Table 13 Adult Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0.0465	mg/kg	3.66E-08	ug/m^3	R	1.0E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0.139	mg/kg	1.09E-07	ug/m^3	R	3.0E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	8.11E-08	ug/m^3	R	2.2E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Methylcyclohexane	0.004	mg/kg	3.15E-09	ug/m^3	R	8.6E-13	mg/kg-day	8.6E-01	mg/kg-day	3.00E+00	mg/m^3	1.0E-12
	Benzo(a)anthracene	3.87	mg/kg	3.05E-06	ug/m^3	R	8.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	3.6	mg/kg	2.83E-06	ug/m^3	R	7.8E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.03E-06	ug/m^3	R	8.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	2	mg/kg	1.57E-06	ug/m^3	R	4.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzofuran	0.61	mg/kg	4.80E-07	ug/m^3	R	1.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Di-n-octylphthalate	0.46	mg/kg	3.62E-07	ug/m^3	R	9.9E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.28E-06	ug/m^3	R	6.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m^3	R	1.0E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	1.31E-09	ug/m^3	R	3.6E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	14300	mg/kg	1.13E-02	ug/m^3	R	3.1E-06	mg/kg-day	1.4E-03	mg/kg-day	5.00E-03	mg/m^3	2.2E-03
	Arsenic	6.07	mg/kg	4.78E-06	ug/m^3	R	1.3E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	38.1	mg/kg	3.00E-05	ug/m^3	R	8.2E-09	mg/kg-day	3.0E-05	mg/kg-day	1.00E-04	mg/m^3	2.7E-04
	Cobalt	66	mg/kg	5.20E-05	ug/m^3	R	1.4E-08	mg/kg-day	5.7E-06	mg/kg-day	2.00E-05	mg/m^3	2.5E-03
	Iron	51800	mg/kg	4.08E-02	ug/m^3	R	1.1E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	17200	mg/kg	1.35E-02	ug/m^3	R	3.7E-06	mg/kg-day	1.4E-05	mg/kg-day	5.00E-05	mg/m^3	2.7E-01
	Vanadium	44.1	mg/kg	3.47E-05	ug/m^3	R	9.5E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												2.7E-01
												Total Hazard Index Across All Exposure Routes/Pathways	3.3E+00

Notes
EPC Selected for Hazard Calculation (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day
mg/m^3 = milligrams per cubic meter
ug/m^3 = micrograms per cubic meter

Table 13 Child Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium, Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	5.4E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1.8E-02
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.6E-06	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	3.2E-02
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	1.2E-06	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	5.9E-02
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	4.6E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	4.5E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	4.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	4.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	2.3E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	7.0E-06	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	3.5E-03
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	5.3E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.7E-04
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	3.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	5.6E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.9E-03
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.9E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	1.7E-01	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.7E-01
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	7.0E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.3E-01
	Chromium	38.1	mg/kg	38.1	mg/kg	M	4.4E-04	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.5E-01
	Cobalt	66	mg/kg	66	mg/kg	M	7.6E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.8E-02
	Iron	51800	mg/kg	51800	mg/kg	M	6.0E-01	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	2.0E+00
	Manganese	17200	mg/kg	17200	mg/kg	M	2.0E-01	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	9.9E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	5.1E-04	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5.1E-01
	(Total)												1.3E+01
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	1.5E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	5.0E-03
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	4.5E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	9.0E-03
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	4.7E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	2.3E-02
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	3.9E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.6E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.5E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.6E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	8.4E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	2.0E-06	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	9.9E-04
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	1.5E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.4E-05
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	3.9E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.3E-03
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.6E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	4.6E-03	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	9.3E-01
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	6.3E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.1E-02
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.2E-05	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	1.6E-01
	Cobalt	66	mg/kg	66	mg/kg	M	2.1E-05	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	3.6E-03
	Iron	51800	mg/kg	51800	mg/kg	M	1.7E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	5.6E-02
	Manganese	17200	mg/kg	17200	mg/kg	M	5.6E-03	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	7.0E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	1.4E-05	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	5.5E-01
	(Total)												8.7E+00

Table 13 Child Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0.0465	mg/kg	3.66E-08	ug/m^3	R	2.5E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0.139	mg/kg	1.09E-07	ug/m^3	R	7.6E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	8.11E-08	ug/m^3	R	5.6E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Methylcyclohexane	0.004	mg/kg	3.15E-09	ug/m^3	R	2.2E-12	mg/kg-day	8.6E-01	mg/kg-day	3.00E+00	mg/m^3	2.5E-12
	Benzo(a)anthracene	3.87	mg/kg	3.05E-06	ug/m^3	R	2.1E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	3.6	mg/kg	2.83E-06	ug/m^3	R	2.0E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.03E-06	ug/m^3	R	2.1E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	2	mg/kg	1.57E-06	ug/m^3	R	1.1E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzofuran	0.61	mg/kg	4.80E-07	ug/m^3	R	3.3E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Di-n-octylphthalate	0.46	mg/kg	3.62E-07	ug/m^3	R	2.5E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.28E-06	ug/m^3	R	1.6E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m^3	R	2.6E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	1.31E-09	ug/m^3	R	9.1E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	14300	mg/kg	1.13E-02	ug/m^3	R	7.8E-06	mg/kg-day	1.4E-03	mg/kg-day	5.00E-03	mg/m^3	5.6E-03
	Arsenic	6.07	mg/kg	4.78E-06	ug/m^3	R	3.3E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	38.1	mg/kg	3.00E-05	ug/m^3	R	2.1E-08	mg/kg-day	3.0E-05	mg/kg-day	1.00E-04	mg/m^3	6.9E-04
	Cobalt	66	mg/kg	5.20E-05	ug/m^3	R	3.6E-08	mg/kg-day	5.7E-06	mg/kg-day	2.00E-05	mg/m^3	6.3E-03
	Iron	51800	mg/kg	4.08E-02	ug/m^3	R	2.8E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	17200	mg/kg	1.35E-02	ug/m^3	R	9.4E-06	mg/kg-day	1.4E-05	mg/kg-day	5.00E-05	mg/m^3	6.7E-01
	Vanadium	44.1	mg/kg	3.47E-05	ug/m^3	R	2.4E-08	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												6.8E-01
												Total Hazard Index Across All Exposure Routes/Pathways	2.3E+01

Notes:

EPC Selected for Hazard Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 13 Tresspasser/Visitor RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
Receptor Population Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	2.8E-09	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	9.4E-05
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	8.4E-09	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.7E-04
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	6.2E-09	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	3.1E-04
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	2.4E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	2.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	2.2E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	2.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	1.2E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	3.7E-08	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.8E-05
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	2.8E-08	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.4E-06
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.8E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	2.9E-07	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	9.7E-06
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.0E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	8.7E-04	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	8.7E-04
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	3.7E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.2E-03
	Chromium	38.1	mg/kg	38.1	mg/kg	M	2.3E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	7.7E-04
	Cobalt	66	mg/kg	66	mg/kg	M	4.0E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.0E-04
	Iron	51800	mg/kg	51800	mg/kg	M	3.1E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.0E-02
	Manganese	17200	mg/kg	17200	mg/kg	M	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	5.2E-02
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	2.7E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	2.7E-03
	(Total)												6.9E-02
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	9.9E-09	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	3.3E-04
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	3.0E-08	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	5.9E-04
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	3.1E-08	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.5E-03
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	2.6E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.1E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.0E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.1E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	5.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	1.3E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	6.5E-05
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	9.8E-08	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.9E-06
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	8.0E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	2.6E-06	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	8.6E-05
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.1E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	3.1E-04	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	6.1E-02
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	4.1E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.4E-03
	Chromium	38.1	mg/kg	38.1	mg/kg	M	8.1E-07	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	1.1E-02
	Cobalt	66	mg/kg	66	mg/kg	M	1.4E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	2.3E-04
	Iron	51800	mg/kg	51800	mg/kg	M	1.1E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	3.7E-03
	Manganese	17200	mg/kg	17200	mg/kg	M	3.7E-04	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	4.6E-01
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	9.4E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	3.6E-02
	(Total)												5.8E-01

Table 13 Tresspasser/Visitor RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
Receptor Population: Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0.0465	mg/kg	3 66E-08	ug/m^3	R	1.8E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dieldrin	0 139	mg/kg	1 09E-07	ug/m^3	R	5.5E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Arochlor 1254 (PCB-1254)	0 103	mg/kg	8 11E-08	ug/m^3	R	4.1E-13	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Methylcyclohexane	0.004	mg/kg	3 15E-09	ug/m^3	R	1.6E-14	mg/kg-day	8.6E-01	mg/kg-day	3.00E+00	mg/m	1.8E-14
	Benzo(a)anthracene	3.87	mg/kg	3.05E-06	ug/m^3	R	1.5E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(a)pyrene	3.6	mg/kg	2.83E-06	ug/m^3	R	1.4E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3 03E-06	ug/m^3	R	1.5E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzo(a,h)anthracene	2	mg/kg	1 57E-06	ug/m^3	R	7.9E-12	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Dibenzofuran	0 61	mg/kg	4 80E-07	ug/m^3	R	2.4E-12	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Di-n-octylphthalate	0.46	mg/kg	3.62E-07	ug/m^3	R	1.8E-12	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2 28E-06	ug/m^3	R	1.1E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m^3	R	1.9E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Total 2,3,7,8-TCDD TEQ	0 001668	mg/kg	1.31E-09	ug/m^3	R	6.6E-15	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Aluminum	14300	mg/kg	1.13E-02	ug/m^3	R	5.7E-08	mg/kg-day	1.4E-03	mg/kg-day	5.00E-03	mg/m^3	4.0E-05
	Arsenic	6 07	mg/kg	4.78E-06	ug/m^3	R	2.4E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Chromium	38 1	mg/kg	3.00E-05	ug/m^3	R	1.5E-10	mg/kg-day	3 0E-05	mg/kg-day	1.00E-04	mg/m^3	5.0E-06
	Cobalt	66	mg/kg	5.20E-05	ug/m^3	R	2.6E-10	mg/kg-day	5 7E-06	mg/kg-day	2.00E-05	mg/m^3	4.6E-05
	Iron	51800	mg/kg	4 08E-02	ug/m^3	R	2.1E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Manganese	17200	mg/kg	1.35E-02	ug/m^3	R	6.8E-08	mg/kg-day	1.4E-05	mg/kg-day	5.00E-05	mg/m^3	4.9E-03
	Vanadium	44 1	mg/kg	3.47E-05	ug/m^3	R	1.7E-10	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												5.0E-03
												Total Hazard Index Across All Exposure Routes/Pathways	6.5E-01

Notes

EPC Selected for Hazard Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 13 Worker RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium: Total Soil (Surface + Subsurface)
Exposure Point: OU3B
Receptor Population: 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	1.5E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	5.0E-03
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	4.5E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	9.0E-03
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	3.3E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	1.7E-02
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	1.3E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	6.5E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	2.0E-06	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	9.8E-04
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	1.5E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.4E-05
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	9.4E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	1.6E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	5.2E-04
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	5.4E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	4.6E-02	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	4.6E-02
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	2.0E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.5E-02
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.2E-04	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	4.1E-02
	Cobalt	66	mg/kg	66	mg/kg	M	2.1E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-02
	Iron	51800	mg/kg	51800	mg/kg	M	1.7E-01	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	5.6E-01
	Manganese	17200	mg/kg	17200	mg/kg	M	5.6E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.8E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	1.4E-04	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	1.4E-01
	(Total)												3.7E+00
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	4.5E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1.5E-03
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.4E-07	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	2.7E-03
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	1.4E-07	mg/kg-day	2.0E-05	mg/kg-day	NA	NA	7.1E-03
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	1.2E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	4.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	4.6E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	4.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	2.5E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	6.0E-07	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	3.0E-04
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	4.5E-07	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.3E-05
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	3.7E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	1.2E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	3.9E-04
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	4.9E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum	14300	mg/kg	14300	mg/kg	M	1.4E-03	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	2.8E-01
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	6.3E-03
	Chromium	38.1	mg/kg	38.1	mg/kg	M	3.7E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	5.0E-02
	Cobalt	66	mg/kg	66	mg/kg	M	6.5E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	1.1E-03
	Iron	51800	mg/kg	51800	mg/kg	M	5.1E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.7E-02
	Manganese	17200	mg/kg	17200	mg/kg	M	1.7E-03	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	2.1E+00
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	4.3E-06	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	1.7E-01
	(Total)												2.6E+00

Table 13 Worker RME OU3B Total Soil (Surface + Subsurface)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
Receptor Population: 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation of dust	Aldrin	0.0465	mg/kg	1.36E-05	ug/m³	R	2.7E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Dieldrin	0.139	mg/kg	4.05E-05	ug/m³	R	7.9E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	3.00E-05	ug/m³	R	5.9E-09	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Methylcyclohexane	0.004	mg/kg	1.17E-06	ug/m³	R	2.3E-10	mg/kg-day	8.6E-01	mg/kg-day	3.00E+00	mg/m³	2.7E-10
	Benzo(a)anthracene	3.87	mg/kg	1.13E-03	ug/m³	R	2.2E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Benzo(a)pyrene	3.6	mg/kg	1.05E-03	ug/m³	R	2.1E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Benzo(b)fluoranthene	3.85	mg/kg	1.12E-03	ug/m³	R	2.2E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Dibenzo(a,h)anthracene	2	mg/kg	5.83E-04	ug/m³	R	1.1E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Dibenzofuran	0.61	mg/kg	1.78E-04	ug/m³	R	3.5E-08	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Di-n-octylphthalate	0.46	mg/kg	1.34E-04	ug/m³	R	2.6E-08	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	8.45E-04	ug/m³	R	1.7E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Pentachlorophenol	4.82	mg/kg	1.41E-03	ug/m³	R	2.7E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	4.86E-07	ug/m³	R	9.5E-11	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Aluminum	14300	mg/kg	4.17E+00	ug/m³	R	8.2E-04	mg/kg-day	1.4E-03	mg/kg-day	5.00E-03	mg/m³	5.8E-01
	Arsenic	6.07	mg/kg	1.77E-03	ug/m³	R	3.5E-07	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Chromium	38.1	mg/kg	1.11E-02	ug/m³	R	2.2E-06	mg/kg-day	3.0E-05	mg/kg-day	1.00E-04	mg/m³	7.2E-02
	Cobalt	66	mg/kg	1.92E-02	ug/m³	R	3.8E-06	mg/kg-day	5.7E-06	mg/kg-day	2.00E-05	mg/m³	6.6E-01
	Iron	51800	mg/kg	1.51E+01	ug/m³	R	3.0E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	Manganese	17200	mg/kg	5.01E+00	ug/m³	R	9.8E-04	mg/kg-day	1.4E-05	mg/kg-day	5.00E-05	mg/m³	7.0E+01
	Vanadium	44.1	mg/kg	1.29E-02	ug/m³	R	2.5E-06	mg/kg-day	NA	mg/kg-day	NA	mg/m³	NC
	(Total)												7.1E+01
												Total Hazard Index Across All Exposure Routes/Pathways	7.8E+01

Notes

EPC Selected for Hazard Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 13 Adult Resident RME OU3A Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,2-Dichloroethane	3.89	µg/L	3.89	µg/L	M	1.1E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	5.3E-03
	1,2-Dichloropropane	0.41	µg/L	0.41	µg/L	M	1.1E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,3,5-Trimethylbenzene (Mesitylene)	75.9	µg/L	75.9	µg/L	M	2.1E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	4.2E-02
	1,4-Dichlorobenzene	0.49	µg/L	0.49	µg/L	M	1.3E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	4.5E-04
	Azulene	4.1	µg/L	4.1	µg/L	M	1.1E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	1.7E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	1.7E-03
	Ethylbenzene	92.3	µg/L	92.3	µg/L	M	2.5E-03	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	2.5E-02
	Xylenes (total)	128	µg/L	128	µg/L	M	3.5E-03	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	1.8E-02
	1,2,4-Trimethylbenzene	93.3	µg/L	93.3	µg/L	M	2.6E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	5.1E-02
	1-Methylnaphthalene	34.6	µg/L	34.6	µg/L	M	9.5E-04	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	1.4E-02
	2,4,6-Trichlorophenol	8.59	µg/L	8.59	µg/L	M	2.4E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	4,6-Dinitro-2-Methylphenol	10.3	µg/L	10.3	µg/L	M	2.8E-04	mg/kg-day	1.0E-04	mg/kg-day	NA	NA	2.8E+00
	4-Chloro-3-Methylphenol	1.2	µg/L	1.2	µg/L	M	3.3E-05	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	4.7E-04
	Bis(2-chloroethoxy) methane	2.86	µg/L	2.86	µg/L	M	7.8E-05	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	2.6E-02
	Dimethyl Phthalate	1.1	µg/L	1.1	µg/L	M	3.0E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indene	19	µg/L	19	µg/L	M	5.2E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Barium (total)	3230	µg/L	3230	µg/L	M	8.8E-02	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	4.4E-01
	Beryllium (total)	3.73	µg/L	3.73	µg/L	M	1.0E-04	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	5.1E-02
	Cadmium (total)	4.39	µg/L	4.39	µg/L	M	1.2E-04	mg/kg-day	5.0E-04	mg/kg-day	NA	NA	2.4E-01
	Copper (total)	736	µg/L	736	µg/L	M	2.0E-02	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	5.0E-01
	Mercury (dissolved)	0.134	µg/L	0.134	µg/L	M	3.7E-06	mg/kg-day	1.0E-04	mg/kg-day	NA	NA	3.7E-02
	Nickel (total)	28.9	µg/L	28.9	µg/L	M	7.9E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	4.0E-02
	Zinc (total)	477	µg/L	477	µg/L	M	1.3E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	4.4E-02
	Total												4.4E+00

Table 13 Adult Resident RME OU3A Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium. Groundwater/Vapor
Exposure Point. OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	1,2-Dichloroethane	3 89	µg/L	2 36	µg/L	R	1.9E-06	mg/kg-day	2 00E-02	mg/kg-day	NA	NA	9 6E-05
	1,2-Dichloropropane	0 41	µg/L	0 24	µg/L	R	3.9E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,3,5-Trimethylbenzene (Mesitylene)	75 9	µg/L	44 77	µg/L	R	6.4E-04	mg/kg-day	5 0E-02	mg/kg-day	NA	NA	1 3E-02
	1,4-Dichlorobenzene	0 49	µg/L	0 31	µg/L	R	3 5E-06	mg/kg-day	3 0E-02	mg/kg-day	NA	NA	1 2E-04
	Azulene	4 1	µg/L	2 64	µg/L	R	1 8E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Chloroform	0 63	µg/L	0 38	µg/L	R	5 7E-07	mg/kg-day	1 0E-02	mg/kg-day	NA	NA	5 7E-05
	Ethylbenzene	92 3	µg/L	52 65	µg/L	R	5 4E-04	mg/kg-day	1 0E-01	mg/kg-day	NA	NA	5.4E-03
	Xylenes (total)	128	µg/L	73 14	µg/L	R	7 6E-04	mg/kg-day	2 0E-01	mg/kg-day	NA	NA	3 8E-03
	1,2,4-Trimethylbenzene	93 3	µg/L	55 27	µg/L	R	1.4E-03	mg/kg-day	5 0E-02	mg/kg-day	NA	NA	2 7E-02
	1-Methylnaphthalene	34.6	µg/L	24 71	µg/L	R	6 2E-04	mg/kg-day	7 0E-02	mg/kg-day	NA	NA	8 8E-03
	2,4,6-Trichlorophenol	8 59	µg/L	8 59	µg/L	R	1 1E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	4,6-Dinitro-2-Methylphenol	10 3	µg/L	10 30	µg/L	R	1 2E-05	mg/kg-day	1 0E-04	mg/kg-day	NA	NA	1 2E-01
	4-Chloro-3-Methylphenol	1 2	µg/L	1 20	µg/L	R	8.9E-06	mg/kg-day	7 0E-02	mg/kg-day	NA	NA	1 3E-04
	Bis(2-chloroethoxy) methane	2 86	µg/L	2.86	µg/L	R	1 1E-06	mg/kg-day	3 0E-03	mg/kg-day	NA	NA	3.6E-04
	Dimethyl Phthalate	1 1	µg/L	1.10	µg/L	R	5 4E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indene	19	µg/L	11 77	µg/L	R	7.9E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Barium (total)	3230	µg/L	3230 00	µg/L	R	1.6E-04	mg/kg-day	1 4E-02	mg/kg-day	NA	NA	1.1E-02
	Beryllium (total)	3 73	µg/L	3 73	µg/L	R	1 8E-07	mg/kg-day	1 0E-05	mg/kg-day	NA	NA	1 8E-02
	Cadmium (total)	4 39	µg/L	4 39	µg/L	R	2.2E-07	mg/kg-day	2 5E-05	mg/kg-day	NA	NA	8 7E-03
	Copper (total)	736	µg/L	736.00	µg/L	R	3 7E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	9.2E-04
	Mercury (dissolved)	0.134	µg/L	0 13	µg/L	R	6.7E-09	mg/kg-day	2 1E-05	mg/kg-day	NA	NA	3.2E-04
	Nickel (total)	28 9	µg/L	28.9	µg/L	R	3 0E-07	mg/kg-day	8 0E-04	mg/kg-day	NA	NA	3.7E-04
	Zinc (total)	477	µg/L	477	µg/L	R	1.4E-05	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	4.7E-05
	(Total)												2 2E-01

Table 13 Adult Resident RME OU3A Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,2-Dichloroethane	3 89	µg/L	3 89	µg/L	M	2 3E-04	mg/kg-day	7 00E-01	mg/kg-day	2 00E+00	mg/m^2	3 3E-04
	1,2-Dichloropropane	0 41	µg/L	0.41	µg/L	M	2 5E-05	mg/kg-day	1 1E-03	mg/kg-day	4 00E-03	mg/m^3	2 3E-02
	1,3 5-Trimethylbenzene (Mesitylene)	75 9	µg/L	75 9	µg/L	M	4 7E-03	mg/kg-day	1 7E-03	mg/kg-day	6 00E-03	mg/m^4	2 8E+00
	1,4-Dichlorobenzene	0 49	µg/L	0 49	µg/L	M	2 7E-05	mg/kg-day	2 3E-01	mg/kg-day	8 00E-01	mg/m^5	1 2E-04
	Azulene	4 1	µg/L	4.1	µg/L	M	2 2E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^6	NC
	Chloroform	0 63	µg/L	0 63	µg/L	M	3 8E-05	mg/kg-day	1 4E-02	mg/kg-day	5 00E-02	mg/m^7	2 7E-03
	Ethylbenzene	92 3	µg/L	92.3	µg/L	M	6 0E-03	mg/kg-day	2 9E-01	mg/kg-day	1 00E+00	mg/m^8	2 1E-02
	Xylenes (total)	128	µg/L	128	µg/L	M	8 2E-03	mg/kg-day	2 9E-02	mg/kg-day	1.00E-01	mg/m^9	2 8E-01
	1,2,4-Trimethylbenzene	93 3	µg/L	93.3	µg/L	M	5 7E-03	mg/kg-day	1 7E-03	mg/kg-day	6 00E-03	mg/m^{10}	3 4E+00
	1-Methylnaphthalene	34 6	µg/L	34.6	µg/L	M	1 5E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^{11}	NC
	Indene	19	µg/L	19	µg/L	M	1 1E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^{12}	NC
	(Total)												6 4E+00
												Total Hazard Index Across All Exposure Routes/Pathways	1.1E+01

Notes:
Dermal intake calculations use values for DAevent from Appendix
EPC Selected for Hazard Calculation. (M) Medium Specific, (R) Route Specific
Ingestion Route EPC Value = Medium EPC Value
Dermal Route EPC Value = Medium EPC Value - CWD (Concentration leaving shower droplet) Note that for adult resident dermal exposure to groundwater, the Route EPC values are different from the Medium EPC values only for the volatile organics This difference is due to the loss of contaminant through volatilization which occurs during showering.
Inhalation Route EPC Value = Medium EPC Value as determined by Foster and Chrostowski Shower Model and EPA Region 3 inputs (See Appendix)
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Child Resident RME OU3A Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	1,2-Dichloroethane	3.89	µg/L	3.89	µg/L	M	2.2E-04	mg/kg-day	2.00E-02	mg/kg-day	NA	NA	1.1E-02
	1,2-Dichloropropane	0.41	µg/L	0.41	µg/L	M	2.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,3,5-Trimethylbenzene (Mesitylene)	75.9	µg/L	75.9	µg/L	M	4.4E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	8.8E-02
	1,4-Dichlorobenzene	0.49	µg/L	0.49	µg/L	M	2.8E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	9.4E-04
	Azulene	4.1	µg/L	4.1	µg/L	M	2.4E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	3.6E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	3.6E-03
	Ethylbenzene	92.3	µg/L	92.3	µg/L	M	5.3E-03	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	5.3E-02
	Xylenes (total)	128	µg/L	128	µg/L	M	7.4E-03	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	3.7E-02
	1,2,4-Trimethylbenzene	93.3	µg/L	93.3	µg/L	M	5.4E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	1.1E-01
	1-Methylnaphthalene	34.6	µg/L	34.6	µg/L	M	2.0E-03	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	2.9E-02
	2,4,6-Trichlorophenol	8.59	µg/L	8.59	µg/L	M	5.0E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	4,6-Dinitro-2-Methylphenol	10.3	µg/L	10.3	µg/L	M	5.9E-04	mg/kg-day	1.0E-04	mg/kg-day	NA	NA	5.9E+00
	4-Chloro-3-Methylphenol	1.2	µg/L	1.2	µg/L	M	6.9E-05	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	9.9E-04
	Bis(2-chloroethoxy) methane	2.86	µg/L	2.86	µg/L	M	1.7E-04	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	5.5E-02
	Dimethyl Phthalate	1.1	µg/L	1.1	µg/L	M	6.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indene	19	µg/L	19	µg/L	M	1.1E-03	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Barium (total)	3230	µg/L	3230	µg/L	M	1.9E-01	mg/kg-day	2.0E-01	mg/kg-day	NA	NA	9.3E-01
	Beryllium (total)	3.73	µg/L	3.73	µg/L	M	2.2E-04	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.1E-01
	Cadmium (total)	4.39	µg/L	4.39	µg/L	M	2.5E-04	mg/kg-day	5.0E-04	mg/kg-day	NA	NA	5.1E-01
	Copper (total)	736	µg/L	736	µg/L	M	4.3E-02	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.1E+00
	Mercury (dissolved)	0.134	µg/L	0.134	µg/L	M	7.7E-06	mg/kg-day	1.0E-04	mg/kg-day	NA	NA	7.7E-02
	Nickel (total)	28.9	µg/L	28.9	µg/L	M	1.7E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	8.3E-02
	Zinc (total)	477	µg/L	477	µg/L	M	2.8E-02	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	9.2E-02
	Total												9.2E+00

Table 13 Child Resident RME OU3A Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	1 2-Dichloroethane	3 89	µg/L	3.89	µg/L	M	6 1E-06	mg/kg-day	2 00E-02	mg/kg-day	NA	NA	3 1E-04
	1.2-Dichloropropane	0 41	µg/L	0 41	µg/L	M	1 3E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1.3,5-Trimethylbenzene (Mesitylene)	75 9	µg/L	75.9	µg/L	M	2 1E-03	mg/kg-day	5 0E-02	mg/kg-day	NA	NA	4 3E-02
	1.4-Dichlorobenzene	0 49	µg/L	0 49	µg/L	M	1 1E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	3 7E-04
	Azulene	4 1	µg/L	4.1	µg/L	M	5 7E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	1 9E-06	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	1 9E-04
	Ethylbenzene	92 3	µg/L	92.3	µg/L	M	1 9E-03	mg/kg-day	1 0E-01	mg/kg-day	NA	NA	1 9E-02
	Xylenes (total)	128	µg/L	128	µg/L	M	2 6E-03	mg/kg-day	2 0E-01	mg/kg-day	NA	NA	1 3E-02
	1,2,4-Trimethylbenzene	93.3	µg/L	93 3	µg/L	M	4 6E-03	mg/kg-day	5 0E-02	mg/kg-day	NA	NA	9 2E-02
	1-Methylnaphthalene	34 6	µg/L	34.6	µg/L	M	1 7E-03	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	2 4E-02
	2,4,6-Trichlorophenol	8 59	µg/L	8 59	µg/L	M	2 2E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	4.6-Dinitro-2-Methylphenol	10.3	µg/L	10 3	µg/L	M	2 4E-05	mg/kg-day	1 0E-04	mg/kg-day	NA	NA	2 4E-01
	4-Chloro-3-Methylphenol	1 2	µg/L	1.2	µg/L	M	1 8E-05	mg/kg-day	7.0E-02	mg/kg-day	NA	NA	2 6E-04
	Bis(2-chloroethoxy) methane	2 86	µg/L	2 86	µg/L	M	2 2E-06	mg/kg-day	3 0E-03	mg/kg-day	NA	NA	7 2E-04
	Dimethyl Phthalate	1.1	µg/L	1 1	µg/L	M	1 1E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Indene	19	µg/L	19	µg/L	M	2 5E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Barium (total)	3230	µg/L	3230	µg/L	M	4 2E-04	mg/kg-day	1 4E-02	mg/kg-day	NA	NA	3 0E-02
	Beryllium (total)	3 73	µg/L	3 73	µg/L	M	4 6E-07	mg/kg-day	1 0E-05	mg/kg-day	NA	NA	4.6E-02
	Cadmium (total)	4.39	µg/L	4 39	µg/L	M	5.3E-07	mg/kg-day	2 5E-05	mg/kg-day	NA	NA	2 1E-02
	Copper (total)	736	µg/L	736	µg/L	M	9 2E-05	mg/kg-day	4 0E-02	mg/kg-day	NA	NA	2 3E-03
	Mercury (dissolved)	0 134	µg/L	0.134	µg/L	M	1 7E-08	mg/kg-day	2.1E-05	mg/kg-day	NA	NA	8 0E-04
	Nickel (total)	28 9	µg/L	28.9	µg/L	M	7.2E-07	mg/kg-day	8 0E-04	mg/kg-day	NA	NA	9 1E-04
	Zinc (total)	477	µg/L	477	µg/L	M	3 6E-05	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1 2E-04
	(Total)												5.3E-01
												Total Hazard Index Across All Exposure Routes/Pathways	9 7E+00

Notes:
Dermal intake calculations use values for DAevent from Appendix
EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific
Ingestion and Dermal Route EPC Value = Medium EPC Value
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Adult Resident RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	alpha-BHC	0.0075	µg/L	0 0075	µg/L	M	2.1E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0 0204	µg/L	0.0204	µg/L	M	5.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	µg/L	0 00781	µg/L	M	2 1E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	7.1E-03
	Dieldrin	0 321	µg/L	0 321	µg/L	M	8.8E-06	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.8E-01
	Heptachlor Epoxide	0 00819	µg/L	0.00819	µg/L	M	2.2E-07	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	1.7E-02
	Benzene	0 49	µg/L	0 49	µg/L	M	1.3E-05	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	3 4E-03
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	1.1E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	1.6E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	4.1E-03
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	2.7E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	2.7E-03
	Trichloroethylene (TCE)	0 17	µg/L	0 17	µg/L	M	4.7E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.6E-02
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	9.9E-03	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	2.5E+00
	Acenaphthene	53.3	µg/L	53 3	µg/L	M	1.5E-03	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	2.4E-02
	Acetophenone	62	µg/L	62	µg/L	M	1.7E-03	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	1.7E-02
	Anthracene	42 8	µg/L	42.8	µg/L	M	1.2E-03	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	3.9E-03
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	2.7E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1 1	µg/L	1.1	µg/L	M	3.0E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	4.7E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	µg/L	44.8	µg/L	M	1.2E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	2.5E-02
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	3.6E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.8E-01
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	1.1E-03	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	5.5E-01
	Fluorene	80.9	µg/L	80.9	µg/L	M	2.2E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	5.5E-02
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0 66	µg/L	M	1.8E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	µg/L	239	µg/L	M	6.5E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.3E-01
	Pentachlorophenol	572	µg/L	572	µg/L	M	1.6E-02	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	5.2E-01
	Phenanthrene	223	µg/L	223	µg/L	M	6.1E-03	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	2.0E-01
	Pyrene	33.1	µg/L	33.1	µg/L	M	9.1E-04	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	3.0E-02
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	1.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	1.2E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	1.2E+00
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	9.0E-05	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	2.3E-01
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	7.9E-05	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2 6E-01
	Chromium (Total)	56.1	µg/L	56 1	µg/L	M	1.5E-03	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	5.1E-01
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	5.2E-02
	Iron (Total)	52900	µg/L	52900	µg/L	M	1.4E+00	mg/kg-day	3 0E-01	mg/kg-day	NA	NA	4.8E+00
	Lead (Total)	27.1	µg/L	27 1	µg/L	M	7.4E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	7.6E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.8E+00
	Vanadium (Total)	102	µg/L	102	µg/L	M	2.8E-03	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	2.8E+00
													1.8E+01

Table 13 Adult Resident RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	alpha-BHC	0.0075	µg/L	0.0075	µg/L	R	6.4E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0.0204	µg/L	0.0204	µg/L	R	1.8E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	µg/L	0.00781	µg/L	R	1.2E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	4.0E-04
	Dieldrin	0.321	µg/L	0.321	µg/L	R	3.9E-06	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	7.9E-02
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	R	1.6E-07	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	1.2E-02
	Benzene	0.49	µg/L	0.257	µg/L	R	6.4E-07	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	1.6E-04
	Methyl tert-butyl ether (MTBE)	4	µg/L	2.56	µg/L	R	9.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	4.59	µg/L	R	9.6E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	2.4E-04
	Tetrachloroethylene (PCE)	1	µg/L	0.633	µg/L	R	6.4E-06	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	6.4E-04
	Trichloroethylene (TCE)	0.17	µg/L	0.1022	µg/L	R	3.0E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.9E-04
	2-Methylnaphthalene	360	µg/L	223	µg/L	R	5.4E-03	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	1.4E+00
	Acenaphthene	53.3	µg/L	44.35	µg/L	R	1.2E-03	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	1.9E-02
	Acetophenone	62	µg/L	60.68	µg/L	R	5.4E-05	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	5.4E-04
	Anthracene	42.8	µg/L	39.03	µg/L	R	1.9E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	6.4E-03
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	R	2.2E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	R	4.2E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	R	6.7E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	µg/L	34.4	µg/L	R	9.6E-04	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	1.9E-02
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	R	3.5E-03	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	3.5E-01
	Dibenzofuran	40.3	µg/L	40.3	µg/L	R	1.2E-03	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	6.2E-01
	Fluorene	80.9	µg/L	73.65	µg/L	R	2.5E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.2E-02
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	R	2.7E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	µg/L	168.80	µg/L	R	1.9E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	9.4E-02
	Pentachlorophenol	572	µg/L	572	µg/L	R	1.2E-01	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	4.1E+00
	Phenanthrene	223	µg/L	223	µg/L	R	1.1E-02	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	3.6E-01
	Pyrene	33.1	µg/L	32.52	µg/L	R	3.2E-03	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.1E-01
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	R	1.8E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	µg/L	42000	µg/L	R	2.1E-03	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	4.1E-01
	Antimony (Dissolved)	3	µg/L	3.30	µg/L	R	1.6E-07	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	2.7E-03
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	R	1.4E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	4.8E-04
	Chromium (Total)	56.1	µg/L	56.1	µg/L	R	5.4E-06	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	7.2E-02
	Cobalt (Total)	38	µg/L	37.7	µg/L	R	7.4E-07	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	1.2E-04
	Iron (Total)	52900	µg/L	52900	µg/L	R	2.7E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	9.0E-03
	Lead (Total)	27.1	µg/L	27.10	µg/L	R	1.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	R	1.4E-04	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	1.7E-01
	Vanadium (Total)	102	µg/L	102	µg/L	R	4.9E-06	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	1.9E-01
	(Total)												8.0E+00

Table 13 Adult Resident RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium: Groundwater/Vapor
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	Benzene	0 49	µg/L	0.49	µg/L	M	3.5E-05	mg/kg-day	8 6E-03	mg/kg-day	3 E-02	mg/m^3	4.1E-03
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	2.2E-04	mg/kg-day	8 6E-01	mg/kg-day	3 E+00	mg/m^3	2.5E-04
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	2.1E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	5 5E-05	mg/kg-day	7.7E-02	mg/kg-day	3 E-01	mg/m^3	7.2E-04
	Trichloroethylene (TCE)	0 17	µg/L	0.17	µg/L	M	1.0E-05	mg/kg-day	1 1E-02	mg/kg-day	4.E-02	mg/m^3	9.2E-04
	Acenaphthene	53 3	µg/L	53.3	µg/L	M	1.3E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Acetophenone	62	µg/L	62	µg/L	M	2.0E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Anthracene	42.8	µg/L	42 8	µg/L	M	5.7E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Biphenyl	44 8	µg/L	44.8	µg/L	M	1.6E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m3	NC
	Fluorene	80 9	µg/L	80.9	µg/L	M	1.1E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	2.1E-02	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Naphthalene	239	µg/L	239	µg/L	M	1.1E-02	mg/kg-day	8 6E-04	mg/kg-day	3 E-03	mg/m^3	1.2E+01
	Pyrene	33 1	µg/L	33.1	µg/L	M	8.7E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												1.2E+01
												Total Hazard Index Across All Exposure Routes/Pathways	3.9E+01

Notes
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific
Ingestion Route EPC Value = Medium EPC Value.
Dermal Route EPC Value = Medium EPC Value - CWD (Concentration leaving shower droplet) Note that for adult resident dermal exposure to groundwater, the Route EPC values are different from the Medium EPC values only for the volatile organics.
This difference is due to the loss of contaminant through volatilization which occurs during showering.
Inhalation Route EPC Value = Medium EPC Value as determined by Foster and Chrostowski Shower Model and EPA Region 3 inputs (See Appendix)
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Child Resident RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	4.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	1.2E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	4.5E-07	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1.5E-02
	Dieldrin	0.321	µg/L	0.321	µg/L	M	1.9E-05	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	3.7E-01
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	4.7E-07	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	3.6E-02
	Benzene	0.49	µg/L	0.49	µg/L	M	2.8E-05	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	7.1E-03
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	2.3E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	3.5E-04	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	8.7E-03
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	5.8E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	5.8E-03
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	9.8E-06	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.3E-02
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	2.1E-02	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	5.2E+00
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	3.1E-03	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	5.1E-02
	Acetophenone	62	µg/L	62	µg/L	M	3.6E-03	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	3.6E-02
	Anthracene	42.8	µg/L	42.8	µg/L	M	2.5E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	8.2E-03
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	5.7E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	6.4E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	9.8E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	µg/L	44.8	µg/L	M	2.6E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	5.2E-02
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	7.5E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.8E-01
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	2.3E-03	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.2E+00
	Fluorene	80.9	µg/L	80.9	µg/L	M	4.7E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.2E-01
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	3.8E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	µg/L	239	µg/L	M	1.4E-02	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	6.9E-01
	Pentachlorophenol	572	µg/L	572	µg/L	M	3.3E-02	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.1E+00
	Phenanthrene	223	µg/L	223	µg/L	M	1.3E-02	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	4.3E-01
	Pyrene	33.1	µg/L	33.1	µg/L	M	1.9E-03	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	6.4E-02
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	2.9E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	2.4E+00	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.4E+00
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	1.9E-04	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	4.8E-01
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	1.7E-04	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.6E-01
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	3.2E-03	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.1E+00
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	2.2E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-01
	Iron (Total)	52900	µg/L	52900	µg/L	M	3.1E+00	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.0E+01
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	1.6E-03	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	1.6E-01	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	8.0E+00
	Vanadium (Total)	102	µg/L	102	µg/L	M	5.9E-03	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	5.9E+00
													3.8E+01

Table 13 Child Resident RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	1.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	3.6E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	2.4E-08	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	8.0E-04
	Dieldrin	0.321	µg/L	0.321	µg/L	M	7.6E-06	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.5E-01
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	3.2E-07	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	2.4E-02
	Benzene	0.49	µg/L	0.49	µg/L	M	2.5E-06	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	6.2E-04
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	3.0E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	2.5E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	6.3E-04
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	2.0E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	2.0E-03
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	9.5E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.2E-03
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	1.7E-02	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	4.3E+00
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	2.7E-03	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	4.6E-02
	Acetophenone	62	µg/L	62	µg/L	M	1.1E-04	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	1.1E-03
	Anthracene	42.8	µg/L	42.8	µg/L	M	4.2E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.4E-02
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	4.6E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	8.4E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	1.3E-03	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	µg/L	44.8	µg/L	M	2.5E-03	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	5.0E-02
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	6.9E-03	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	6.9E-01
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	2.4E-03	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.2E+00
	Fluorene	80.9	µg/L	80.9	µg/L	M	5.3E-03	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.3E-01
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	5.3E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	µg/L	239	µg/L	M	5.3E-03	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.7E-01
	Pentachlorophenol	572	µg/L	572	µg/L	M	*2.4E-01*	mg/kg-day	*3.0E-02*	mg/kg-day	NA	NA	*8.1E+00*
	Phenanthrene	223	µg/L	223	µg/L	M	2.1E-02	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	7.1E-01
	Pyrene	33.1	µg/L	33.1	µg/L	M	6.1E-03	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	2.0E-01
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	3.5E-04	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	5.3E-03	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	1.1E+00
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	4.2E-07	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	7.0E-03
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	3.7E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	1.2E-03
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	1.4E-05	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	1.9E-01
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	1.9E-06	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	3.2E-04
	Iron (Total)	52900	µg/L	52900	µg/L	M	6.5E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	2.2E-02
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	3.4E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	3.5E-04	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	4.3E-01
	Vanadium (Total)	102	µg/L	102	µg/L	M	1.3E-05	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	5.0E-01
	(Total)												1.8E+01
	Total Hazard Index Across All Exposure Routes/Pathways												5.7E+01

Notes.
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Hazard Calculation: (M) Medium Specific, (R) Route Specific.
Ingestion and Dermal Route EPC Value = Medium EPC Value.
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 13 Worker RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
Receptor Population 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	4.4E-10	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	1.2E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	4.6E-10	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	1.5E-05
	Dieldrin	0.321	µg/L	0.321	µg/L	M	1.9E-08	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	3.8E-04
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	4.8E-10	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	3.7E-05
	Benzene	0.49	µg/L	0.49	µg/L	M	2.9E-08	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	7.2E-06
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	2.3E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	3.5E-07	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	8.8E-06
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	5.9E-08	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	5.9E-06
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	1.0E-08	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	3.3E-05
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	2.1E-05	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	5.3E-03
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	3.1E-06	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	5.2E-05
	Acetophenone	62	µg/L	62	µg/L	M	3.6E-06	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	3.6E-05
	Anthracene	42.8	µg/L	42.8	µg/L	M	2.5E-06	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	8.4E-06
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	5.8E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	6.5E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	1.0E-07	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	µg/L	44.8	µg/L	M	2.6E-06	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	5.3E-05
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	7.6E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	3.8E-04
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	2.4E-06	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.2E-03
	Fluorene	80.9	µg/L	80.9	µg/L	M	4.7E-06	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.2E-04
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	3.9E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	µg/L	239	µg/L	M	1.4E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	7.0E-04
	Pentachlorophenol	572	µg/L	572	µg/L	M	3.4E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.1E-03
	Phenanthrene	223	µg/L	223	µg/L	M	1.3E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	4.4E-04
	Pyrene	33.1	µg/L	33.1	µg/L	M	1.9E-06	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	6.5E-05
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	2.9E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	2.5E-03	mg/kg-day	1.0E+00	mg/kg-day	NA	NA	2.5E-03
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	1.9E-07	mg/kg-day	4.0E-04	mg/kg-day	NA	NA	4.8E-04
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	1.7E-07	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	5.7E-04
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	3.3E-06	mg/kg-day	3.0E-03	mg/kg-day	NA	NA	1.1E-03
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	2.2E-06	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	1.1E-04
	Iron (Total)	52900	µg/L	52900	µg/L	M	3.1E-03	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.0E-02
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	1.6E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	1.6E-04	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	8.1E-03
	Vanadium (Total)	102	µg/L	102	µg/L	M	6.0E-06	mg/kg-day	1.0E-03	mg/kg-day	NA	NA	6.0E-03
													3.9E-02

Table 13 Worker RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: OU3B
Receptor Population: 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Dermal	alpha-BHC	0.0075	μg/L	0.0075	μg/L	M	1.1E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	beta-BHC	0.0204	μg/L	0.0204	μg/L	M	3.2E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aldrin	0.00781	μg/L	0.00781	μg/L	M	2.1E-10	mg/kg-day	3.0E-05	mg/kg-day	NA	NA	7.1E-06
	Dieldrin	0.321	μg/L	0.321	μg/L	M	7.0E-08	mg/kg-day	5.0E-05	mg/kg-day	NA	NA	1.4E-03
	Heptachlor Epoxide	0.00819	μg/L	0.00819	μg/L	M	2.8E-09	mg/kg-day	1.3E-05	mg/kg-day	NA	NA	2.1E-04
	Benzene	0.49	μg/L	0.49	μg/L	M	2.2E-08	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	5.4E-06
	Methyl tert-butyl ether (MTBE)	4	μg/L	4	μg/L	M	2.7E-08	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	1,1,2,2-Tetrachloroethane	6	μg/L	6	μg/L	M	2.2E-07	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	5.6E-06
	Tetrachloroethylene (PCE)	1	μg/L	1	μg/L	M	1.8E-07	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	1.8E-05
	Trichloroethylene (TCE)	0.17	μg/L	0.17	μg/L	M	8.5E-09	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	2.8E-05
	2-Methylnaphthalene	360	μg/L	360	μg/L	M	1.5E-04	mg/kg-day	4.0E-03	mg/kg-day	NA	NA	3.8E-02
	Acenaphthene	53.3	μg/L	53.3	μg/L	M	2.4E-05	mg/kg-day	6.0E-02	mg/kg-day	NA	NA	4.1E-04
	Acetophenone	62	μg/L	62	μg/L	M	9.7E-07	mg/kg-day	1.0E-01	mg/kg-day	NA	NA	9.7E-06
	Anthracene	42.8	μg/L	42.8	μg/L	M	3.7E-05	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.2E-04
	Benzo(a)anthracene	0.99	μg/L	0.99	μg/L	M	3.9E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(a)pyrene	1.1	μg/L	1.1	μg/L	M	7.4E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Benzo(b)fluoranthene	1.7	μg/L	1.7	μg/L	M	1.2E-05	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Biphenyl	44.8	μg/L	44.8	μg/L	M	2.2E-05	mg/kg-day	5.0E-02	mg/kg-day	NA	NA	4.4E-04
	Bis(2-ethylhexyl)phthalate	130	μg/L	130	μg/L	M	6.2E-05	mg/kg-day	1.0E-02	mg/kg-day	NA	NA	6.2E-03
	Dibenzofuran	40.3	μg/L	40.3	μg/L	M	2.2E-05	mg/kg-day	2.0E-03	mg/kg-day	NA	NA	1.1E-02
	Fluorene	80.9	μg/L	80.9	μg/L	M	4.6E-05	mg/kg-day	4.0E-02	mg/kg-day	NA	NA	1.2E-03
	Indeno(1,2,3-cd)pyrene	0.66	μg/L	0.66	μg/L	M	4.6E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Naphthalene	239	μg/L	239	μg/L	M	4.6E-05	mg/kg-day	2.0E-02	mg/kg-day	NA	NA	2.3E-03
	Pentachlorophenol	572	μg/L	572	μg/L	M	2.1E-03	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	7.1E-02
	Phenanthrene	223	μg/L	223	μg/L	M	1.9E-04	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	6.3E-03
	Pyrene	33.1	μg/L	33.1	μg/L	M	5.4E-05	mg/kg-day	3.0E-02	mg/kg-day	NA	NA	1.8E-03
	Total 2,3,7,8-TCDD TEQ	0.496	μg/L	0.496	μg/L	M	3.1E-06	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Aluminum (Total)	42000	μg/L	42000	μg/L	M	4.3E-05	mg/kg-day	5.0E-03	mg/kg-day	NA	NA	8.5E-03
	Antimony (Dissolved)	3	μg/L	3.3	μg/L	M	3.2E-09	mg/kg-day	6.0E-05	mg/kg-day	NA	NA	5.4E-05
	Arsenic (Dissolved)	3	μg/L	2.9	μg/L	M	2.8E-09	mg/kg-day	3.0E-04	mg/kg-day	NA	NA	9.4E-06
	Chromium (Total)	56.1	μg/L	56.1	μg/L	M	1.1E-07	mg/kg-day	7.5E-05	mg/kg-day	NA	NA	1.4E-03
	Cobalt (Total)	38	μg/L	37.7	μg/L	M	1.5E-08	mg/kg-day	6.0E-03	mg/kg-day	NA	NA	2.5E-06
	Iron (Total)	52900	μg/L	52900	μg/L	M	5.0E-05	mg/kg-day	3.0E-01	mg/kg-day	NA	NA	1.7E-04
	Lead (Total)	27.1	μg/L	27.1	μg/L	M	2.6E-09	mg/kg-day	NA	mg/kg-day	NA	NA	NC
	Manganese (Total)	2770	μg/L	2770	μg/L	M	2.7E-06	mg/kg-day	8.0E-04	mg/kg-day	NA	NA	3.3E-03
	Vanadium (Total)	102	μg/L	102	μg/L	M	1.0E-07	mg/kg-day	2.6E-05	mg/kg-day	NA	NA	3.9E-03
	(Total)												1.6E-01

Table 13 Worker RME OU3B Groundwater
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium. Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
Receptor Population 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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	Benzene	0.49	µg/L	4.38	µg/m^3	R	1.0E-04	mg/kg-day	8.6E-03	mg/kg-day	3.E-02	mg/m^3	1.2E-02
	Methyl tert-butyl ether (MTBE)	4	µg/L	31	µg/m^3	R	7.3E-04	mg/kg-day	8.6E-01	mg/kg-day	3.E+00	mg/m^3	8.5E-04
	1,1,2,2-Tetrachloroethane	6	µg/L	32 2	µg/m^3	R	7.6E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Tetrachloroethylene (PCE)	1	µg/L	6.19	µg/m^3	R	1.5E-04	mg/kg-day	7.7E-02	mg/kg-day	3.E-01	mg/m^3	1.9E-03
	Trichloroethylene (TCE)	0.17	µg/L	1.18	µg/m^3	R	2.8E-05	mg/kg-day	1.1E-02	mg/kg-day	4 E-02	mg/m^3	2.5E-03
	Acenaphthene	53 3	µg/L	256	µg/m^3	R	6.0E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Acetophenone	62	µg/L	73.9	µg/m^3	R	1.7E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Anthracene	42 8	µg/L	143	µg/m^3	R	3.4E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Biphenyl	44.8	µg/L	245	µg/m^3	R	5.8E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m3	NC
	Fluorene	80.9	µg/L	276	µg/m^3	R	6.5E-03	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	2-Methylnaphthalene	360	µg/L	2190	µg/m^3	R	5.1E-02	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Naphthalene	239	µg/L	1520	µg/m^3	R	3.6E-02	mg/kg-day	8 6E-04	mg/kg-day	3.E-03	mg/m^3	4.2E+01
	Pyrene	33.1	µg/L	33.4	µg/m^3	R	7.8E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												4.2E+01
												Total Hazard Index Across All Exposure Routes/Pathways	4.2E+01

Notes

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific.

Ingestion and Dermal Route EPC Value = Medium EPC Value.

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 13 Adult Resident RME OU3A Indoor Air (Groundwater Vapor Intrusion)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation (Indoor)	1,2-Dichloroethane	3 89	ug/L	8 23E-02	ug/m^3	R	2.3E-05	mg/kg-day	7.0E-01	mg/kg-day	2.0E+00	mg/m^3	3.2E-05
	1,3,5-Trimethylbenzene	75 9	ug/L	4 76E+00	ug/m^3	R	1 3E-03	mg/kg-day	1 7E-03	mg/kg-day	6.0E-03	mg/m^3	7 7E-01
	Azulene	4 1	ug/L	9.70E-01	ug/m^3	R	2.7E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzene	35.7	ug/L	3.84E+00	ug/m^3	R	1.1E-03	mg/kg-day	8.6E-03	mg/kg-day	3.0E-02	mg/m^3	1.2E-01
	Isopropylbenzene (cumene)	9 84	ug/L	1.17E+02	ug/m^3	R	3.2E-02	mg/kg-day	1.1E-01	mg/kg-day	4.0E-01	mg/m^3	2.9E-01
	Xylenes (Total)	128	ug/L	1.27E+01	ug/m^3	R	3 5E-03	mg/kg-day	2.9E-02	mg/kg-day	1.0E-01	mg/m^3	1.2E-01
	1,2,4-Trimethylbenzene	93.3	ug/L	6.14E+00	ug/m^3	R	1.7E-03	mg/kg-day	1 7E-03	mg/kg-day	6.0E-03	mg/m^3	9.9E-01
	Indene	19	ug/L	4.00E-01	ug/m^3	R	1.1E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												2.3E+00
												Total Hazard Index Across All Exposure Routes/Pathways	2 3E+00

Notes.

EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific

NA = not available

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

Table 13 Child Resident RME OU3A Indoor Air (Groundwater Vapor Intrusion)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point OU3A
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation (Indoor)	1,2-Dichloroethane	3 89	ug/L	8.23E-02	ug/m^3	R	5 7E-05	mg/kg-day	7.0E-01	mg/kg-day	2.0E+00	mg/m^3	8.1E-05
	1,3,5-Trimethylbenzene	75.9	ug/L	4.76E+00	ug/m^3	R	3 3E-03	mg/kg-day	1.7E-03	mg/kg-day	6.0E-03	mg/m^3	1.9E+00
	Azulene	4.1	ug/L	9.70E-01	ug/m^3	R	6 7E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Benzene	35 7	ug/L	3.84E+00	ug/m^3	R	2 7E-03	mg/kg-day	8.6E-03	mg/kg-day	3.0E-02	mg/m^3	3.1E-01
	Isopropylbenzene (cumene)	9.84	ug/L	1.17E+02	ug/m^3	R	8 1E-02	mg/kg-day	1.1E-01	mg/kg-day	4.0E-01	mg/m^3	7.4E-01
	Xylenes (Total)	128	ug/L	1.27E+01	ug/m^3	R	8 8E-03	mg/kg-day	2 9E-02	mg/kg-day	1.0E-01	mg/m^3	3.0E-01
	1,2,4-Trimethylbenzene	93 3	ug/L	6.14E+00	ug/m^3	R	4 3E-03	mg/kg-day	1 7E-03	mg/kg-day	6.0E-03	mg/m^3	2 5E+00
	Indene	19	ug/L	4.00E-01	ug/m^3	R	2 8E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												5.8E+00
												Total Hazard Index Across All Exposure Routes/Pathways	5.8E+00

Notes.

EPC Selected for Hazard Calculation (M) Medium Specific (R) Route Specific.

NA = not available

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

Table 13 Adult Resident RME OU3B Indoor Air (Groundwater Vapor Intrusion)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point. OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation (Indoor)	1,1,2,2-Tetrachloroethane	6	ug/L	3 14E-02	ug/m^3	R	8.6E-06	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Tetrachloroethylene (PCE)	1	ug/L	2.69E-01	ug/m^3	R	7.4E-05	mg/kg-day	7.7E-02	mg/kg-day	3.0E-01	mg/m^3	9.6E-04
	Trichloroethylene (TCE)	0 17	ug/L	3.01E-02	ug/m^3	R	8 2E-06	mg/kg-day	1 1E-02	mg/kg-day	4.0E-02	mg/m^3	7.5E-04
	2-Methylnaphthalene	360	ug/L	1 43E+00	ug/m^3	R	3.9E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Naphthalene	239	ug/L	1 24E+00	ug/m^3	R	3.4E-04	mg/kg-day	8 6E-04	mg/kg-day	3.0E-03	mg/m^3	4.0E-01
	Phenanthrene	223	ug/L	1.49E+02	ug/m^3	R	4.1E-02	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												4.0E-01
												Total Hazard Index Across All Exposure Routes/Pathways	4.0E-01

Notes
EPC Selected for Hazard Calculation: (M) Medium Specific, (R) Route Specific
NA = not available
mg/kg-day = milligrams per kilogram - day
mg/m^3 = milligrams per cubic meter
ug/L = micrograms per liter
ug/m^3 = micrograms per cubic meter

Table 13 Child Resident RME OU3B Indoor Air (Groundwater Vapor Intrusion)
Calculation of Non-Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point OU3B
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	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation (Indoor)	1,1,2,2-Tetrachloroethane	6	ug/L	3.14E-02	ug/m^3	R	2.2E-05	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Tetrachloroethylene (PCE)	1	ug/L	2.69E-01	ug/m^3	R	1.9E-04	mg/kg-day	7.7E-02	mg/kg-day	3.0E-01	mg/m^3	2.4E-03
	Trichloroethylene (TCE)	0.17	ug/L	3.01E-02	ug/m^3	R	2.1E-05	mg/kg-day	1.1E-02	mg/kg-day	4.0E-02	mg/m^3	1.9E-03
	2-Methylnaphthalene	360	ug/L	1.43E+00	ug/m^3	R	9.9E-04	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	Naphthalene	239	ug/L	1.24E+00	ug/m^3	R	8.6E-04	mg/kg-day	8.6E-04	mg/kg-day	3.0E-03	mg/m^3	1.0E+00
	Phenanthrene	223	ug/L	1.49E+02	ug/m^3	R	1.0E-01	mg/kg-day	NA	mg/kg-day	NA	mg/m^3	NC
	(Total)												1.0E+00
												Total Hazard Index Across All Exposure Routes/Pathways	1.0E+00

Notes

EPC Selected for Hazard Calculation (M) Medium Specific, (R) Route Specific.

NA = not available

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

Table 14 Adult Resident RME OU3B Surface Water
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium. Surface Water
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0.286	µg/L	0.286	µg/L	M	2.0E-09	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	3.2E-08
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	3.3E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	4.9E-09
	Aluminum (Total)	394	µg/L	394	µg/L	M	2.7E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4.7	µg/L	4.7	µg/L	M	3.3E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.9E-08
	(Total)										8.6E-08
Dermal	Dieldrin	0.286	µg/L	0.286	µg/L	M	7.1E-08	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0.00000466	µg/L	M	3.3E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	4.9E-06
	Aluminum (Total)	394	µg/L	394	µg/L	M	1.2E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4.7	µg/L	4.7	µg/L	M	1.5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-08
	(Total)										6.1E-06
										Total Cancer Risk Across All Exposure Routes/Pathways	6.2E-06
										Total Child Risk Across All Exposure Routes/Pathways	2.7E-06
										Total Adult and Child Risk Across All Media and All Exposure Routes	8.9E-06

Notes:
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Risk Calculation: (M) Medium Specific, (R) Route Specific.
Ingestion Route EPC Value = Medium EPC Value.
Dermal Route EPC Value = Medium EPC Value
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 14 Child Resident RME OU3B Surface Water
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Surface Water
Exposure Medium Surface Water
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0 286	µg/L	0.286	µg/L	M	2 1E-09	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	3 4E-08
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0 00000466	µg/L	M	3 4E-14	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	5 1E-09
	Aluminum (Total)	394	µg/L	394	µg/L	M	2 9E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4 7	µg/L	4.7	µg/L	M	3 5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5 2E-08
	(Total)										9 1E-08
Dermal	Dieldrin	0.286	µg/L	0 286	µg/L	M	3 1E-08	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	4 9E-07
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0.00000466	µg/L	M	1 4E-11	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	2.1E-06
	Aluminum (Total)	394	µg/L	394	µg/L	M	5 4E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4 7	µg/L	4.7	µg/L	M	6 4E-09	mg/kg-day	1 5E+00	$(mg/kg\text{-}day)^{-1}$	9.6E-09
	(Total)										2.6E-06
										Total Cancer Risk Across All Exposure Routes/Pathways	2 7E-06

Total Adult Risk Across All Exposure Routes/Pathways	6 2E-06
Total Adult and Child Risk Across All Media and All Exposure Routes	8 9E-06

Notes:
Dermal intake calculations use values for DAevent from Appendix
EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific
Ingestion and Dermal Route EPC Value = Medium EPC Value
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 14 Trespasser/Visitor RME OU3B Surface Water
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Surface Water
Exposure Medium: Surface Water
Exposure Point OU3B
Receptor Population: Trespasser/Visitor
Receptor Age: Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0 286	µg/L	0 286	µg/L	M	1 5E-09	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	2 4E-08
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0.00000466	µg/L	M	2 4E-14	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	3 6E-09
	Aluminum (Total)	394	µg/L	394	µg/L	M	2 0E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4 7	µg/L	4 7	µg/L	M	2.4E-08	mg/kg-day	1 5E+00	$(mg/kg\text{-}day)^{-1}$	3 7E-08
	(Total)										6 4E-08
Dermal	Dieldrin	0 286	µg/L	0 286	µg/L	M	3 8E-08	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	6 1E-07
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0 00000466	µg/L	M	1 8E-11	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	2 7E-06
	Aluminum (Total)	394	µg/L	394	µg/L	M	6 7E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4 7	µg/L	4 7	µg/L	M	8 0E-09	mg/kg-day	1 5E+00	$(mg/kg\text{-}day)^{-1}$	1 2E-08
	(Total)										3.3E-06
										Total Cancer Risk Across All Exposure Routes/Pathways	3 4E-06

Notes:

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Risk Calculation: (M) Medium Specific, (R) Route Specific

Ingestion and Dermal Route EPC Value = Medium EPC Value

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 14 Worker RME OU3B Surface Water
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current Future
Medium Surface Water
Exposure Medium Surface Water
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0 286	µg/L	0 286	µg/L	M	2 7E-11	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	4.4E-10
	Total 2,3,7,8-TCDD TEQ	0.00000466	µg/L	0 00000466	µg/L	M	4 5E-16	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	6.7E-11
	Aluminum (Total)	394	µg/L	394	µg/L	M	3 8E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4.7	µg/L	4 7	µg/L	M	4 5E-10	mg/kg-day	1 5E+00	$(mg/kg\text{-}day)^{-1}$	6 8E-10
	(Total)										1 2E-09
Dermal	Dieldrin	0 286	µg/L	0 286	µg/L	M	2 6E-09	mg/kg-day	1 6E+01	$(mg/kg\text{-}day)^{-1}$	4 2E-08
	Total 2,3,7,8-TCDD TEQ	0 00000466	µg/L	0 00000466	µg/L	M	1 3E-12	mg/kg-day	1 5E+05	$(mg/kg\text{-}day)^{-1}$	1 9E-07
	Aluminum (Total)	394	µg/L	394	µg/L	M	1 9E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	4 7	µg/L	4 7	µg/L	M	2 3E-10	mg/kg-day	1 5E+00	$(mg/kg\text{-}day)^{-1}$	3 5E-10
	(Total)										2 3E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	2.3E-07

Notes:

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific.

Ingestion Route EPC Value = Medium EPC Value.

Dermal Route EPC Value = Medium EPC Value

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 14 Adult Resident RME OU3B Sediment
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current/Future
Medium: Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	1.1E-08	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	3.0E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.2E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	1.3E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	9.6E-08
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	4.6E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	2.0E-13	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.0E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	7.2E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	2.5E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.7E-08
	Chromium	157	mg/kg	157	mg/kg	M	1.4E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	6.1E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	1.5E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	5.6E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	3.1E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										4.0E-07
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	1.9E-08	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	3.9E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	4.9E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	2.1E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.6E-07
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	5.8E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	7.5E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.1E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	9.0E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.0E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-08
	Chromium	157	mg/kg	157	mg/kg	M	1.7E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	7.7E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	1.9E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	7.1E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	3.9E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										5.8E-07
	Total Cancer Risk Across All Exposure Routes/Pathways										9.8E-07

Total Child Risk Across All Exposure Routes/Pathways	1.6E-06
Total Adult and Child Risk Across All Media and All Exposure Routes	2.6E-06

Notes:

EPC Selected for Risk Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

Table 14 Child Resident RME OU3B Sediment
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current/Future
Medium: Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	2.3E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	4.6E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	6.3E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.6E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	2.8E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.0E-07
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	9.7E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	4.2E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	6.3E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.5E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	5.2E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	7.8E-08
	Chromium	157	mg/kg	157	mg/kg	M	2.9E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.3E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	3.2E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	1.2E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	6.5E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										8.5E-07
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	2.4E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	4.8E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	6.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.4E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	2.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.9E-07
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	7.2E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	9.3E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.4E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.1E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.2E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.9E-08
	Chromium	157	mg/kg	157	mg/kg	M	2.1E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	9.6E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	2.4E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	8.8E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	4.8E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										7.2E-07

Total Cancer Risk Across All Exposure Routes/Pathways: 1.6E-06

Total Adult Risk Across All Exposure Routes/Pathways: 9.8E-07

Total Adult and Child Risk Across All Media and All Exposure Routes: 2.6E-06

Notes:

EPC Selected for Risk Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

Table 14 Trespasser/Visitor RME OU3B Sediment
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current/Future
Medium: Sediment (Wet)
Exposure Medium: Sediment (Wet)
Exposure Point: OU3B
Receptor Population: Trespasser/Visitor
Receptor Age: Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	8.2E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.6E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	2.2E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.6E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	9.7E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.1E-08
	Dibenzofuran	0.53	mg/kg	0 53	mg/kg	M	3.4E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	1.5E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.2E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	5.3E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.8E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.8E-08
	Chromium	157	mg/kg	157	mg/kg	M	1.0E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	4.6E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	1.1E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	4.2E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	2.3E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										3.0E-07
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	3.0E-08	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	6.0E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	7.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.5E-07
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	3.3E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.4E-07
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	9.0E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	1.2E-13	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.7E-08
	Aluminum	8210	mg/kg	8210	mg/kg	M	1.4E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	1.5E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.3E-08
	Chromium	157	mg/kg	157	mg/kg	M	2.7E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	2.9E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	1.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	6.0E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										8.9E-07
	Total Cancer Risk Across All Exposure Routes/Pathways										1.2E-06

Notes:
EPC Selected for Risk Calculation: (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day

Table 14 Worker RME OU3B Sediment
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium: Sediment (Wet)
Exposure Medium Sediment (Wet)
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	3.0E-09	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	6.0E-09
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	8.3E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.0E-08
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	3.6E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.6E-08
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	1.3E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	5.4E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	8.2E-09
	Aluminum	8210	mg/kg	8210	mg/kg	M	2.0E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	6.8E-09	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-08
	Chromium	157	mg/kg	157	mg/kg	M	3.8E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	1.7E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	4.2E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	1.5E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	8.5E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										1.1E-07
Dermal	Arochlor 1254 (PCB-1254)	1.26	mg/kg	1.26	mg/kg	M	5.1E-09	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-08
	Benzo(a)pyrene	3.44	mg/kg	3.44	mg/kg	M	1.3E-08	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	9.5E-08
	Dibenzo(a,h)anthracene	1.5	mg/kg	1.5	mg/kg	M	5.7E-09	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	4.1E-08
	Dibenzofuran	0.53	mg/kg	0.53	mg/kg	M	1.5E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.0000227	mg/kg	0.0000227	mg/kg	M	2.0E-14	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	3.0E-09
	Aluminum	8210	mg/kg	8210	mg/kg	M	2.4E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	2.84	mg/kg	2.84	mg/kg	M	2.6E-09	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.0E-09
	Chromium	157	mg/kg	157	mg/kg	M	4.6E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	7.05	mg/kg	7.05	mg/kg	M	2.0E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	17400	mg/kg	17400	mg/kg	M	5.1E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	644	mg/kg	644	mg/kg	M	1.9E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	35.5	mg/kg	35.5	mg/kg	M	1.0E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										1.5E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	2.6E-07

Notes:
EPC Selected for Risk Calculation: (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day

Table 14 Adult Resident RME OU3B Surface Soil
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	3.7E-08	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	6.2E-07
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	1.0E-07	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	1.7E-06
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	6.2E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.5E-06
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	1.2E-06	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	9.0E-06
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	1.3E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.3E-07
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	4.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.2E-06
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	5.9E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.3E-07
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	5.6E-06	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	6.8E-07
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	5.3E-10	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	7.9E-05
	Aluminum	15000	mg/kg	15000	mg/kg	M	7.0E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	3.9E-06	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	5.8E-06
	Chromium	43.3	mg/kg	43.3	mg/kg	M	2.0E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	7.8E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	3.0E-02	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	1.1E-02	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	2.2E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										1.1E-04
Dermal	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	1.5E-08	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	2.5E-07
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	4.1E-08	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	6.6E-07
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	3.2E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.3E-06
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	6.4E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.7E-06
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	6.6E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.8E-07
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	2.3E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.7E-06
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	3.1E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.2E-07
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	5.6E-06	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	6.7E-07
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	6.3E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	9.4E-06
	Aluminum	15000	mg/kg	15000	mg/kg	M	2.8E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	5.0E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	7.4E-07
	Chromium	43.3	mg/kg	43.3	mg/kg	M	8.1E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	3.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	1.2E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	4.5E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	8.8E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2.1E-05

Table 14 Adult Resident RME OU3B Surface Soil
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0778	mg/kg	6.13E-08	ug/m^3	R	5.8E-12	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	9.8E-11
	Dieldrin	0.22	mg/kg	1.73E-07	ug/m^3	R	1.6E-11	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	2.6E-10
	Benzo(a)anthracene	13.2	mg/kg	1.04E-05	ug/m^3	R	9.8E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	3.0E-10
	Benzo(a)pyrene	2.62	mg/kg	2.06E-06	ug/m^3	R	1.9E-10	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	6.0E-10
	Benzo(b)fluoranthene	2.71	mg/kg	2.13E-06	ug/m^3	R	2.0E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	6.2E-11
	Dibenzo(a,h)anthracene	0.937	mg/kg	7.38E-07	ug/m^3	R	6.9E-11	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	2.1E-10
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	9.92E-07	ug/m^3	R	9.3E-11	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	2.9E-11
	Pentachlorophenol	12	mg/kg	9.45E-06	ug/m^3	R	8.9E-10	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	8.82E-10	ug/m^3	R	8.3E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.2E-08
	Aluminum	15000	mg/kg	1.18E-02	ug/m^3	R	1.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	6.50E-06	ug/m^3	R	6.1E-10	mg/kg-day	1.5E+01	(mg/kg-day)$^{-1}$	9.2E-09
	Chromium	43.3	mg/kg	3.41E-05	ug/m^3	R	3.2E-09	mg/kg-day	4.1E+01	(mg/kg-day)$^{-1}$	1.3E-07
	Cobalt	167	mg/kg	1.31E-04	ug/m^3	R	1.2E-08	mg/kg-day	9.8E+00	(mg/kg-day)$^{-1}$	1.2E-07
	Iron	63800	mg/kg	5.02E-02	ug/m^3	R	4.7E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	1.89E-02	ug/m^3	R	1.8E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	3.68E-05	ug/m^3	R	3.5E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2.8E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	1.3E-04

Total Child Risk Across All Exposure Routes/Pathways	2.5E-04
Total Adult and Child Risk Across All Media and All Exposure Routes	3.8E-04

Notes:

EPC Selected for Risk Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 14 Child Resident RME OU3B Surface Soil
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	7.7E-08	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	2.2E-07	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	3.5E-06
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	1.3E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.5E-06
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	2.6E-06	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.9E-05
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	2.7E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	2.0E-06
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	9.3E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.8E-06
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	1.2E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.1E-07
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.2E-05	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	1.4E-06
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	1.1E-09	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.7E-04
	Aluminum	15000	mg/kg	15000	mg/kg	M	1.5E-02	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	8.2E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-05
	Chromium	43.3	mg/kg	43.3	mg/kg	M	4.3E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	1.7E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	6.3E-02	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	2.4E-02	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	4.6E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										2.2E-04
Dermal	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	2.2E-08	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	3.7E-07
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	6.1E-08	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	9.8E-07
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	4.8E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.5E-06
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	9.4E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.9E-06
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	9.8E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	7.1E-07
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	3.4E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	2.5E-06
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	4.5E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	3.3E-07
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	8.3E-06	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	1.0E-06
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	9.3E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.4E-05
	Aluminum	15000	mg/kg	15000	mg/kg	M	4.2E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	7.3E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Chromium	43.3	mg/kg	43.3	mg/kg	M	1.2E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	4.6E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	1.8E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	6.7E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	1.3E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										3.1E-05

Table 14 Child Resident RME OU3B Surface Soil
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0778	mg/kg	6.13E-08	ug/m^3	R	3.6E-12	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	6.2E-11
	Dieldrin	0.22	mg/kg	1.73E-07	ug/m^3	R	1.0E-11	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	1.6E-10
	Benzo(a)anthracene	13.2	mg/kg	1.04E-05	ug/m^3	R	6.2E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	1.9E-10
	Benzo(a)pyrene	2.62	mg/kg	2.06E-06	ug/m^3	R	1.2E-10	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	3.8E-10
	Benzo(b)fluoranthene	2.71	mg/kg	2.13E-06	ug/m^3	R	1.3E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	3.9E-11
	Dibenzo(a,h)anthracene	0.937	mg/kg	7.38E-07	ug/m^3	R	4.4E-11	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	1.4E-10
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	9.92E-07	ug/m^3	R	5.9E-11	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	1.8E-11
	Pentachlorophenol	12	mg/kg	9.45E-06	ug/m^3	R	5.6E-10	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	8.82E-10	ug/m^3	R	5.2E-14	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	7.9E-09
	Aluminum	15000	mg/kg	1.18E-02	ug/m^3	R	7.0E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	6.50E-06	ug/m^3	R	3.9E-10	mg/kg-day	1.5E+01	(mg/kg-day)$^{-1}$	5.8E-09
	Chromium	43.3	mg/kg	3.41E-05	ug/m^3	R	2.0E-09	mg/kg-day	4.1E+01	(mg/kg-day)$^{-1}$	8.3E-08
	Cobalt	167	mg/kg	1.31E-04	ug/m^3	R	7.8E-09	mg/kg-day	9.8E+00	(mg/kg-day)$^{-1}$	7.7E-08
	Iron	63800	mg/kg	5.02E-02	ug/m^3	R	3.0E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	1.89E-02	ug/m^3	R	1.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	3.68E-05	ug/m^3	R	2.2E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										1.7E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	2.5E-04

Total Adult Risk Across All Exposure Routes/Pathways	1.3E-04
Total Adult and Child Risk Across All Media and All Exposure Routes	3.8E-04

Notes:

EPC Selected for Risk Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 14 Trespasser/Visitor RME OU3B Surface Soil
Calculation of Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe: Current
Medium Surface Soil
Exposure Medium: Surface Soil
Exposure Point OU3B
Receptor Population: Trespasser/Visitor
Receptor Age. Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	8.1E-10	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	1.4E-08
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	2.3E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	3.7E-08
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	1.4E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.0E-07
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	2.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.0E-07
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	2.8E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.1E-08
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	9.7E-09	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	7.1E-08
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	1.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.6E-09
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.2E-07	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	1.5E-08
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	1.2E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.7E-06
	Aluminum	15000	mg/kg	15000	mg/kg	M	1.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	8.6E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.3E-07
	Chromium	43.3	mg/kg	43.3	mg/kg	M	4.5E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	1.7E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	6.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	2.5E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	4.9E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2.3E-06
Dermal	Aldrin	0.0778	mg/kg	0.0778	mg/kg	M	2.8E-09	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	4.8E-08
	Dieldrin	0.22	mg/kg	0.22	mg/kg	M	8.1E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	1.3E-07
	Benzo(a)anthracene	13.2	mg/kg	13.2	mg/kg	M	6.3E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.6E-07
	Benzo(a)pyrene	2.62	mg/kg	2.62	mg/kg	M	1.2E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	9.1E-07
	Benzo(b)fluoranthene	2.71	mg/kg	2.71	mg/kg	M	1.3E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.4E-08
	Dibenzo(a,h)anthracene	0.937	mg/kg	0.937	mg/kg	M	4.5E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	3.3E-07
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	1.26	mg/kg	M	6.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.4E-08
	Pentachlorophenol	12	mg/kg	12	mg/kg	M	1.1E-06	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	1.3E-07
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	0.00112	mg/kg	M	1.2E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.8E-06
	Aluminum	15000	mg/kg	15000	mg/kg	M	5.5E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	8.26	mg/kg	M	9.7E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.5E-07
	Chromium	43.3	mg/kg	43.3	mg/kg	M	1.6E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	167	mg/kg	167	mg/kg	M	6.1E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	63800	mg/kg	63800	mg/kg	M	2.3E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	24000	mg/kg	M	8.8E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	46.7	mg/kg	M	1.7E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										4.1E-06

Table 14 Trespasser/Visitor RME OU3B Surface Soil
Calculation of Cancer Hazards, Reasonable Maximum Exposure

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil
Exposure Point: OU3B
Receptor Population: Trespasser/Visitor
Receptor Age: Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0778	mg/kg	6.13E-08	ug/m^3	R	5.3E-14	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	9.0E-13
	Dieldrin	0.22	mg/kg	1.73E-07	ug/m^3	R	1.5E-13	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	2.4E-12
	Benzo(a)anthracene	13.2	mg/kg	1.04E-05	ug/m^3	R	9.0E-12	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	2.8E-12
	Benzo(a)pyrene	2.62	mg/kg	2.06E-06	ug/m^3	R	1.8E-12	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	5.5E-12
	Benzo(b)fluoranthene	2.71	mg/kg	2.13E-06	ug/m^3	R	1.8E-12	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	5.7E-13
	Dibenzo(a,h)anthracene	0.937	mg/kg	7.38E-07	ug/m^3	R	6.4E-13	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	2.0E-12
	Indeno(1,2,3-cd)pyrene	1.26	mg/kg	9.92E-07	ug/m^3	R	8.6E-13	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	2.7E-13
	Pentachlorophenol	12	mg/kg	9.45E-06	ug/m^3	R	8.2E-12	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.00112	mg/kg	8.82E-10	ug/m^3	R	7.6E-16	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.1E-10
	Aluminum	15000	mg/kg	1.18E-02	ug/m^3	R	1.0E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	8.26	mg/kg	6.50E-06	ug/m^3	R	5.6E-12	mg/kg-day	1.5E+01	(mg/kg-day)$^{-1}$	8.4E-11
	Chromium	43.3	mg/kg	3.41E-05	ug/m^3	R	2.9E-11	mg/kg-day	4.1E+01	(mg/kg-day)$^{-1}$	1.2E-09
	Cobalt	167	mg/kg	1.31E-04	ug/m^3	R	1.1E-10	mg/kg-day	9.8E+00	(mg/kg-day)$^{-1}$	1.1E-09
	Iron	63800	mg/kg	5.02E-02	ug/m^3	R	4.3E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	24000	mg/kg	1.89E-02	ug/m^3	R	1.6E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	46.7	mg/kg	3.68E-05	ug/m^3	R	3.2E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2.5E-09
										Total Cancer Risk Across All Exposure Routes/Pathways	6.5E-06

Notes:

EPC Selected for Risk Calculation: (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 14 Adult Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	2.2E-08	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	3.7E-07
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	6.5E-08	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.0E-06
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	4.8E-08	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	9.7E-08
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	1.9E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.8E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.7E-06	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-05
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.8E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	9.4E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.9E-06
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	2.9E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	2.2E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.4E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	9.9E-07
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	2.3E-06	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-07
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	7.8E-10	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.2E-04
	Aluminum	14300	mg/kg	14300	mg/kg	M	6.7E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	2.9E-06	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.3E-06
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.8E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	3.1E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	2.4E-02	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	8.1E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	2.1E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										1.5E-04
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	8.7E-09	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	2.6E-08	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	4.2E-07
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	2.7E-08	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	5.4E-08
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	2.2E-10	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	9.4E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.9E-07
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	8.8E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	6.4E-06
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	9.4E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.8E-07
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	4.9E-07	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-06
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	1.1E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	8.6E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	7.1E-07	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	5.2E-07
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	2.3E-06	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-07
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	9.4E-11	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.4E-05
	Aluminum	14300	mg/kg	14300	mg/kg	M	2.7E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	3.6E-07	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.5E-07
	Chromium	38.1	mg/kg	38.1	mg/kg	M	7.1E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	1.2E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	9.7E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	3.2E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	8.3E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										2.7E-05

Table 14 Adult Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0 0465	mg/kg	3.66E-08	ug/m^3	R	3.4E-12	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	5.8E-11
	Dieldrin	0 139	mg/kg	1.09E-07	ug/m^3	R	1.0E-11	mg/kg-day	1 6E+01	(mg/kg-day)$^{-1}$	1.6E-10
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	8.11E-08	ug/m^3	R	7.6E-12	mg/kg-day	2 0E+00	(mg/kg-day)$^{-1}$	1.5E-11
	Methylcyclohexane	0.004	mg/kg	3.15E-09	ug/m^3	R	3.0E-13	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	3 87	mg/kg	3.05E-06	ug/m^3	R	2.9E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	8.9E-11
	Benzo(a)pyrene	3 6	mg/kg	2.83E-06	ug/m^3	R	2.7E-10	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	8.3E-10
	Benzo(b)fluoranthene	3 85	mg/kg	3 03E-06	ug/m^3	R	2 8E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	8.8E-11
	Dibenzo(a,h)anthracene	2	mg/kg	1.57E-06	ug/m^3	R	1.5E-10	mg/kg-day	3.1E+00	(mg/kg-day)$^{-1}$	4 6E-10
	Dibenzofuran	0.61	mg/kg	4.80E-07	ug/m^3	R	4.5E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	3.62E-07	ug/m^3	R	3.4E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.28E-06	ug/m^3	R	2.1E-10	mg/kg-day	3.1E-01	(mg/kg-day)$^{-1}$	6.6E-11
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m^3	R	3.6E-10	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	1.31E-09	ug/m^3	R	1.2E-13	mg/kg-day	1 5E+05	(mg/kg-day)$^{-1}$	1.9E-08
	Aluminum	14300	mg/kg	1.13E-02	ug/m^3	R	1.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	6.07	mg/kg	4.78E-06	ug/m^3	R	4.5E-10	mg/kg-day	1.5E+01	(mg/kg-day)$^{-1}$	6.7E-09
	Chromium	38.1	mg/kg	3.00E-05	ug/m^3	R	2.8E-09	mg/kg-day	4.1E+01	(mg/kg-day)$^{-1}$	1.2E-07
	Cobalt	66	mg/kg	5.20E-05	ug/m^3	R	4.9E-09	mg/kg-day	9.8E+00	(mg/kg-day)$^{-1}$	4.8E-08
	Iron	51800	mg/kg	4 08E-02	ug/m^3	R	3.8E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	17200	mg/kg	1 35E-02	ug/m^3	R	1.3E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	44 1	mg/kg	3.47E-05	ug/m^3	R	3.3E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										1.9E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	1.7E-04

Total Child Risk Across All Exposure Routes/Pathways	3.5E-04
Total Adult and Child Risk Across All Media and All Exposure Routes	5.2E-04

Notes:

EPC Selected for Risk Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 14 Child Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	4.6E-08	mg/kg-day	1.7E+01	$(mg/kg-day)^{-1}$	7.8E-07
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.4E-07	mg/kg-day	1.6E+01	$(mg/kg-day)^{-1}$	2.2E-06
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	1.0E-07	mg/kg-day	2.0E+00	$(mg/kg-day)^{-1}$	2.0E-07
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	4.0E-09	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	3.8E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	2.8E-06
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	3.6E-06	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	2.6E-05
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	3.8E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	2.8E-06
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	2.0E-06	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	1.4E-05
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	6.0E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	4.6E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	2.9E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	2.1E-06
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	4.8E-06	mg/kg-day	1.2E-01	$(mg/kg-day)^{-1}$	5.7E-07
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.7E-09	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	2.5E-04
	Aluminum	14300	mg/kg	14300	mg/kg	M	1.4E-02	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	6.0E-06	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	9.0E-06
	Chromium	38.1	mg/kg	38.1	mg/kg	M	3.8E-05	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	6.5E-05	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	5.1E-02	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	1.7E-02	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	4.4E-05	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	(Total)										3.1E-04
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	1.3E-08	mg/kg-day	1.7E+01	$(mg/kg-day)^{-1}$	2.2E-07
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	3.9E-08	mg/kg-day	1.6E+01	$(mg/kg-day)^{-1}$	6.2E-07
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	4.0E-08	mg/kg-day	2.0E+00	$(mg/kg-day)^{-1}$	8.0E-08
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	3.3E-10	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.4E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.0E-06
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.3E-06	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	9.5E-06
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.4E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.0E-06
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	7.2E-07	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	5.3E-06
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	1.7E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	1.3E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.0E-06	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	7.6E-07
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	3.3E-06	mg/kg-day	1.2E-01	$(mg/kg-day)^{-1}$	4.0E-07
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.4E-10	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	2.1E-05
	Aluminum	14300	mg/kg	14300	mg/kg	M	4.0E-04	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	5.4E-07	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	8.1E-07
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.1E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	1.8E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	1.4E-03	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	4.8E-04	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	1.2E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	(Total)										4.0E-05

Table 14 Child Resident RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium: Total Soil (Surface + Subsurface)
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0465	mg/kg	3.66E-08	ug/m³	R	2.2E-12	mg/kg-day	1.7E+01	(mg/kg-day)⁻¹	3.7E-11
	Dieldrin	0.139	mg/kg	1.09E-07	ug/m³	R	6.5E-12	mg/kg-day	1.6E+01	(mg/kg-day)⁻¹	1.0E-10
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	8.11E-08	ug/m³	R	4.8E-12	mg/kg-day	2.0E+00	(mg/kg-day)⁻¹	9.6E-12
	Methylcyclohexane	0.004	mg/kg	3.15E-09	ug/m³	R	1.9E-13	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Benzo(a)anthracene	3.87	mg/kg	3.05E-06	ug/m³	R	1.8E-10	mg/kg-day	3.1E-01	(mg/kg-day)⁻¹	5.6E-11
	Benzo(a)pyrene	3.6	mg/kg	2.83E-06	ug/m³	R	1.7E-10	mg/kg-day	3.1E+00	(mg/kg-day)⁻¹	5.2E-10
	Benzo(b)fluoranthene	3.85	mg/kg	3.03E-06	ug/m³	R	1.8E-10	mg/kg-day	3.1E-01	(mg/kg-day)⁻¹	5.6E-11
	Dibenzo(a,h)anthracene	2	mg/kg	1.57E-06	ug/m³	R	9.4E-11	mg/kg-day	3.1E+00	(mg/kg-day)⁻¹	2.9E-10
	Dibenzofuran	0.61	mg/kg	4.80E-07	ug/m³	R	2.9E-11	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Di-n-octylphthalate	0.46	mg/kg	3.62E-07	ug/m³	R	2.2E-11	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.28E-06	ug/m³	R	1.4E-10	mg/kg-day	3.1E-01	(mg/kg-day)⁻¹	4.2E-11
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m³	R	2.3E-10	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Total 2,3,7,8-TCDD TEQ	0.001666	mg/kg	1.31E-09	ug/m³	R	7.8E-14	mg/kg-day	1.5E+05	(mg/kg-day)⁻¹	1.2E-08
	Aluminum	14300	mg/kg	1.13E-02	ug/m³	R	6.7E-07	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Arsenic	6.07	mg/kg	4.78E-06	ug/m³	R	2.8E-10	mg/kg-day	1.5E+01	(mg/kg-day)⁻¹	4.3E-09
	Chromium	38.1	mg/kg	3.00E-05	ug/m³	R	1.8E-09	mg/kg-day	4.1E+01	(mg/kg-day)⁻¹	7.3E-08
	Cobalt	66	mg/kg	5.20E-05	ug/m³	R	3.1E-09	mg/kg-day	9.8E+00	(mg/kg-day)⁻¹	3.0E-08
	Iron	51800	mg/kg	4.08E-02	ug/m³	R	2.4E-06	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Manganese	17200	mg/kg	1.35E-02	ug/m³	R	8.0E-07	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Vanadium	44.1	mg/kg	3.47E-05	ug/m³	R	2.1E-09	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	(Total)										1.2E-07
										Total Cancer Risk Across All Exposure Routes/Pathways	3.5E-04

Total Adult Risk Across All Exposure Routes/Pathways	1.7E-04
Total Adult and Child Risk Across All Media and All Exposure Routes	5.2E-04

Notes

EPC Selected for Risk Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m³ = milligrams per cubic meter

ug/m³ = micrograms per cubic meter

Table 14 Tresspasser/Visitor RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point: OU3B
Receptor Population Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	4 8E-10	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	8.2E-09
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.4E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	2.3E-08
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0 103	mg/kg	M	1.1E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	2.1E-09
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	4 2E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	4 0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.9E-08
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	3.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.7E-07
	Benzo(b)fluoranthene	3.85	mg/kg	3 85	mg/kg	M	4.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2 9E-08
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	2 1E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.5E-07
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	6 3E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	4 8E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2 9	mg/kg	M	3.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2 2E-08
	Pentachlorophenol	4.82	mg/kg	4 82	mg/kg	M	5.0E-08	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	6 0E-09
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.7E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.6E-06
	Aluminum	14300	mg/kg	14300	mg/kg	M	1.5E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	6.3E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	9.5E-08
	Chromium	38.1	mg/kg	38.1	mg/kg	M	4.0E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	6.9E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	5.4E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	1.8E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	4.6E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										3.2E-06
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	1.7E-09	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	2.9E-08
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	5.1E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	8.1E-08
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	5.3E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	1.1E-08
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	4.4E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.8E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.3E-07
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.7E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.3E-06
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.8E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.3E-07
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	9.5E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.9E-07
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	2.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	1.7E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.4E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.0E-07
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	4.4E-07	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	5.3E-08
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	1.8E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	2.7E-06
	Aluminum	14300	mg/kg	14300	mg/kg	M	5.2E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	7.1E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	1.1E-07
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.4E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	2.4E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	1.9E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	6.3E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	1.6E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										5.3E-06

Table 14 Tresspasser/Visitor RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe. Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
Receptor Population: Trespasser/Visitor
Receptor Age Pre-Adolescent/Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0465	mg/kg	3.66E-08	ug/m³	R	3.2E-14	mg/kg-day	1 7E+01	(mg/kg-day)⁻¹	5 4E-13
	Dieldrin	0.139	mg/kg	1.09E-07	ug/m³	R	9.4E-14	mg/kg-day	1 6E+01	(mg/kg-day)⁻¹	1.5E-12
	Arochlor 1254 (PCB-1254)	0 103	mg/kg	8 11E-08	ug/m³	R	7.0E-14	mg/kg-day	2.0E+00	(mg/kg-day)⁻¹	1 4E-13
	Methylcyclohexane	0 004	mg/kg	3 15E-09	ug/m³	R	2.7E-15	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Benzo(a)anthracene	3.87	mg/kg	3 05E-06	ug/m³	R	2.6E-12	mg/kg-day	3 1E-01	(mg/kg-day)⁻¹	8 1E-13
	Benzo(a)pyrene	3 6	mg/kg	2 83E-06	ug/m³	R	2.4E-12	mg/kg-day	3.1E+00	(mg/kg-day)⁻¹	7.6E-12
	Benzo(b)fluoranthene	3 85	mg/kg	3 03E-06	ug/m³	R	2.6E-12	mg/kg-day	3.1E-01	(mg/kg-day)⁻¹	8.1E-13
	Dibenzo(a,h)anthracene	2	mg/kg	1 57E-06	ug/m³	R	1.4E-12	mg/kg-day	3.1E+00	(mg/kg-day)⁻¹	4 2E-12
	Dibenzofuran	0.61	mg/kg	4 80E-07	ug/m³	R	4.1E-13	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Di-n-octylphthalate	0 46	mg/kg	3 62E-07	ug/m³	R	3.1E-13	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2 28E-06	ug/m³	R	2.0E-12	mg/kg-day	3.1E-01	(mg/kg-day)⁻¹	6 1E-13
	Pentachlorophenol	4.82	mg/kg	3.80E-06	ug/m³	R	3.3E-12	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	1.31E-09	ug/m³	R	1.1E-15	mg/kg-day	1.5E+05	(mg/kg-day)⁻¹	1.7E-10
	Aluminum	14300	mg/kg	1.13E-02	ug/m³	R	9.7E-09	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Arsenic	6.07	mg/kg	4.78E-06	ug/m³	R	4.1E-12	mg/kg-day	1 5E+01	(mg/kg-day)⁻¹	6.2E-11
	Chromium	38.1	mg/kg	3.00E-05	ug/m³	R	2.6E-11	mg/kg-day	4 1E+01	(mg/kg-day)⁻¹	1.1E-09
	Cobalt	66	mg/kg	5.20E-05	ug/m³	R	4.5E-11	mg/kg-day	9.8E+00	(mg/kg-day)⁻¹	4.4E-10
	Iron	51800	mg/kg	4.08E-02	ug/m³	R	3.5E-08	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Manganese	17200	mg/kg	1.35E-02	ug/m³	R	1.2E-08	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Vanadium	44.1	mg/kg	3.47E-05	ug/m³	R	3.0E-11	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	(Total)										1.7E-09
										Total Cancer Risk Across All Exposure Routes/Pathways	8.6E-06

Notes
EPC Selected for Risk Calculation: (M) Medium Specific.
Route EPC Value = Medium EPC Value.
NA = not available
mg/kg = milligrams per kilogram
mg/kg-day = milligrams per kilogram - day
mg/m³ = milligrams per cubic meter
ug/m³ = micrograms per cubic meter

Table 14 Worker RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Total Soil (Surface + Subsurface)
Exposure Medium: Total Soil (Surface + Subsurface)
Exposure Point: OU3B
Receptor Population: 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	2.1E-09	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	3.6E-08
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	6.4E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	1.0E-07
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	4.8E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	9.5E-09
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	1.8E-10	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	1.8E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.3E-07
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	1.7E-07	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	1.2E-06
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	1.8E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.3E-07
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	9.2E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.7E-07
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	2.8E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	2.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	1.3E-07	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	9.8E-08
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	2.2E-07	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	2.7E-08
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	7.7E-11	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.2E-05
	Aluminum	14300	mg/kg	14300	mg/kg	M	6.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	2.8E-07	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.2E-07
	Chromium	38.1	mg/kg	38.1	mg/kg	M	1.8E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	3.0E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	2.4E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	7.9E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	2.0E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										1.4E-05
Dermal	Aldrin	0.0465	mg/kg	0.0465	mg/kg	M	6.5E-10	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	1.1E-08
	Dieldrin	0.139	mg/kg	0.139	mg/kg	M	1.9E-09	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	3.1E-08
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	0.103	mg/kg	M	2.0E-09	mg/kg-day	2.0E+00	(mg/kg-day)$^{-1}$	4.0E-09
	Methylcyclohexane	0.004	mg/kg	0.004	mg/kg	M	1.7E-11	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	3.87	mg/kg	M	7.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.1E-08
	Benzo(a)pyrene	3.6	mg/kg	3.6	mg/kg	M	6.5E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.8E-07
	Benzo(b)fluoranthene	3.85	mg/kg	3.85	mg/kg	M	7.0E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	5.1E-08
	Dibenzo(a,h)anthracene	2	mg/kg	2	mg/kg	M	3.6E-08	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	2.7E-07
	Dibenzofuran	0.61	mg/kg	0.61	mg/kg	M	8.5E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	0.46	mg/kg	M	6.4E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	2.9	mg/kg	M	5.3E-08	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.8E-08
	Pentachlorophenol	4.82	mg/kg	4.82	mg/kg	M	1.7E-07	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	2.0E-08
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	0.001668	mg/kg	M	7.0E-12	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	1.0E-06
	Aluminum	14300	mg/kg	14300	mg/kg	M	2.0E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic	6.07	mg/kg	6.07	mg/kg	M	2.7E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.1E-08
	Chromium	38.1	mg/kg	38.1	mg/kg	M	5.3E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt	66	mg/kg	66	mg/kg	M	9.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron	51800	mg/kg	51800	mg/kg	M	7.2E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese	17200	mg/kg	17200	mg/kg	M	2.4E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium	44.1	mg/kg	44.1	mg/kg	M	6.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2.0E-06

Table 14 Worker RME OU3B Total Soil (Surface + Subsurface)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Total Soil (Surface + Subsurface)
Exposure Medium Total Soil (Surface + Subsurface)
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation of dust	Aldrin	0.0465	mg/kg	1.36E-05	ug/m^3	R	3.8E-11	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	6.4E-10
	Dieldrin	0.139	mg/kg	4.05E-05	ug/m^3	R	1.1E-10	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.8E-09
	Arochlor 1254 (PCB-1254)	0.103	mg/kg	3.00E-05	ug/m^3	R	8.4E-11	mg/kg-day	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-10
	Methylcyclohexane	0.004	mg/kg	1.17E-06	ug/m^3	R	3.3E-12	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Benzo(a)anthracene	3.87	mg/kg	1.13E-03	ug/m^3	R	3.2E-09	mg/kg-day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	9.8E-10
	Benzo(a)pyrene	3.6	mg/kg	1.05E-03	ug/m^3	R	2.9E-09	mg/kg-day	3.1E+00	$(mg/kg\text{-}day)^{-1}$	9.1E-09
	Benzo(b)fluoranthene	3.85	mg/kg	1.12E-03	ug/m^3	R	3.1E-09	mg/kg-day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	9.7E-10
	Dibenzo(a,h)anthracene	2	mg/kg	5.83E-04	ug/m^3	R	1.6E-09	mg/kg-day	3.1E+00	$(mg/kg\text{-}day)^{-1}$	5.1E-09
	Dibenzofuran	0.61	mg/kg	1.78E-04	ug/m^3	R	5.0E-10	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Di-n-octylphthalate	0.46	mg/kg	1.34E-04	ug/m^3	R	3.7E-10	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	2.9	mg/kg	8.45E-04	ug/m^3	R	2.4E-09	mg/kg-day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	7.3E-10
	Pentachlorophenol	4.82	mg/kg	1.41E-03	ug/m^3	R	3.9E-09	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.001668	mg/kg	4.86E-07	ug/m^3	R	1.4E-12	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	2.0E-07
	Aluminum	14300	mg/kg	4.17E+00	ug/m^3	R	1.2E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic	6.07	mg/kg	1.77E-03	ug/m^3	R	4.9E-09	mg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	7.4E-08
	Chromium	38.1	mg/kg	1.11E-02	ug/m^3	R	3.1E-08	mg/kg-day	4.1E+01	$(mg/kg\text{-}day)^{-1}$	1.3E-06
	Cobalt	66	mg/kg	1.92E-02	ug/m^3	R	5.4E-08	mg/kg-day	9.8E+00	$(mg/kg\text{-}day)^{-1}$	5.3E-07
	Iron	51800	mg/kg	1.51E+01	ug/m^3	R	4.2E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese	17200	mg/kg	5.01E+00	ug/m^3	R	1.4E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium	44.1	mg/kg	1.29E-02	ug/m^3	R	3.6E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										2.1E-06
										Total Cancer Risk Across All Exposure Routes/Pathways	1.9E-05

Notes

EPC Selected for Risk Calculation (M) Medium Specific.

Route EPC Value = Medium EPC Value.

NA = not available

mg/kg = milligrams per kilogram

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/m^3 = micrograms per cubic meter

Table 14 Adult Resident RME OU3A Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater/Vapor
Exposure Point OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor (Units)	Cancer Risk
Ingestion	1 2-Dichloroethane	3.89	μg/L	3.89	μg/L	M	3.7E-05	mg/kg-day	9.10E-02	mg/kg-day	3.3E-06
	1,2-Dichloropropane	0.41	μg/L	0.41	μg/L	M	3.9E-06	mg/kg-day	6.8E-02	mg/kg-day	2.6E-07
	1,3 5-Trimethylbenzene (Mesitylene)	75.9	μg/L	75.9	μg/L	M	7.1E-04	mg/kg-day	NA	mg/kg-day	NC
	1,4-Dichlorobenzene	0.49	μg/L	0.49	μg/L	M	4.6E-06	mg/kg-day	2.4E-02	mg/kg-day	1.1E-07
	Azulene	4.1	μg/L	4.1	μg/L	M	3.9E-05	mg/kg-day	NA	mg/kg-day	NC
	Chloroform	0.63	μg/L	0.63	μg/L	M	5.9E-06	mg/kg-day	NA	mg/kg-day	NC
	Ethylbenzene	92.3	μg/L	92.3	μg/L	M	8.7E-04	mg/kg-day	NA	mg/kg-day	NC
	Xylenes (total)	128	μg/L	128	μg/L	M	1.2E-03	mg/kg-day	NA	mg/kg-day	NC
	1,2,4-Trimethylbenzene	93.3	μg/L	93.3	μg/L	M	8.8E-04	mg/kg-day	NA	mg/kg-day	NC
	1-Methylnaphthalene	34.6	μg/L	34.6	μg/L	M	3.3E-04	mg/kg-day	NA	mg/kg-day	NC
	2,4,6-Trichlorophenol	8.59	μg/L	8.59	μg/L	M	8.1E-05	mg/kg-day	1.1E-02	mg/kg-day	8.9E-07
	4,6-Dinitro-2-Methylphenol	10.3	μg/L	10.3	μg/L	M	9.7E-05	mg/kg-day	NA	mg/kg-day	NC
	4-Chloro-3-Methylphenol	1.2	μg/L	1.2	μg/L	M	1.1E-05	mg/kg-day	NA	mg/kg-day	NC
	Bis(2-chloroethoxy) methane	2.86	μg/L	2.86	μg/L	M	2.7E-05	mg/kg-day	NA	mg/kg-day	NC
	Dimethyl Phthalate	1.1	μg/L	1.1	μg/L	M	1.0E-05	mg/kg-day	NA	mg/kg-day	NC
	Indene	19	μg/L	19	μg/L	M	1.8E-04	mg/kg-day	NA	mg/kg-day	NC
	Barium (total)	3230	μg/L	3230	μg/L	M	3.0E-02	mg/kg-day	NA	mg/kg-day	NC
	Beryllium (total)	3.73	μg/L	3.73	μg/L	M	3.5E-05	mg/kg-day	NA	mg/kg-day	NC
	Cadmium (total)	4.39	μg/L	4.39	μg/L	M	4.1E-05	mg/kg-day	NA	mg/kg-day	NC
	Copper (total)	736	μg/L	736	μg/L	M	6.9E-03	mg/kg-day	NA	mg/kg-day	NC
	Mercury (dissolved)	0.134	μg/L	0.134	μg/L	M	1.3E-06	mg/kg-day	NA	mg/kg-day	NC
	Nickel (total)	28.9	μg/L	28.9	μg/L	M	2.7E-04	mg/kg-day	NA	mg/kg-day	NC
	Zinc (total)	477	μg/L	477	μg/L	M	4.5E-03	mg/kg-day	NA	mg/kg-day	NC
	Total										4.6E-06

Table 14 Adult Resident RME OU3A Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium: Groundwater
Exposure Medium: Groundwater/Vapor
Exposure Point: OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor (Units)	Cancer Risk
Dermal	1,2-Dichloroethane	3.89	µg/L	2.36	µg/L	R	6.6E-07	mg/kg-day	9.10E-02	mg/kg-day	6.0E-08
	1,2-Dichloropropane	0.41	µg/L	0.24	µg/L	R	1.4E-07	mg/kg-day	6.8E-02	mg/kg-day	9.2E-09
	1,3,5-Trimethylbenzene (Mesitylene)	75.9	µg/L	44.8	µg/L	R	2.2E-04	mg/kg-day	NA	mg/kg-day	NC
	1,4-Dichlorobenzene	0.49	µg/L	0.31	µg/L	R	1.2E-06	mg/kg-day	2.4E-02	mg/kg-day	2.8E-08
	Azulene	4.1	µg/L	2.64	µg/L	R	6.2E-06	mg/kg-day	NA	mg/kg-day	NC
	Chloroform	0.63	µg/L	0.38	µg/L	R	1.9E-07	mg/kg-day	NA	mg/kg-day	NC
	Ethylbenzene	92.3	µg/L	52.6	µg/L	R	1.9E-04	mg/kg-day	NA	mg/kg-day	NC
	Xylenes (total)	128	µg/L	73.1	µg/L	R	2.6E-04	mg/kg-day	NA	mg/kg-day	NC
	1,2,4-Trimethylbenzene	93.3	µg/L	55.3	µg/L	R	4.6E-04	mg/kg-day	NA	mg/kg-day	NC
	1-Methylnaphthalene	34.6	µg/L	24.7	µg/L	R	2.1E-04	mg/kg-day	NA	mg/kg-day	NC
	2,4,6-Trichlorophenol	8.59	µg/L	8.59	µg/L	R	3.8E-05	mg/kg-day	1.1E-02	mg/kg-day	4.2E-07
	4,6-Dinitro-2-Methylphenol	10.3	µg/L	10.3	µg/L	R	4.1E-06	mg/kg-day	NA	mg/kg-day	NC
	4-Chloro-3-Methylphenol	1.2	µg/L	1.20	µg/L	R	3.0E-06	mg/kg-day	NA	mg/kg-day	NC
	Bis(2-chloroethoxy) methane	2.86	µg/L	2.86	µg/L	R	3.7E-07	mg/kg-day	NA	mg/kg-day	NC
	Dimethyl Phthalate	1.1	µg/L	1.10	µg/L	R	1.9E-07	mg/kg-day	NA	mg/kg-day	NC
	Indene	19	µg/L	11.8	µg/L	R	2.7E-05	mg/kg-day	NA	mg/kg-day	NC
	Barium (total)	3230	µg/L	3230	µg/L	R	5.5E-05	mg/kg-day	NA	mg/kg-day	NC
	Beryllium (total)	3.73	µg/L	3.73	µg/L	R	6.3E-08	mg/kg-day	NA	mg/kg-day	NC
	Cadmium (total)	4.39	µg/L	4.39	µg/L	R	7.4E-08	mg/kg-day	NA	mg/kg-day	NC
	Copper (total)	736	µg/L	736	µg/L	R	1.3E-05	mg/kg-day	NA	mg/kg-day	NC
	Mercury (dissolved)	0.134	µg/L	0.13	µg/L	R	2.3E-09	mg/kg-day	NA	mg/kg-day	NC
	Nickel (total)	28.9	µg/L	28.9	µg/L	R	1.0E-07	mg/kg-day	NA	mg/kg-day	NC
	Zinc (total)	477	µg/L	477	µg/L	R	4.8E-06	mg/kg-day	NA	mg/kg-day	NC
	(Total)										5.2E-07

Table 14 Adult Resident RME OU3A Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater/Vapor
Exposure Point OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor (Units)	Cancer Risk
Inhalation	1,2-Dichloroethane	3.89	µg/L	3.89	µg/L	M	7.9E-05	mg/kg-day	9.10E-02	mg/kg-day	7.2E-06
	1,2-Dichloropropane	0.41	µg/L	0.41	µg/L	M	8.5E-06	mg/kg-day	NA	mg/kg-day	NC
	1,3 5-Trimethylbenzene (Mesitylene)	75.9	µg/L	75.9	µg/L	M	1.6E-03	mg/kg-day	NA	mg/kg-day	NC
	1,4-Dichlorobenzene	0.49	µg/L	0.49	µg/L	M	9.2E-06	mg/kg-day	2.2E-02	mg/kg-day	2.0E-07
	Azulene	4.1	µg/L	4.1	µg/L	M	7.5E-05	mg/kg-day	NA	mg/kg-day	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	1.3E-05	mg/kg-day	8.1E-02	mg/kg-day	1.1E-06
	Ethylbenzene	92.3	µg/L	92.3	µg/L	M	2.0E-03	mg/kg-day	NA	mg/kg-day	NC
	Xylenes (total)	128	µg/L	128	µg/L	M	2.8E-03	mg/kg-day	NA	mg/kg-day	NC
	1,2,4-Trimethylbenzene	93.3	µg/L	93.3	µg/L	M	2.0E-03	mg/kg-day	NA	mg/kg-day	NC
	1-Methylnaphthalene	34.6	µg/L	34.6	µg/L	M	5.1E-04	mg/kg-day	NA	mg/kg-day	NC
	Indene	19	µg/L	19	µg/L	M	3.7E-04	mg/kg-day	NA	mg/kg-day	NC
	(Total)										8.5E-06
	Total Cancer Risk Across Ingestion, Dermal and Inhalation of Shower Vapors Exposure Routes/Pathways										1.4E-05

Total Chilld Risk Across Ingestion and Dermal Exposure Routes/Pathways	2.7E-06
Total Adult and Child Risk For Indoor Vapor Intrusion Pathway	1.7E-05
Total Adult and Child Risk Across All Media and All Exposure Routes	3.3E-05

Notes:
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Risk Calculation: (M) Medium Specific, (R) Route Specific.
Ingestion Route EPC Value = Medium EPC Value.
Dermal Route EPC Value = Medium EPC Value - CWD (Concentration leaving shower droplet) Note that for adult resident dermal exposure to groundwater, the Route EPC values are different from the Medium EPC values only for the volatile organics. This difference is due to the loss of contaminant through volatilization which occurs during showering.
Inhalation Route EPC Value = Medium EPC Value as determined by Foster and Chrostowski Shower Model and EPA Region 3 inputs (See Appendix)
NA = not available
µg/L = micrograms per liter

Table 14 Child Resident RME OU3A Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor (Units)	Cancer Risk
Ingestion	1,2-Dichloroethane	3.89	µg/L	3.89	µg/L	M	1.9E-05	mg/kg-day	9.10E-02	mg/kg-day	1.8E-06
	1,2-Dichloropropane	0.41	µg/L	0.41	µg/L	M	2.0E-06	mg/kg-day	6.8E-02	mg/kg-day	1.4E-07
	1,3,5-Trimethylbenzene (Mesitylene)	75.9	µg/L	75.9	µg/L	M	3.8E-04	mg/kg-day	NA	mg/kg-day	NC
	1,4-Dichlorobenzene	0.49	µg/L	0.49	µg/L	M	2.4E-06	mg/kg-day	2.4E-02	mg/kg-day	5.8E-08
	Azulene	4.1	µg/L	4.1	µg/L	M	2.0E-05	mg/kg-day	NA	mg/kg-day	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	3.1E-06	mg/kg-day	NA	mg/kg-day	NC
	Ethylbenzene	92.3	µg/L	92.3	µg/L	M	4.6E-04	mg/kg-day	NA	mg/kg-day	NC
	Xylenes (total)	128	µg/L	128	µg/L	M	6.3E-04	mg/kg-day	NA	mg/kg-day	NC
	1,2,4-Trimethylbenzene	93.3	µg/L	93.3	µg/L	M	4.6E-04	mg/kg-day	NA	mg/kg-day	NC
	1-Methylnaphthalene	34.6	µg/L	34.6	µg/L	M	1.7E-04	mg/kg-day	NA	mg/kg-day	NC
	2,4,6-Trichlorophenol	8.59	µg/L	8.59	µg/L	M	4.3E-05	mg/kg-day	1.1E-02	mg/kg-day	4.7E-07
	4,6-Dinitro-2-Methylphenol	10.3	µg/L	10.3	µg/L	M	5.1E-05	mg/kg-day	NA	mg/kg-day	NC
	4-Chloro-3-Methylphenol	1.2	µg/L	1.2	µg/L	M	5.9E-06	mg/kg-day	NA	mg/kg-day	NC
	Bis(2-chloroethoxy) methane	2.86	µg/L	2.86	µg/L	M	1.4E-05	mg/kg-day	NA	mg/kg-day	NC
	Dimethyl Phthalate	1.1	µg/L	1.1	µg/L	M	5.4E-06	mg/kg-day	NA	mg/kg-day	NC
	Indene	19	µg/L	19	µg/L	M	9.4E-05	mg/kg-day	NA	mg/kg-day	NC
	Barium (total)	3230	µg/L	3230	µg/L	M	1.6E-02	mg/kg-day	NA	mg/kg-day	NC
	Beryllium (total)	3.73	µg/L	3.73	µg/L	M	1.8E-05	mg/kg-day	NA	mg/kg-day	NC
	Cadmium (total)	4.39	µg/L	4.39	µg/L	M	2.2E-05	mg/kg-day	NA	mg/kg-day	NC
	Copper (total)	736	µg/L	736	µg/L	M	3.6E-03	mg/kg-day	NA	mg/kg-day	NC
	Mercury (dissolved)	0.134	µg/L	0.134	µg/L	M	6.6E-07	mg/kg-day	NA	mg/kg-day	NC
	Nickel (total)	28.9	µg/L	28.9	µg/L	M	1.4E-04	mg/kg-day	NA	mg/kg-day	NC
	Zinc (total)	477	µg/L	477	µg/L	M	2.4E-03	mg/kg-day	NA	mg/kg-day	NC
	Total										2.4E-06

Table 14 Child Resident RME OU3A Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor (Units)	Cancer Risk
Dermal	1,2-Dichloroethane	3.89	µg/L	3.89	µg/L	M	5.2E-07	mg/kg-day	9.10E-02	mg/kg-day	4.8E-08
	1,2-Dichloropropane	0.41	µg/L	0.41	µg/L	M	1 1E-07	mg/kg-day	6.8E-02	mg/kg-day	7.8E-09
	1,3,5-Trimethylbenzene (Mesitylene)	75.9	µg/L	75.9	µg/L	M	1.8E-04	mg/kg-day	NA	mg/kg-day	NC
	1,4-Dichlorobenzene	0.49	µg/L	0.49	µg/L	M	9.5E-07	mg/kg-day	2.4E-02	mg/kg-day	2.3E-08
	Azulene	4.1	µg/L	4.1	µg/L	M	4.9E-06	mg/kg-day	NA	mg/kg-day	NC
	Chloroform	0.63	µg/L	0.63	µg/L	M	1.6E-07	mg/kg-day	NA	mg/kg-day	NC
	Ethylbenzene	92.3	µg/L	92.3	µg/L	M	1.6E-04	mg/kg-day	NA	mg/kg-day	NC
	Xylenes (total)	128	µg/L	128	µg/L	M	2.3E-04	mg/kg-day	NA	mg/kg-day	NC
	1,2,4-Trimethylbenzene	93.3	µg/L	93.3	µg/L	M	3.9E-04	mg/kg-day	NA	mg/kg-day	NC
	1-Methylnaphthalene	34.6	µg/L	34.6	µg/L	M	1.4E-04	mg/kg-day	NA	mg/kg-day	NC
	2,4,6-Trichlorophenol	8.59	µg/L	8.59	µg/L	M	1.9E-05	mg/kg-day	1.1E-02	mg/kg-day	2.1E-07
	4,6-Dinitro-2-Methylphenol	10.3	µg/L	10.3	µg/L	M	2.0E-06	mg/kg-day	NA	mg/kg-day	NC
	4-Chloro-3-Methylphenol	1.2	µg/L	1.2	µg/L	M	1.5E-06	mg/kg-day	NA	mg/kg-day	NC
	Bis(2-chloroethoxy) methane	2.86	µg/L	2.86	µg/L	M	1.9E-07	mg/kg-day	NA	mg/kg-day	NC
	Dimethyl Phthalate	1.1	µg/L	1.1	µg/L	M	9.5E-08	mg/kg-day	NA	mg/kg-day	NC
	Indene	19	µg/L	19	µg/L	M	2.2E-05	mg/kg-day	NA	mg/kg-day	NC
	Barium (total)	3230	µg/L	3230	µg/L	M	3.6E-05	mg/kg-day	NA	mg/kg-day	NC
	Beryllium (total)	3.73	µg/L	3.73	µg/L	M	3.9E-08	mg/kg-day	NA	mg/kg-day	NC
	Cadmium (total)	4.39	µg/L	4.39	µg/L	M	4.6E-08	mg/kg-day	NA	mg/kg-day	NC
	Copper (total)	736	µg/L	736	µg/L	M	7.8E-06	mg/kg-day	NA	mg/kg-day	NC
	Mercury (dissolved)	0.134	µg/L	0.134	µg/L	M	1.4E-09	mg/kg-day	NA	mg/kg-day	NC
	Nickel (total)	28.9	µg/L	28.9	µg/L	M	6.2E-08	mg/kg-day	NA	mg/kg-day	NC
	Zinc (total)	477	µg/L	477	µg/L	M	3.1E-06	mg/kg-day	NA	mg/kg-day	NC
	(Total)										2.9E-07
	Total Cancer Risk Across Ingestion and Dermal Exposure Routes/Pathways										2.7E-06

Total Adult Risk Across Ingestion, Dermal and Inhalation of Shower Vapors Exposure Routes/Pathways	1.4E-05
Total Adult and Child Risk For Indoor Vapor Intrusion Pathway	1.7E-05
Total Adult and Child Risk Across All Media and All Exposure Routes	3.3E-05

Notes:
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Risk Calculation: (M) Medium Specific, (R) Route Specific.
Ingestion and Dermal Route EPC Value = Medium EPC Value.
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 14 Adult Resident RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	alpha-BHC	0 0075	µg/L	0.0075	µg/L	M	7 0E-06	mg/kg-day	6.3E+00	$(mg/kg\text{-}day)^{-1}$	4.4E-07
	beta-BHC	0 0204	µg/L	0.0204	µg/L	M	1.9E-07	mg/kg-day	1.8E+00	$(mg/kg\text{-}day)^{-1}$	3.4E-07
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	7 3E-06	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	Dieldrin	0.321	µg/L	0.321	µg/L	M	3 0E-06	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	4.8E-05
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	7 7E-08	mg/kg-day	9.1E+00	$(mg/kg\text{-}day)^{-1}$	7.0E-07
	Benzene	0.49	µg/L	0.49	µg/L	M	4 6E-06	mg/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-07
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	3 8E-05	mg/kg-day	4.0E-03	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	1,1,2 2-Tetrachloroethane	6	µg/L	6	µg/L	M	5 6E-05	mg/kg-day	2.0E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-05
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	9 4E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	5.1E-06
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	1 6E-06	mg/kg-day	4.0E-01	$(mg/kg\text{-}day)^{-1}$	6.4E-07
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	3.4E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	5.0E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Acetophenone	62	µg/L	62	µg/L	M	5 8E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Anthracene	42.8	µg/L	42.8	µg/L	M	4.0E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	9.3E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.8E-06
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	1.0E-05	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	7.5E-05
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	1 6E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.2E-05
	Biphenyl	44.8	µg/L	44.8	µg/L	M	4.2E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	1.2E-03	mg/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1.7E-05
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	3.8E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Fluorene	80.9	µg/L	80.9	µg/L	M	7.6E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	6.2E-06	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	4.5E-06
	Naphthalene	239	µg/L	239	µg/L	M	2.2E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Pentachlorophenol	572	µg/L	572	µg/L	M	5.4E-03	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	6.4E-04
	Phenanthrene	223	µg/L	223	µg/L	M	2.1E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Pyrene	33.1	µg/L	33.1	µg/L	M	3.1E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	4.7E-06	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	5.0E-01
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	3.9E-01	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	3.1E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	2.7E-05	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.1E-05
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	5 3E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	3.5E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron (Total)	52900	µg/L	52900	µg/L	M	5.0E-01	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	2.5E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	2.6E-02	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium (Total)	102	µg/L	102	µg/L	M	9.6E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
											5.0E-01

Table 14 Adult Resident RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater/Vapor
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	alpha-BHC	0.0075	µg/L	0.0075	µg/L	R	2.2E-08	mg/kg-day	6.3E+00	$(mg/kg\text{-}day)^{-1}$	1.4E-07
	beta-BHC	0.0204	µg/L	0.0204	µg/L	R	6.2E-08	mg/kg-day	1.8E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-07
	Aldrin	0.00781	µg/L	0.00781	µg/L	R	4.1E-09	mg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	7.0E-08
	Dieldrin	0.321	µg/L	0.321	µg/L	R	1.4E-06	mg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2.2E-05
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	R	5.4E-08	mg/kg-day	9.1E+00	$(mg/kg\text{-}day)^{-1}$	4.9E-07
	Benzene	0.49	µg/L	0.257	µg/L	R	2.2E-07	mg/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-08
	Methyl tert-butyl ether (MTBE)	4	µg/L	2.56	µg/L	R	3.3E-07	mg/kg-day	4.0E-03	$(mg/kg\text{-}day)^{-1}$	1.3E-09
	1,1,2,2-Tetrachloroethane	6	µg/L	4.59	µg/L	R	3.3E-06	mg/kg-day	2.0E-01	$(mg/kg\text{-}day)^{-1}$	6.6E-07
	Tetrachloroethylene (PCE)	1	µg/L	0.633	µg/L	R	2.2E-06	mg/kg-day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	Trichloroethylene (TCE)	0.17	µg/L	0.1022	µg/L	R	1.0E-07	mg/kg-day	4.0E-01	$(mg/kg\text{-}day)^{-1}$	4.1E-08
	2-Methylnaphthalene	360	µg/L	223	µg/L	R	1.9E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Acenaphthene	53.3	µg/L	44.35	µg/L	R	4.0E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Acetophenone	62	µg/L	60.68	µg/L	R	1.9E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Anthracene	42.8	µg/L	39.03	µg/L	R	6.6E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	R	7.6E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	5.6E-05
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	R	1.4E-04	mg/kg-day	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1.0E-03
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	R	2.3E-04	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-04
	Biphenyl	44.8	µg/L	34.4	µg/L	R	3.3E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	R	1.2E-03	mg/kg-day	2.5E-02	$(mg/kg\text{-}day)^{-1}$	3.0E-05
	Dibenzofuran	40.3	µg/L	40.3	µg/L	R	4.2E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Fluorene	80.9	µg/L	73.65	µg/L	R	8.5E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	R	9.3E-05	mg/kg-day	7.3E-01	$(mg/kg\text{-}day)^{-1}$	6.8E-05
	Naphthalene	239	µg/L	168.80	µg/L	R	6.4E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Pentachlorophenol	572	µg/L	572	µg/L	R	4.2E-02	mg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	5.1E-03
	Phenanthrene	223	µg/L	223	µg/L	R	3.7E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Pyrene	33.1	µg/L	32.52	µg/L	R	1.1E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	R	6.0E-05	mg/kg-day	1.5E+05	$(mg/kg\text{-}day)^{-1}$	1.0E+00
	Aluminum (Total)	42000	µg/L	42000	µg/L	R	7.1E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Antimony (Dissolved)	3	µg/L	3.30	µg/L	R	5.6E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	R	4.9E-08	mg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7.4E-08
	Chromium (Total)	56.1	µg/L	56.1	µg/L	R	1.9E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Cobalt (Total)	38	µg/L	37.7	µg/L	R	2.5E-07	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Iron (Total)	52900	µg/L	52900	µg/L	R	9.3E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Lead (Total)	27.1	µg/L	27.10	µg/L	R	4.6E-08	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	R	4.6E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Vanadium (Total)	102	µg/L	102	µg/L	R	1.7E-06	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										1.0E+00

Table 14 Adult Resident RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium. Groundwater
Exposure Medium Groundwater/Vapor
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Benzene	0 49	µg/L	0.49	µg/L	M	1.2E-05	mg/kg-day	2.7E-02	$(mg/kg\text{-}day)^{-1}$	3.2E-07
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	7.4E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	7.3E-05	mg/kg-day	2 0E-01	$(mg/kg\text{-}day)^{-1}$	1 5E-05
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	1.9E-05	mg/kg-day	2 1E-02	$(mg/kg\text{-}day)^{-1}$	4 0E-07
	Trichloroethylene (TCE)	0.17	µg/L	0 17	µg/L	M	3.5E-06	mg/kg-day	4.0E-01	$(mg/kg\text{-}day)^{-1}$	1 4E-06
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	4.6E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Acetophenone	62	µg/L	62	µg/L	M	6.8E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Anthracene	42.8	µg/L	42 8	µg/L	M	1.9E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Biphenyl	44.8	µg/L	44 8	µg/L	M	5.4E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Fluorene	80.9	µg/L	80 9	µg/L	M	3.7E-04	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	7.0E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Naphthalene	239	µg/L	239	µg/L	M	3.6E-03	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	Pyrene	33.1	µg/L	33 1	µg/L	M	3.0E-05	mg/kg-day	NA	$(mg/kg\text{-}day)^{-1}$	NC
	(Total)										1.7E-05
	Total Cancer Risk Across Ingestion, Dermal and Inhalation of Shower Vapors Exposure Routes/Pathways										1.5E+00

Total Chilld Risk Across Ingestion and Dermal Exposure Routes/Pathways	1.3E+00
Total Adult and Child Risk For Indoor Vapor Intrusion Pathway	3.7E-06
Total Adult and Child Risk Across All Media and All Exposure Routes	2.8E+00

Notes
Dermal intake calculations use values for DAevent from Appendix .
EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific.
Ingestion Route EPC Value = Medium EPC Value.
Dermal Route EPC Value = Medium EPC Value - CWD (Concentration leaving shower droplet) Note that for adult resident dermal exposure to groundwater, the Route EPC values are different from the Medium EPC values only for the volatile organics. This difference is due to the loss of contaminant through volatilization which occurs during showering.
Inhalation Route EPC Value = Medium EPC Value as determined by Foster and Chrostowski Shower Model and EPA Region 3 inputs (See Appendix)
NA = not available
µg/L = micrograms per liter
mg/kg-day = milligrams per kilogram - day

Table 14 Child Resident RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	3.7E-08	mg/kg-day	6.3E+00	(mg/kg-day)$^{-1}$	2.3E-07
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	1.0E-07	mg/kg-day	1.8E+00	(mg/kg-day)$^{-1}$	1.8E-07
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	3.9E-08	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	6.5E-07
	Dieldrin	0.321	µg/L	0.321	µg/L	M	1.6E-06	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	2.5E-05
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	4.1E-08	mg/kg-day	9.1E+00	(mg/kg-day)$^{-1}$	3.7E-07
	Benzene	0.49	µg/L	0.49	µg/L	M	2.4E-06	mg/kg-day	5.5E-02	(mg/kg-day)$^{-1}$	1.3E-07
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	2.0E-05	mg/kg-day	4.0E-03	(mg/kg-day)$^{-1}$	7.9E-08
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	3.0E-05	mg/kg-day	2.0E-01	(mg/kg-day)$^{-1}$	5.9E-06
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	5.0E-06	mg/kg-day	5.4E-01	(mg/kg-day)$^{-1}$	2.7E-06
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	8.4E-07	mg/kg-day	4.0E-01	(mg/kg-day)$^{-1}$	3.4E-07
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	1.8E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	2.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acetophenone	62	µg/L	62	µg/L	M	3.1E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Anthracene	42.8	µg/L	42.8	µg/L	M	2.1E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	4.9E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.6E-06
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	5.4E-06	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	4.0E-05
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	8.4E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.1E-06
	Biphenyl	44.8	µg/L	44.8	µg/L	M	2.2E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	6.4E-04	mg/kg-day	1.4E-02	(mg/kg-day)$^{-1}$	9.0E-06
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	2.0E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Fluorene	80.9	µg/L	80.9	µg/L	M	4.0E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	3.3E-06	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.4E-06
	Naphthalene	239	µg/L	239	µg/L	M	1.2E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pentachlorophenol	572	µg/L	572	µg/L	M	2.8E-03	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	3.4E-04
	Phenanthrene	223	µg/L	223	µg/L	M	1.1E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pyrene	33.1	µg/L	33.1	µg/L	M	1.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	2.5E-06	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	3.1E-01
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	2.1E-01	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	1.6E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	1.4E-05	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	2.2E-05
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	2.8E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	1.9E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron (Total)	52900	µg/L	52900	µg/L	M	2.6E-01	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	1.3E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	1.4E-02	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium (Total)	102	µg/L	102	µg/L	M	5.1E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
											3.1E-01

Table 14 Child Resident RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	1.1E-08	mg/kg-day	6.3E+00	(mg/kg-day)$^{-1}$	6.8E-08
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	3.1E-08	mg/kg-day	1.8E+00	(mg/kg-day)$^{-1}$	5.5E-08
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	2.1E-09	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	3.5E-08
	Dieldrin	0.321	µg/L	0.321	µg/L	M	6.5E-07	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	1.0E-05
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	2.7E-08	mg/kg-day	9.1E+00	(mg/kg-day)$^{-1}$	2.5E-07
	Benzene	0.49	µg/L	0.49	µg/L	M	2.1E-07	mg/kg-day	5.5E-02	(mg/kg-day)$^{-1}$	1.2E-08
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	2.6E-07	mg/kg-day	4.0E-03	(mg/kg-day)$^{-1}$	1.0E-09
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	2.2E-06	mg/kg-day	2.0E-01	(mg/kg-day)$^{-1}$	4.3E-07
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	1.7E-06	mg/kg-day	5.4E-01	(mg/kg-day)$^{-1}$	9.4E-07
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	8.2E-08	mg/kg-day	4.0E-01	(mg/kg-day)$^{-1}$	3.3E-08
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	1.5E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	2.4E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acetophenone	62	µg/L	62	µg/L	M	9.5E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Anthracene	42.8	µg/L	42.8	µg/L	M	3.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	3.9E-05	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	2.9E-05
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	7.2E-05	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	5.2E-04
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	1.1E-04	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	8.3E-05
	Biphenyl	44.8	µg/L	44.8	µg/L	M	2.2E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	5.9E-04	mg/kg-day	2.5E-02	(mg/kg-day)$^{-1}$	1.5E-05
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	2.1E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Fluorene	80.9	µg/L	80.9	µg/L	M	4.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	4.6E-05	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	3.3E-05
	Naphthalene	239	µg/L	239	µg/L	M	4.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pentachlorophenol	572	µg/L	572	µg/L	M	2.1E-02	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	2.5E-03
	Phenanthrene	223	µg/L	223	µg/L	M	1.8E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pyrene	33.1	µg/L	33.1	µg/L	M	5.2E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	3.0E-05	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	9.9E-01
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	4.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	3.6E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	3.1E-08	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	4.7E-08
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	1.2E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	1.6E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron (Total)	52900	µg/L	52900	µg/L	M	5.6E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	2.9E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	3.0E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium (Total)	102	µg/L	102	µg/L	M	1.1E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										9.9E-01

Total Cancer Risk Across Ingestion and Dermal Exposure Routes/Pathways	1.3E+00
Total Adult Risk Across Ingestion, Dermal and Inhalation of Shower Vapors Exposure Routes/Pathways	1.5E+00
Total Adult and Child Risk For Indoor Vapor Intrusion Pathway	3.7E-06
Total Adult and Child Risk Across All Media and All Exposure Routes	2.8E+00

Notes

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Risk Calculation: (M) Medium Specific, (R) Route Specific.

Ingestion and Dermal Route EPC Value = Medium EPC Value.

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 14 Worker RME OU3B Groundwater

Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	alpha-BHC	0.0075	µg/L	0.0075	µg/L	M	6.3E-12	mg/kg-day	6.3E+00	(mg/kg-day)$^{-1}$	4.0E-11
	beta-BHC	0.0204	µg/L	0.0204	µg/L	M	1.7E-11	mg/kg-day	1.8E+00	(mg/kg-day)$^{-1}$	3.1E-11
	Aldrin	0.00781	µg/L	0.00781	µg/L	M	6.6E-12	mg/kg-day	1.7E+01	(mg/kg-day)$^{-1}$	1.1E-10
	Dieldrin	0.321	µg/L	0.321	µg/L	M	2.7E-10	mg/kg-day	1.6E+01	(mg/kg-day)$^{-1}$	4.3E-09
	Heptachlor Epoxide	0.00819	µg/L	0.00819	µg/L	M	6.9E-12	mg/kg-day	9.1E+00	(mg/kg-day)$^{-1}$	6.3E-11
	Benzene	0.49	µg/L	0.49	µg/L	M	4.1E-10	mg/kg-day	5.5E-02	(mg/kg-day)$^{-1}$	2.3E-11
	Methyl tert-butyl ether (MTBE)	4	µg/L	4	µg/L	M	3.4E-09	mg/kg-day	4.0E-03	(mg/kg-day)$^{-1}$	1.3E-11
	1,1,2,2-Tetrachloroethane	6	µg/L	6	µg/L	M	5.0E-09	mg/kg-day	2.0E-01	(mg/kg-day)$^{-1}$	1.0E-09
	Tetrachloroethylene (PCE)	1	µg/L	1	µg/L	M	8.4E-10	mg/kg-day	5.4E-01	(mg/kg-day)$^{-1}$	4.5E-10
	Trichloroethylene (TCE)	0.17	µg/L	0.17	µg/L	M	1.4E-10	mg/kg-day	4.0E-01	(mg/kg-day)$^{-1}$	5.7E-11
	2-Methylnaphthalene	360	µg/L	360	µg/L	M	3.0E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acenaphthene	53.3	µg/L	53.3	µg/L	M	4.5E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Acetophenone	62	µg/L	62	µg/L	M	5.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Anthracene	42.8	µg/L	42.8	µg/L	M	3.6E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzo(a)anthracene	0.99	µg/L	0.99	µg/L	M	8.3E-10	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	6.1E-10
	Benzo(a)pyrene	1.1	µg/L	1.1	µg/L	M	9.2E-10	mg/kg-day	7.3E+00	(mg/kg-day)$^{-1}$	6.7E-09
	Benzo(b)fluoranthene	1.7	µg/L	1.7	µg/L	M	1.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	1.0E-09
	Biphenyl	44.8	µg/L	44.8	µg/L	M	3.8E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	µg/L	130	µg/L	M	1.1E-07	mg/kg-day	1.4E-02	(mg/kg-day)$^{-1}$	1.5E-09
	Dibenzofuran	40.3	µg/L	40.3	µg/L	M	3.4E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Fluorene	80.9	µg/L	80.9	µg/L	M	6.8E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	µg/L	0.66	µg/L	M	5.5E-10	mg/kg-day	7.3E-01	(mg/kg-day)$^{-1}$	4.0E-10
	Naphthalene	239	µg/L	239	µg/L	M	2.0E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pentachlorophenol	572	µg/L	572	µg/L	M	4.8E-07	mg/kg-day	1.2E-01	(mg/kg-day)$^{-1}$	5.8E-08
	Phenanthrene	223	µg/L	223	µg/L	M	1.9E-07	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Pyrene	33.1	µg/L	33.1	µg/L	M	2.8E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	µg/L	0.496	µg/L	M	4.2E-10	mg/kg-day	1.5E+05	(mg/kg-day)$^{-1}$	6.2E-05
	Aluminum (Total)	42000	µg/L	42000	µg/L	M	3.5E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Antimony (Dissolved)	3	µg/L	3.3	µg/L	M	2.8E-09	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Arsenic (Dissolved)	3	µg/L	2.9	µg/L	M	2.4E-09	mg/kg-day	1.5E+00	(mg/kg-day)$^{-1}$	3.6E-09
	Chromium (Total)	56.1	µg/L	56.1	µg/L	M	4.7E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Cobalt (Total)	38	µg/L	37.7	µg/L	M	3.2E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Iron (Total)	52900	µg/L	52900	µg/L	M	4.4E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Lead (Total)	27.1	µg/L	27.1	µg/L	M	2.3E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Manganese (Total)	2770	µg/L	2770	µg/L	M	2.3E-06	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Vanadium (Total)	102	µg/L	102	µg/L	M	8.6E-08	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
											6.2E-05

Table 14 Worker RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Dermal	alpha-BHC	0.0075	μg/L	0.0075	μg/L	M	1.6E-11	mg/kg-day	6.3E+00	$(mg/kg-day)^{-1}$	1.0E-10
	beta-BHC	0.0204	μg/L	0.0204	μg/L	M	4.5E-11	mg/kg-day	1.8E+00	$(mg/kg-day)^{-1}$	8.2E-11
	Aldrin	0.00781	μg/L	0.00781	μg/L	M	3.0E-12	mg/kg-day	1.7E+01	$(mg/kg-day)^{-1}$	5.2E-11
	Dieldrin	0.321	μg/L	0.321	μg/L	M	1.0E-09	mg/kg-day	1.6E+01	$(mg/kg-day)^{-1}$	1.6E-08
	Heptachlor Epoxide	0.00819	μg/L	0.00819	μg/L	M	4.0E-11	mg/kg-day	9.1E+00	$(mg/kg-day)^{-1}$	3.6E-10
	Benzene	0.49	μg/L	0.49	μg/L	M	3.1E-10	mg/kg-day	5.5E-02	$(mg/kg-day)^{-1}$	1.7E-11
	Methyl tert-butyl ether (MTBE)	4	μg/L	4	μg/L	M	3.8E-10	mg/kg-day	4.0E-03	$(mg/kg-day)^{-1}$	1.5E-12
	1,1,2,2-Tetrachloroethane	6	μg/L	6	μg/L	M	3.2E-09	mg/kg-day	2.0E-01	$(mg/kg-day)^{-1}$	6.4E-10
	Tetrachloroethylene (PCE)	1	μg/L	1	μg/L	M	2.5E-09	mg/kg-day	5.4E-01	$(mg/kg-day)^{-1}$	1.4E-09
	Trichloroethylene (TCE)	0.17	μg/L	0.17	μg/L	M	1.2E-10	mg/kg-day	4.0E-01	$(mg/kg-day)^{-1}$	4.9E-11
	2-Methylnaphthalene	360	μg/L	360	μg/L	M	2.2E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Acenaphthene	53.3	μg/L	53.3	μg/L	M	3.5E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Acetophenone	62	μg/L	62	μg/L	M	1.4E-08	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Anthracene	42.8	μg/L	42.8	μg/L	M	5.3E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Benzo(a)anthracene	0.99	μg/L	0.99	μg/L	M	5.5E-08	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	4.0E-08
	Benzo(a)pyrene	1.1	μg/L	1.1	μg/L	M	1.1E-07	mg/kg-day	7.3E+00	$(mg/kg-day)^{-1}$	7.7E-07
	Benzo(b)fluoranthene	1.7	μg/L	1.7	μg/L	M	1.7E-07	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	1.2E-07
	Biphenyl	44.8	μg/L	44.8	μg/L	M	3.2E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Bis(2-ethylhexyl)phthalate	130	μg/L	130	μg/L	M	8.9E-07	mg/kg-day	2.5E-02	$(mg/kg-day)^{-1}$	2.2E-08
	Dibenzofuran	40.3	μg/L	40.3	μg/L	M	3.1E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Fluorene	80.9	μg/L	80.9	μg/L	M	6.6E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Indeno(1,2,3-cd)pyrene	0.66	μg/L	0.66	μg/L	M	6.6E-08	mg/kg-day	7.3E-01	$(mg/kg-day)^{-1}$	4.8E-08
	Naphthalene	239	μg/L	239	μg/L	M	6.6E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Pentachlorophenol	572	μg/L	572	μg/L	M	3.0E-05	mg/kg-day	1.2E-01	$(mg/kg-day)^{-1}$	3.7E-06
	Phenanthrene	223	μg/L	223	μg/L	M	2.7E-06	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Pyrene	33.1	μg/L	33.1	μg/L	M	7.7E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Total 2,3,7,8-TCDD TEQ	0.496	μg/L	0.496	μg/L	M	4.4E-08	mg/kg-day	1.5E+05	$(mg/kg-day)^{-1}$	6.6E-03
	Aluminum (Total)	42000	μg/L	42000	μg/L	M	6.1E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Antimony (Dissolved)	3	μg/L	3.3	μg/L	M	4.6E-11	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Arsenic (Dissolved)	3	μg/L	2.9	μg/L	M	4.0E-11	mg/kg-day	1.5E+00	$(mg/kg-day)^{-1}$	6.1E-11
	Chromium (Total)	56.1	μg/L	56.1	μg/L	M	1.5E-09	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Cobalt (Total)	38	μg/L	37.7	μg/L	M	2.1E-10	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Iron (Total)	52900	μg/L	52900	μg/L	M	7.2E-07	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Lead (Total)	27.1	μg/L	27.1	μg/L	M	3.8E-11	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Manganese (Total)	2770	μg/L	2770	μg/L	M	3.8E-08	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	Vanadium (Total)	102	μg/L	102	μg/L	M	1.4E-09	mg/kg-day	NA	$(mg/kg-day)^{-1}$	NC
	(Total)										6.6E-03

Table 14 Worker RME OU3B Groundwater
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Future
Medium Groundwater
Exposure Medium Groundwater
Exposure Point OU3B
Receptor Population 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	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	Benzene	0.49	µg/L	4.38	µg/m³	R	1 5E-06	mg/kg-day	2.7E-02	(mg/kg-day)⁻¹	4 0E-08
	Methyl tert-butyl ether (MTBE)	4	µg/L	31	µg/m³	R	1 0E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	1,1,2,2-Tetrachloroethane	6	µg/L	32 2	µg/m³	R	1 1E-05	mg/kg-day	2.0E-01	(mg/kg-day)⁻¹	2.2E-06
	Tetrachloroethylene (PCE)	1	µg/L	6 19	µg/m³	R	2 1E-06	mg/kg-day	2.1E-02	(mg/kg-day)⁻¹	4.4E-08
	Trichloroethylene (TCE)	0.17	µg/L	1 18	µg/m³	R	4.0E-07	mg/kg-day	4.0E-01	(mg/kg-day)⁻¹	1 6E-07
	Acenaphthene	53.3	µg/L	256	µg/m³	R	8 6E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Acetophenone	62	µg/L	73 9	µg/m³	R	2.5E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Anthracene	42.8	µg/L	143	µg/m³	R	4.8E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Biphenyl	44.8	µg/L	245	µg/m³	R	8.2E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Fluorene	80.9	µg/L	276	µg/m³	R	9.3E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	2-Methylnaphthalene	360	µg/L	2190	µg/m³	R	7.3E-04	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Naphthalene	239	µg/L	1520	µg/m³	R	5.1E-04	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Pyrene	33.1	µg/L	33.4	µg/m³	R	1.1E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	(Total)										2.4E-06
										Total Cancer Risk Across All Exposure Routes/Pathways	6.6E-03

Notes

Dermal intake calculations use values for DAevent from Appendix .

EPC Selected for Risk Calculation. (M) Medium Specific, (R) Route Specific.

Ingestion and Dermal Route EPC Value = Medium EPC Value.

NA = not available

µg/L = micrograms per liter

mg/kg-day = milligrams per kilogram - day

Table 14 Adult Resident RME OU3A Indoor Air (Groundwater Vapor Intrusion)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point. OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation (Indoor)	1,2-Dichloroethane	3 89	ug/L	8 23E-02	ug/m^3	R	7 7E-06	mg/kg-day	9 1E-02	(mg/kg-day)$^{-1}$	7 0E-07
	1,3,5-Trimethylbenzene	75 9	ug/L	4 76E+00	ug/m^3	R	4 5E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Azulene	4 1	ug/L	9 70E-01	ug/m^3	R	9 1E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Benzene	35 7	ug/L	3 84E+00	ug/m^3	R	3 6E-04	mg/kg-day	2 7E-02	(mg/kg-day)$^{-1}$	9 7E-06
	Isopropylbenzene (cumene)	9 84	ug/L	1 17E+02	ug/m^3	R	1 1E-02	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Xylenes (Total)	128	ug/L	1 27E+01	ug/m^3	R	1 2E-03	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	1,2,4-Trimethylbenzene	93 3	ug/L	6 14E+00	ug/m^3	R	5 8E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Indene	19	ug/L	4.00E-01	ug/m^3	R	3 8E-05	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										1 0E-05
										Total Cancer Risk Across Indoor Vapor Intrusion Pathway	1 0E-05

Total Child Risk Across Indoor Vapor Intrusion Pathway	6 6E-06
Total Adult and Child Risk Across Indoor Vapor Intrusion Pathway	1.7E-05

Notes.
EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific
NA = not available
mg/kg-day = milligrams per kilogram - day
mg/m^3 = milligrams per cubic meter
ug/L = micrograms per liter
ug/m^3 = micrograms per cubic meter

Table 14 Child Resident RME OU3A Indoor Air (Groundwater Vapor Intrusion)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point OU3A
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation (indoor)	1,2-Dichloroethane	3 89	ug/L	8 23E-02	ug/m³	R	4 9E-06	mg/kg-day	9 1E-02	(mg/kg-day)⁻¹	4 4E-07
	1,3,5-Trimethylbenzene	75 9	ug/L	4 76E+00	ug/m³	R	2.8E-04	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Azulene	4 1	ug/L	9 70E-01	ug/m³	R	5.8E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Benzene	35 7	ug/L	3 84E+00	ug/m³	R	2 3E-04	mg/kg-day	2 7E-02	(mg/kg-day)⁻¹	6 2E-06
	Isopropylbenzene (cumene)	9 84	ug/L	1 17E+02	ug/m³	R	7 0E-03	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Xylenes (Total)	128	ug/L	1 27E+01	ug/m³	R	7 5E-04	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	1,2,4-Trimethylbenzene	93 3	ug/L	6 14E+00	ug/m³	R	3 6E-04	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Indene	19	ug/L	4 00E-01	ug/m³	R	2 4E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	(Total)										6.6E-06
										Total Cancer Risk Across Indoor Vapor Intrusion Pathway	6 6E-06

Total Adult Risk Across Indoor Vapor Intrusion Pathway	1.0E-05
Total Adult and Child Risk Across Indoor Vapor Intrusion Pathway	1 7E-05

Notes
EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific.
NA = not available
mg/kg-day = milligrams per kilogram - day
mg/m³ = milligrams per cubic meter
ug/L = micrograms per liter
ug/m³ = micrograms per cubic meter

Table 14 Adult Resident RME OU3B Indoor Air (Groundwater Vapor Intrusion)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium Indoor Air
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation (Indoor)	1,1,2,2-Tetrachloroethane	6	ug/L	3 14E-02	ug/m^3	R	2 9E-06	mg/kg-day	2 0E-01	(mg/kg-day)$^{-1}$	5 9E-07
	Tetrachloroethylene (PCE)	1	ug/L	2 69E-01	ug/m^3	R	2 5E-05	mg/kg-day	2 1E-02	(mg/kg-day)$^{-1}$	5.3E-07
	Trichloroethylene (TCE)	0 17	ug/L	3 01E-02	ug/m^3	R	2 8E-06	mg/kg-day	4 0E-01	(mg/kg-day)$^{-1}$	1 1E-06
	2-Methylnaphthalene	360	ug/L	1 43E+00	ug/m^3	R	1 3E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Naphthalene	239	ug/L	1 24E+00	ug/m^3	R	1 2E-04	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	Phenanthrene	223	ug/L	1 49E+02	ug/m^3	R	1 4E-02	mg/kg-day	NA	(mg/kg-day)$^{-1}$	NC
	(Total)										2 3E-06
										Total Cancer Risk Across Indoor Vapor Intrusion Pathway	2 3E-06

Total Child Risk Across Indoor Vapor Intrusion Pathway	1 4E-06
Total Adult and Child Risk Across Indoor Vapor Intrusion Pathway	3 7E-06

Notes:

EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific

NA = not available

mg/kg-day = milligrams per kilogram - day

mg/m^3 = milligrams per cubic meter

ug/L = micrograms per liter

ug/m^3 = micrograms per cubic meter

Table 14 Child Resident RME OU3B Indoor Air (Groundwater Vapor Intrusion)
Calculation of Cancer Risks, Reasonable Maximum Exposure

Scenario Timeframe Current/Future
Medium Groundwater
Exposure Medium. Indoor Air
Exposure Point OU3B
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 Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation (Indoor)	1,1,2,2-Tetrachloroethane	6	ug/L	3 14E-02	ug/m³	R	1 9E-06	mg/kg-day	2 0E-01	(mg/kg-day)⁻¹	3 7E-07
	Tetrachloroethylene (PCE)	1	ug/L	2 69E-01	ug/m³	R	1 6E-05	mg/kg-day	2 1E-02	(mg/kg-day)⁻¹	3 4E-07
	Trichloroethylene (TCE)	0 17	ug/L	3 01E-02	ug/m³	R	1 8E-06	mg/kg-day	4 0E-01	(mg/kg-day)⁻¹	7 2E-07
	2-Methylnaphthalene	360	ug/L	1 43E+00	ug/m³	R	8 5E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Naphthalene	239	ug/L	1 24E+00	ug/m³	R	7 4E-05	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	Phenanthrene	223	ug/L	1 49E+02	ug/m³	R	8 9E-03	mg/kg-day	NA	(mg/kg-day)⁻¹	NC
	(Total)										1 4E-06
										Total Cancer Risk Across Indoor Vapor Intrusion Pathway	1.4E-06

Total Adult Risk Across Indoor Vapor Intrusion Pathway	2.3E-06
Total Adult and Child Risk Across Indoor Vapor Intrusion Pathway	3 7E-06

Notes
EPC Selected for Risk Calculation (M) Medium Specific, (R) Route Specific
NA = not available
mg/kg-day = milligrams per kilogram - day
mg/m³ = milligrams per cubic meter
ug/L = micrograms per liter
ug/m³ = micrograms per cubic meter

Table 15
REMEDIAL GOAL OBJECTIVES
FOR GROUNDWATER

COC	Units	MCL	Site-Specific Risk-Based Value
Benzo(a)pyrene	µg/L	0.2	NA
Dieldrin	µg/L	Not Applicable (NA)	3.8E-02
Bis (2-ethylhexyl)phthalate	µg/L	6	NA
Diebenzofuran	µg/L	NA	4.0E+00
2- Methylnaphthalene	µg/L	NA	2.0E+00
Naphthalene[1]	µg/L	NA	3.0E+00
Pentachlorophenol	µg/L	1	NA
Phenanthrene	µg/L	NA	4.1E+01
Total 2,3,7,8-TCDD	µg/L	3.0E-05	NA
1,2,4-Trimethylbenzene	µg/L	NA	1.6E+01
1,3,5-Trimethylbenzene	µg/L	NA	1.6E+01
4,6-Dinitro-2-methylphenol	µg/L	NA	1.7E+00
Aluminum[2]	µg/L	50-200	NA
Arsenic	µg/L	10	NA
Chromium	µg/L	100	NA
Barium	µg/L	2000	NA
Manganese[2]	µg/L	50	NA
Iron[2]	µg/L	300	NA
Vanadium	µg/L	NA	3.1E+00

[1]The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for an adult resident is 1.2E+01 µg/l.
[2]Based on National Secondary Drinking Water Regulations.

Table 16
REMEDIAL GOAL OBJECTIVES
FOR OU3B SOILS

COC	Units	Remedial Goal Objective	Basis for Remedial Goal Objective
Benzo(a)pyrene	mg/kg	1.3	Site-Specific Risk-Based Value
Dieldrin	mg/kg	1.1E-02[1]	Statewide Health Standards Soil to Groundwater
PCP	mg/kg	0.5[1]	Statewide Health Standards Soil to Groundwater
Total 2,3,7,8-TCDD TEQ	mg/kg	1.2E-04	Statewide Health Standards Direct Contact
Aluminum	mg/kg	6.2E+03	Site-Specific Risk-Based Value
Iron	mg/kg	1.5E+04	Site-Specific Risk-Based Value
Manganese[2]	mg/kg	1.6E+02	Site-Specific Risk-Based Value

[1]Soil to groundwater value based on 1/10 the generic value for saturated soils.
[2]The site-specific risk-based value presented is for the risk for construction workers, which is the most stringent. The site-specific risk-based value for child and adult resident are 5.7E+02 mg/kg and 5.5E+03 mg/kg, respectively.

Table 17 (*Page 1 of 5*)
Summary of Applicable or Relevant and Appropriate Requirements (ARARs)
And To Be Considered (TBC) Material
For the Havertown PCP Superfund Site

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER DETAIL REGARDING ARARS IN THE CONTEXT OF THE REMEDY
Chemical Specific				
A. Water				
Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs)[1]	40 CFR §§ 141.11, 141.61 and 141.62	Relevant and Appropriate	MCLs are enforceable standards for public drinking water supply systems which have at least 15 service connections or are used by at least 25 persons. These requirements are not directly applicable since groundwater in the vicinity of the site is not used as private drinking water supply. However, under the circumstances of this Site, MCLs are relevant and appropriate requirements which were considered in establishing groundwater cleanup levels.	The groundwater will meet these requirements. The cleanup standards for groundwater are set at or below the existing MCLs.
Pennsylvania Water Quality Standards	25 Pa. Code § 93.7 and 93.8a	Relevant and Appropriate	These are the specific water quality criteria established pursuant to Section 304 of the Clean Water Act. These provisions set the concentration of pollutants that are allowable at levels which preserve human health based on water and fish ingestion and to preserve aquatic life. Ambient water quality criteria may be relevant and appropriate to CERCLA cleanups based on uses of a water body.	The discharge of treated groundwater would meet the guidelines established for protection of aquatic life.
Integrated Risk Information System (IRIS)	EPA Office of Research and Development	To Be Considered	IRIS is an EPA database containing up-to-date health risk and EPA regulatory information for numerous chemicals. IRIS is the preferred source of toxicity information as it contains only those reference doses RfDs and cancer slope factors that have been verified by the RfD or Carcinogen Risk Assessment Verification Endeavor Workgroups.	These non-enforceable toxicity values have been considered while developing site-specific cleanup standards for each remedial alternative.

[1] EPA has determined that Act 2 does not, on the facts and circumstances of this remedy impose any groundwater requirements more stringent than the federal standard.

Table 17 *(Page 2 of 5)*
Summary of Applicable or Relevant and Appropriate Requirements (ARARs)
And To Be Considered (TBC) Material
For the Havertown PCP Superfund Site

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER DETAIL REGARDING ARARS IN THE CONTEXT OF THE REMEDY
Chemical Specific				
B. Soil				
Risk Assessment Guidance for Superfund – Volume 1 Human Health Manual Part A, December 1989	EPA Office of Emergency and Remedial Response EPA/540/1-89/002	To be Considered	EPA guidance for calculating baseline human health risk and establishing risk-based performance standards for Superfund cleanups. Section 7.4 sets forth method for identifying appropriate toxicity values for contaminants of concern.	There are currently no federal standards establishing acceptable concentrations for contaminants in soil or sediment at the site. This guidance document was considered when establishing risk based cleanup standards.
Office of Solid Waste and Emergency Response Directive on Approach for Addressing Dioxin in Soil at CERCLA and RCRASites	Directive 9200.4-26	To Be Considered	Establishes recommended preliminary remediation goals for dioxin in residential surface soil.	The soil will meet the recommended cleanup goal for dioxin.
Pennsylvania Land Recycling and Environmental Remediation Standards (Act 2)	25 Pa Code § 250.305 and § 250.308	Applicable	This regulation establishes remediation standards for soil cleanup activities that are protective of human health and the environment.	Under the facts and circumstances of this Site, EPA has selected the Statewide health Standard for dieldrin, dioxin and PCP as the applicable requirements for soil cleanup at the Site.
Location Specific				
There are no location specific ARARs identified.				

Table 17 *(Page 3 of 5)*
Summary of Applicable or Relevant and Appropriate Requirements (ARARs)
And To Be Considered (TBC) Material
For the Havertown PCP Superfund Site

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER DETAIL REGARDING ARARS IN THE CONTEXT OF THE REMEDY
Action Specific				
A. Water				
Pennsylvania Clean Streams Law	25 Pa. Code §§ 16.1, 16.24, 16.31 – 16.33, 16.41, 16.51 and 16.101-102	Applicable	The objective of this statute is to reclaim and restore polluted streams. The law provides for the protection of streams and water quality control. This statute may be applicable to remedial alternatives that require the discharge of water/waste, and/or the cleanup of contaminated streams.	The groundwater treatment plant will comply with these discharge standards. The Site already generates a discharge from the groundwater pump-and-treat facility which is in compliance with the substantive parts of these provisions.
Clean Water Act (CWA) Pennsylvania National Pollutant Discharge Elimination System Requirements	40 CFR §§ 122.2, 122.4, 122.5, 122.21, 122.26, 122.29, 122.41, 122.43 – 122.45, 122.47,122.48 (All of these sections, except for 122.47, are incorporated by reference into Pennsylvania's regulation by 25 Pa. Code § 92.2.) 25 Pa. Code §§ 92.3, 92.7, 92.31, 92.41, 92.51, 92.55, 92.57, 92.73, 93.6, 93.7 and 95.2	Applicable	Establishes effluent limitations for discharges to waters of Pennsylvania and the United States.	At the Site, EPA is currently operating a pump-and-treat facility that discharges treated water in compliance with the substantive parts of these provisions.
Storm Water Management Act	32 P.S. § 680.13	Applicable	Requires implementation of storm water control measures to prevent injury to health, safety, or property.	Storm water shall be managed in accordance with these requirements during implementation of the remedy

Table 17 *(Page 4 of 5)*
Summary of Applicable or Relevant and Appropriate Requirements (ARARs)
And To Be Considered (TBC) Material
For the Havertown PCP Superfund Site

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER DETAIL REGARDING ARARS IN THE CONTEXT OF THE REMEDY
Action Specific				
B. Soil				
Erosion and Sediment Control	25 Pa. Code §§ 102.4(b)(1), 102.11, 102.22	Applicable	Identifies erosion and sediment control requirements and criteria for activities involving land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria.	These regulations apply to construction activities at the site which disturb the ground surface, including clearing, grading, and excavation.
C. Hazardous Waste				
Resource Conservation and Recovery Act (RCRA) Pennsylvania Hazardous Waste Management Regulations	25 Pa. Code §§ 262a.34 (which incorporates by reference 40 CFR § 262.34), 264a.173 40 CFR § 262.34 (accumulation time and requirements) 40 CFR §§ 264.171-175 (containers)	Relevant and Appropriate	These provisions govern the accumulation time for hazardous wastes and management of containers, and will be followed when treatment sludge and/or excavated soil is stored at the Site.	The groundwater treatment remedy generates hazardous sludge. These requirements are for the generation and disposal of hazardous sludge and excavated soil from OU3B. RCRA requirements for the preferred alternative are found in Pennsylvania's EPA-authorized RCRA regulations. When treatment sludge or soil will be staged in containers prior to off-site disposal, its handling will comply with 40 CFR § 262.34 (accumulation time and requirements), 40 CFR §§ 264.171-175 and 25 Pa Code § 264a.173 (Containers).
D. Air				
Fugitive Air Emissions	25 Pa Code §§ 123.1 – 123.2 40 CFR § 50.6 – 50.7	Applicable	Establishes the fugitive dust regulation for particulate matter.	Excavation activities will comply with these regulations.
Visible Emissions	25 Pa Code § 123.41	Applicable	Establishes opacity limits for visible air emissions.	Emissions from the excavation and construction will comply with this requirement.

Table 17 *(Page 5 of 5)*
Summary of Applicable or Relevant and Appropriate Requirements (ARARs)
And To Be Considered (TBC) Material
For the Havertown PCP Superfund Site

ARAR OR TBC	LEGAL CITATION	CLASSIFICATION	SUMMARY OF REQUIREMENT	FURTHER DETAIL REGARDING ARARS IN THE CONTEXT OF THE REMEDY
Action Specific				
E. Other				
Underground Injection Control Program	40 CFR §§144.82, 144.83, 144.84, 144.85, 144.86, 144.89, 40 CFR §§ 146.5, 146.6, 146.7, 146.8, 146.10, 146.51	Applicable	Establishes classes of injection wells and establishes requirements for Class V wells under the Underground Injection Control Program.	These regulations apply to the in-situ portion of the remedy for the source area.

Table 18
Alternatives Cost Summary

Alternative	Capital Costs	Annual O&M	Total Present Worth
1A	$0	$0	$0
2A	$555,000	$50,000	$1,175,000
3A	$1,062,000	$151,000	$2,936,000
4A	$4,390,000	$55,000	$5,072,000
5A	$6,066,000	$55,000	$6,748,000
1B	$30,000	$0[1]	$30,000
2B	$99,000	$88,000	$1,191,000
3B	$1,240,000	$132,000	$2,878,000
4B	$4,371,000	$128,000	$5,959,000
5B	$12,538,000	$128,000	$14,126,000
6B	$4,485,000	$128,000	$6,073,000
7B	$12,652,000	$128,000	$14,240,000

[1]The O&M costs associated with this Alternative are assumed to be part of the ongoing OU2 Long-term Remedial Action costs

Table 19
Selected Remedy (3A) - Augmented Containment and Restoration by In-Situ Flushing

Item No.	Description	Units	Unit Cost	No. Units	Total Cost
100	**Capital Cost**				
101	Mobilize/demobilize drilling rig & crew	LS	$15,000.00	1	$15,000
102	Organic vapor analyzer rental	Day	$155.00	14	$2,170
103	Decontaminate rig, augers, screen (rental)	Day	$1,000.00	12	$12,000
104	Field technician	HR	$132.00	36	$4,752
	Injection Wells				
105	6" stainless steel casing (2 wells, 70' deep each with 30' of screen, so 40' of casing). See note (a).	LF	$65.00	80	$5,200
106	2" pitless adaptor	EA	$300.00	3	$900
107	6" stainless steel well screen (2 wells, 30 feet screen each)(a)	LF	$100.00	60	$6,000
108	6" well, bentonite seal. See note (a).	EA	$300.00	2	$600
131	Hollow stem auger, 11" dia borehole (2 wells at 50' each)(a)	LF	$73.00	100	$7,300
109	Well development equipment rental. See note (a).	WK	$700.00	2	$1,400
110	Vault for new injection wells	EA	$34,000.00	3	$102,000
111	Mobilize/demobilize construction equipment and crew	LS	$15,000.00	1	$15,000
112	2" PVC double-wall piping from plant to injection wells (common pipe to wells by RW-1, RW-2, and CW-26D)	LF	$95.00	600	$57,000
113	Excavating. Trench, medium soil, 4' to 6' deep, excluding sheeting or dewatering	LF	$30.00	600	$18,000
114	Backfill with excavated material	CY	$15.00	400	$6,000
115	Delivered & dumped, backfill with stone, compacted with vibrating plate	CY	$48.00	140	$6,720
116	Restoration of sod over cap	SY	$3.00	1,200	$3,600
117	Electrical and controls for wells	LS	$50,000.00	1	$50,000
	Recovery Wells				
118	One time access agreement /repair fee	EA	$5,000.00	1	$5,000
119	6" stainless steel casing (1 well, 70' deep each with 30' of screen, so 40' of casing)	LF	$65.00	40	$2,600
120	2" pitless adaptor	EA	$300.00	1	$300
121	6" stainless steel well screen (1 well, 30 feet screen each)	FT	$100.00	30	$3,000
122	Hollow stem auger, 11" dia borehole (1 well at 75' each)	FT	$73.00	75	$5,475
123	6" well, bentonite seal	EA	$300.00	1	$300
124	Vault for new recovery well, including installation, piping, lid	EA	$34,000.00	1	$34,000
125	Submersible pump for new recovery well (5-10 gpm, 120' head)	EA	$2,200.00	1	$2,200
126	2" PVC double-wall piping (Piping from recovery well to the forcemain at RW-3)	LF	$95.00	340	$32,300
127	Excavating. Trench, medium soil, 4' to 6' deep, excluding sheeting or dewatering	LF	$30.00	340	$10,200
128	Backfill with excavated material	CY	$15.00	230	$3,450
129	Delivered & dumped, backfill with stone, compacted with vibrating plate	CY	$48.00	80	$3,840
130	Site Paving (parking lot and driveway)	SY	$7.50	150	$1,125
131	Upsizing pumps in collection trench and manhole	EA	$5,000.00	1	$5,000
132	5,000 Gallon storage tanks, mixing system, and piping for injection water at plant	LS	$45,000.00	1	$45,000

Table 19

Selected Remedy (3A) - Augmented Containment and Restoration by In-Situ Flushing

Item No.	Description	Units	Unit Cost	No. Units	Total Cost
133	Detection systems. water level sensor, float switch, incl. 50' cable, excl. wires & conduit	EA	$600.00	1	$600
134	New pretreatment equipment	LS	$100,000.00	1	$100,000
135	Demolition of existing pretreatment units, preparation	LS	$40,000.00	1	$40,000
136	Installation of new pretreatment equipment	LS	$50,000.00	1	$50,000
137	Electrical and controls for wells	LS	$50,000.00	1	$50,000
	Capital Cost Subtotal				**$708,032**
	Contingency on construction capital costs	%	25		$177,008
	Design & permitting	%	15		$106,205
	Construction management	%	10		$70,803
Total Construction Cost					**$1,062,000**
200	**Annual O&M Costs**				
201	Analytical Cost (4 wells quarterly)**	EA	$2,000.00	16	$32,000
202	Labor to collect samples (1 crew, 12 hours/each at $75/hour)**	Event	$900.00	4	$3,600
203	Data analysis and report preparation**	EA	$2,000.00	0	$0
204	Project management, technical support, etc.	Annual	$10,000.00	1	$10,000
205	Additional electricity cost for the treatment plant	Annual	$2,000.00	1	$2,000
206	Additional electricity cost for the injection wells and recovery wells	kwhr	$0.10	40,000	$4,000
207	Additional chemicals including caustic, acid, hydrogen peroxide, and ferric chloride	Annual	$15,000.00	1	$15,000
208	Routine Maintenance	Annual	$15,000.00	1	$15,000
209	Additional waste sludge incineration	Ton	$1,000.00	26	$26,000
210	Surfactant (annual use based on 0.05% into 20 gpm, 365 days per year) (b)	Pound	$1.00	43,825	$43,825
211	sulfuric acid (based on 4.1lb/1000 gallons) (b)	Pound	$0.40	0	$0
212	sodium hydroxide (based on 1.5 lb/1000 gallon) (b)	Pound	$0.40	0	$0
					$0
	Total Annual O&M Costs				**$151,000**
Present Worth Cost of Annual O&M Costs (7% discount rate for 30 years)					$1,874,000
Total Present Worth Cost with a Discount Rate of 7% (30 Year Operation)					**$2,936,000**

Note: (a) The existing well CW-26D can be reused as an injection well, but will require a vault and piping.
(b) Chemical costs are based on surfactant only. Acid or alkaline may be needed depending on the final flushing reagent selected.

** Other wells are already sampled as part of the OU2 operations.

Table 19

Selected Remedy (4B) - Partial Excavation and Off-site Disposal (S-2), Followed by Groundwater Extraction with Recovery Wells, Ex-situ Treatment, and Surface Discharge (GW-1)

Item No.	Description	Units	Unit Cost	No. Units	Total Cost
100	**Capital Cost**				
	Excavation				
101	Mobilize/demobilize equipment & crew	LA	$5,000.00	1	$5,000
102	Excavate and load, bank measure, medium material, 2 C.Y. bucket, hydraulic excavator	BCY	$10.00	1,692	$16,920
103	Delivered & dumped, backfill with stone	BCY	$36.00	119	$4,267
104	Unclassified fill, 6" lifts, off-site, includes delivery, spreading, and compaction	CY	$14.00	1,692	$23,688
105	Loam or topsoil, imported topsoil, 6" deep furnish and place	LCY	$39.50	142	$5,609
106	Seeding, vegetative cover	ACRE	$26,000.00	0 6	$15,600
107	Steel sheeting, install, pull, and salvage to 15 ft	SF	$11.00	4,800	$52,800
108	2" diameter contractor's trash pump, 75 gpm	Day	$75.00	60	$4,500
109	Ground penetrating radar	Day	$1,650.00	10	$16,500
110	Spray washing, decontaminate heavy equipment	EA	$820.00	1	$820
111	Spray washers, surface decontamination, pressure washers	SF	$3.00	7,640	$22,920
112	Incineration of excavated soil, including transportation	CY	$1,900.00	1,049	$1,993,100
113	Off-site landfill disposal of excavated soil, including transportation	CY	$300.00	643	$192,900
114	Confirmatory soil sampling	EA	$2,000.00	20	$40,000
	Site Access				
115	Access bridge	EA	$50,000.00	1	$50,000
	Institutional Controls				
116	Deed restriction	EA	$15,000.00	1	$15,000
117	One time access agreement fee	EA	$2,000.00	10	$20,000
Total Capital Cost for Soil Treatment					**$2,479,624**
	Groundwater Extraction Wells				
118	Mobilize/demobilize drilling rig & crew	LS	$5,000.00	1	$5,000
119	Organic vapor analyzer rental	Day	$155.00	7	$1,085
120	Decontaminate rig, augers, screen (rental)	Day	$1,000.00	6	$6,000
121	Field technician	HR	$132.00	18	$2,376
122	6" stainless steel casing (3 wells, each with 4')	LF	$65.00	12	$780
123	2" pitless adaptor	EA	$300.00	3	$900
124	6" stainless steel well screen (3 wells, each with 25')	LF	$100.00	75	$7,500
125	4" submergible pump, 15-20 gpm, head < 80', w/ controls	EA	$2,200.00	3	$6,600
126	Hollow stem auger, 11" dia borehole, depth < 100 ft	LF	$73.00	75	$5,475
127	6" stainless steel well plug	LF	$500.00	3	$1,500
128	Split spoon sample, 2" x 24", during drilling	EA	$55.00	8	$440
129	DOT steel drums, 55 gal, open, 17C	EA	$110.00	24	$2,640
130	Well development equipment rental	WK	$700.00	3	$2,100
131	6" screen, filter pack	LF	$50.00	75	$3,750
132	6" well, bentonite seal	EA	$300.00	3	$900

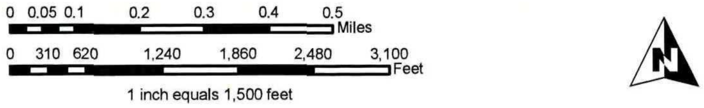
Table 19

Selected Remedy (4B) - Partial Excavation and Off-site Disposal (S-2), Followed by Groundwater Extraction with Recovery Wells, Ex-situ Treatment, and Surface Discharge (GW-1)

Item No.	Description	Units	Unit Cost	No. Units	Total Cost
133	Restricted area, well protection (with 4 posts & explosion proof receptacle)	EA	$2,050.00	3	$6,150
134	Electrical power and controls	LS	$100,000.00	1	$100,000
	Trenching/piping to the GW Treatment Plant				
135	Excavating. Trench, medium soil, 4' to 6' deep, excluding sheeting or dewatering	LF	$30.00	2,000	$60,000
136	Backfill with excavated material	CY	$15.00	511	$7,665
137	Delivered & dumped, backfill with stone, compacted with vibrating plate	BCY	$48.00	74	$3,552
138	2" PVC double-wall piping	LF	$95.00	2,000	$190,000
	Groundwater Treatment Plant				
139	New pretreatment equipment	LS	$100,000.00	0*	$0
140	Demolition of existing units, preparation	LS	$40,000.00	0*	$0
141	Installation of new pretreatment equipment	LS	$50,000.00	0*	$0
	Groundwater Monitoring Wells				
142	Construct five new groundwater monitoring wells	EA	$4,000.00	5	$20,000
Total Capital Cost for Groundwater Treatment					**$434,413**
	Capital Cost Subtotal				**$2,914,037**
	Contingency On Construction Capital Costs	%	25		$728,509
	Remedial Design & Permitting	%	15		$437,106
	Construction Management	%	10		$291,404
Total Capital Cost					**$4,371,000**
200	**Annual O&M Costs**				
201	Analytical Cost (7 subsurface soil, 3 sediment, 3 surface water, 5 groundwater, 2 times a year)	EA	$2,000.00	36	$72,000
202	Labor to collect samples (2 employees, 40 hours/each at $75/hour)	Event	$6,000.00	2	$12,000
203	Data analysis and report preparation	EA	$2,000.00	2	$4,000
204	Project management, technical support, etc.	Annual	$10,000.00	1	$10,000
205	Additional electricity cost for the treatment plant	Annual	$10,000.00	0*	$0
206	Additional chemicals including caustic, acid, hydrogen peroxide, and ferric chloride	Annual	$10,000.00	0*	$0
207	Routine Maintenance	Annual	$30,000.00	1	$30,000
208	Additional waste sludge incineration	Ton	$1,000.00	0*	$0
	Total Annual O&M Costs				**$128,000**
Present Worth Cost of Annual O&M Costs (7% discount rate for 30 years)					$1,588,000
Total Present Worth Cost with a Discount Rate of 7% (30 Year Operation)					**$5,959,000**

* These costs are included as part of the OU3A remedial costs. Refer to the OU3A FFS for these item costs.

Figure 1 General Location



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Data Sources:
Background Image USGS Mr_SID
Site Location from USEPA Reports
Image downloaded from PASDA (www.pasda.psu.edu)

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Figure 2
Site Features
Havertown PCP Site

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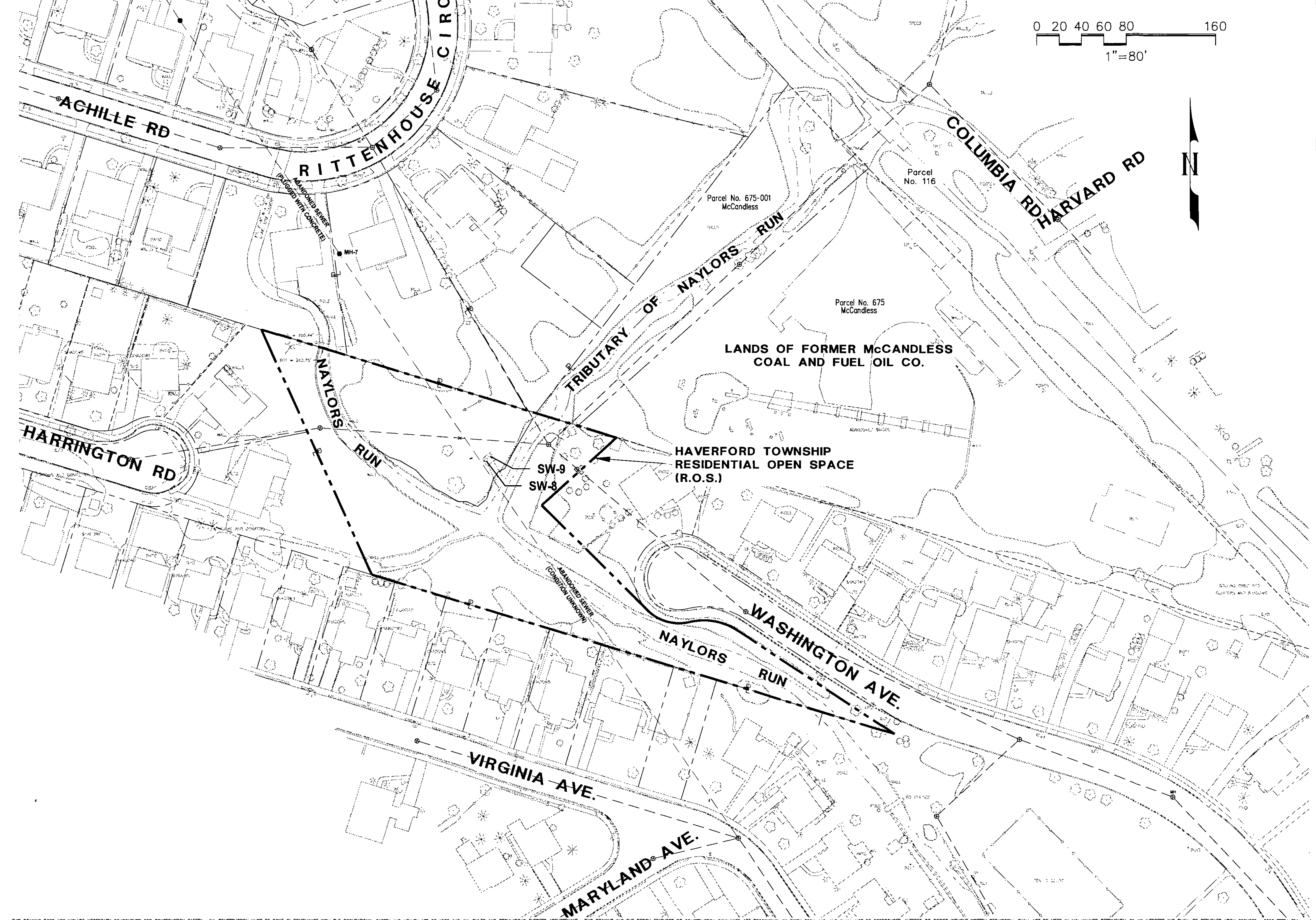
Figure 3
Source Area Plume Map



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GENERAL BOUNDARY OF THE ROS AREA
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Figure 5
March/September 2006 Plume Map
Havertown PCP site OU3A

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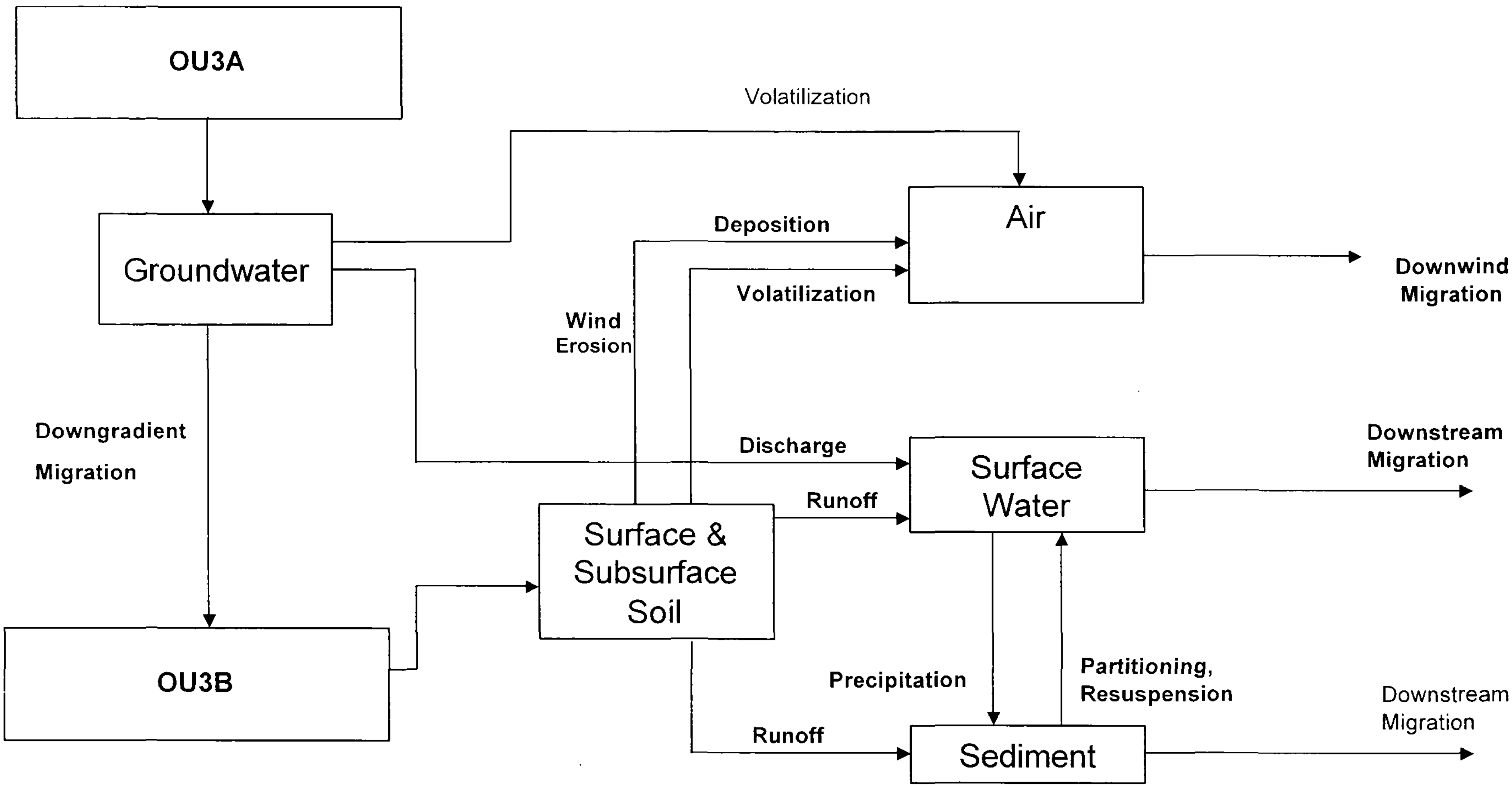


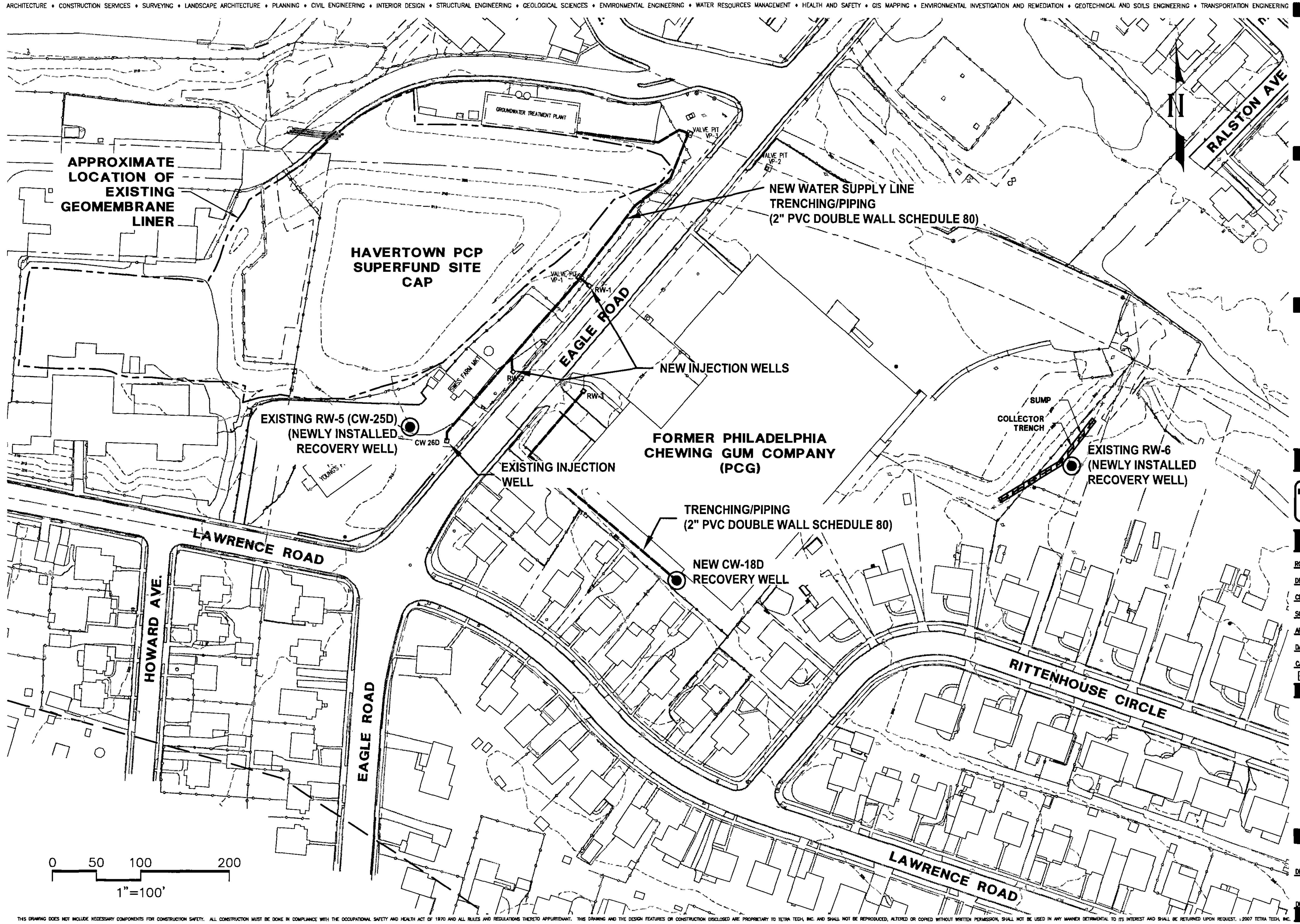
Figure 6
Conceptual Exposure Model
Havertown PCP Site

RECEPTORS

MEDIA	EXPOSURE PATHWAYS	Construction Worker (Adult)	Trespasser and Visitor (Adolescent)	Resident (Adult/ Child)
Soil (Surface and/or Subsurface)	Dermal Absorption, Ingestion	F (Total)	C (SS only) F (Total)	C (SS only) F (total)
Groundwater	Dermal Absorption, Inhalation of Vapors, Ingestion	F	NA	F
Air (Dust and/or Vapors)	Inhalation	F	C/F	C/F
Surface Water	Dermal Absorption, Ingestion	C/F	C/F	C/F
Sediment	Dermal Absorption, Ingestion	C/F	C/F	C/F

C – Current Use Scenario
F – Future Use Scenario
NA – Not applicable to this media/receptor
SS – Surface Soil
Total – Combined Surface and Subsurface Soil

Figure 7
Conceptual Exposure Model
Havertown PCP Site



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GENERAL FEATURES OF ALTERNATIVE 3A

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FIGURE 8

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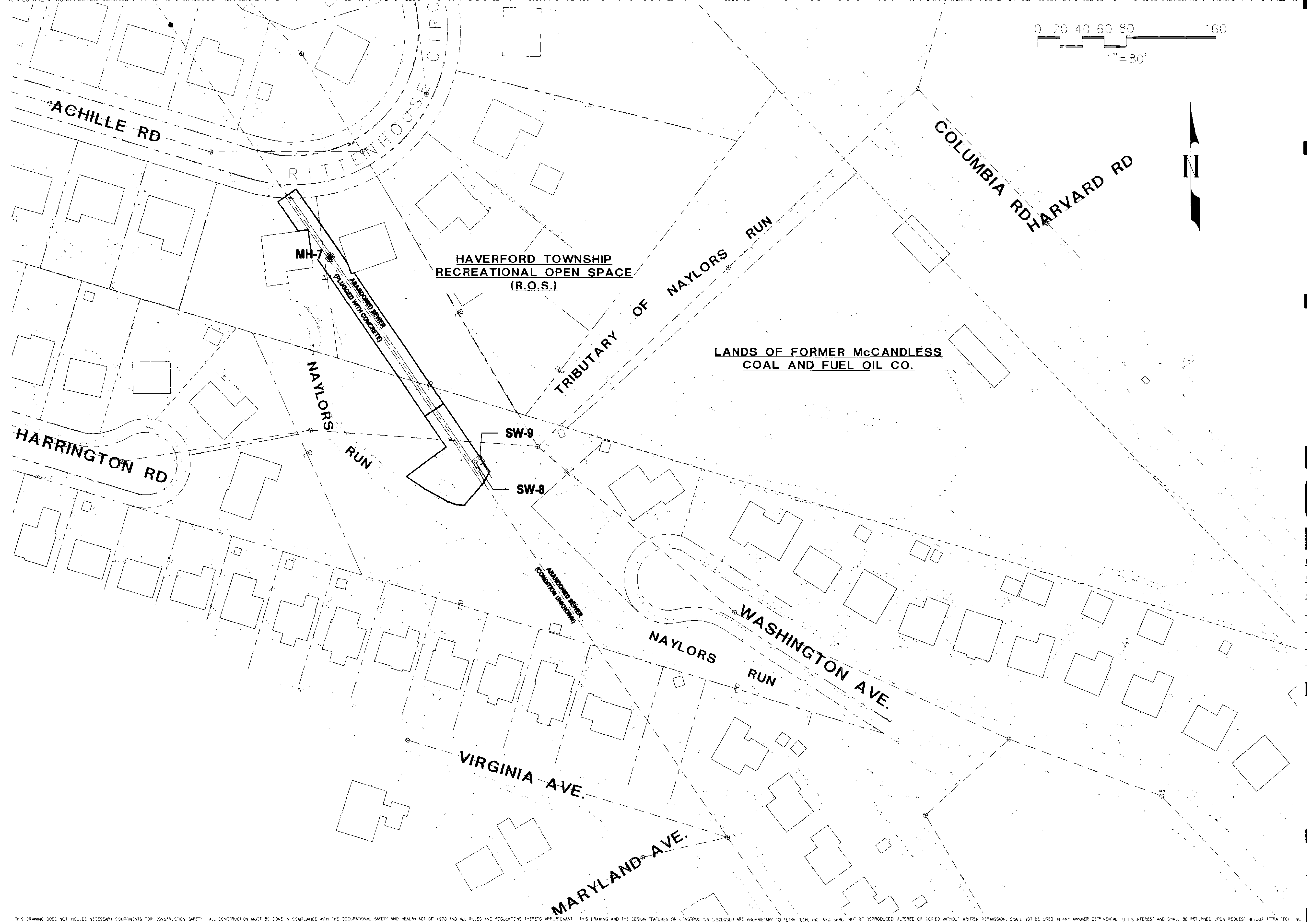

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AREA OF EXCAVATION FOR ALTERNATIVE 4B
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Figure 9
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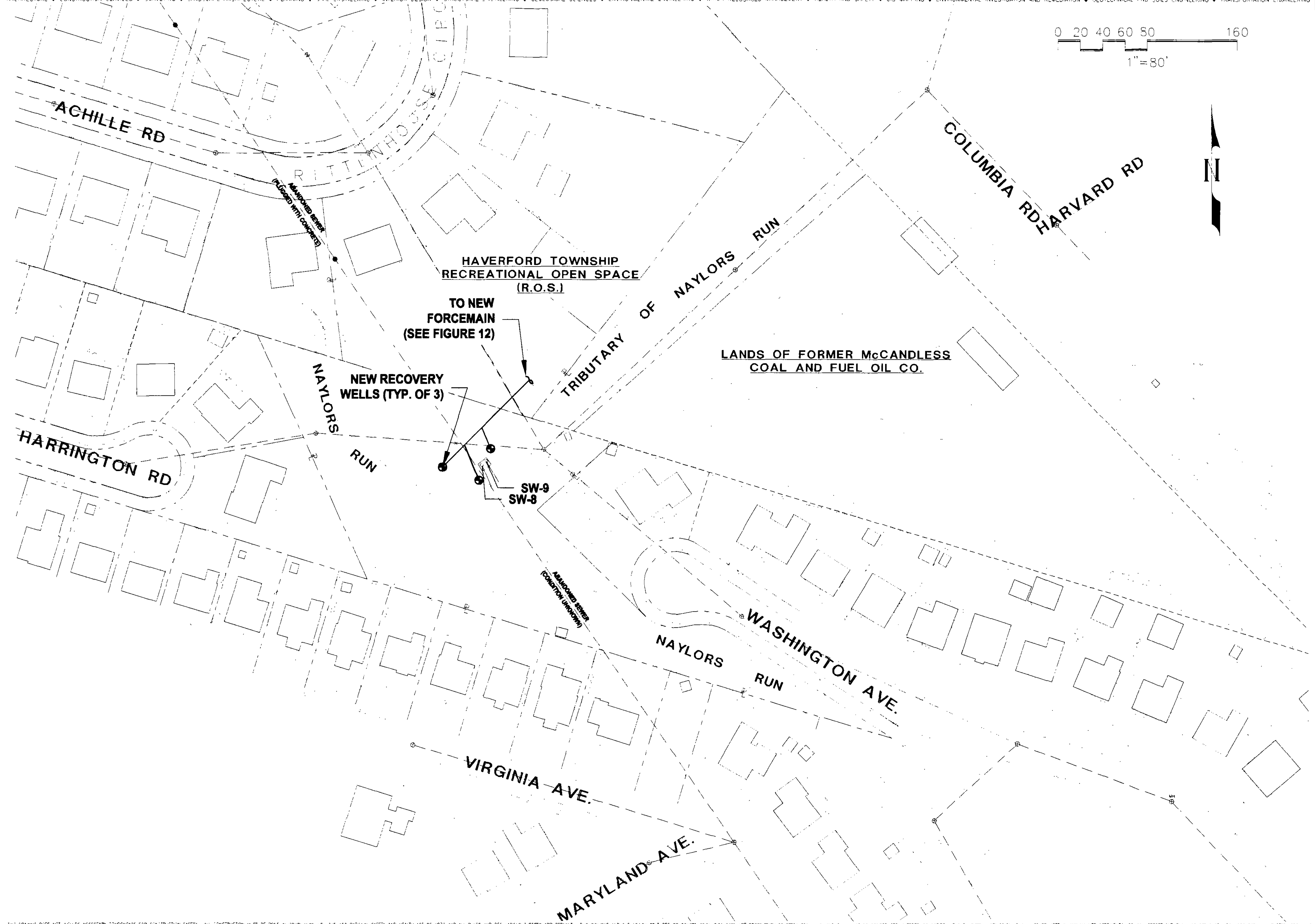

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LOCATIONS OF RECOVERY WELLS FOR ALTERNATIVE 4B
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Figure 10
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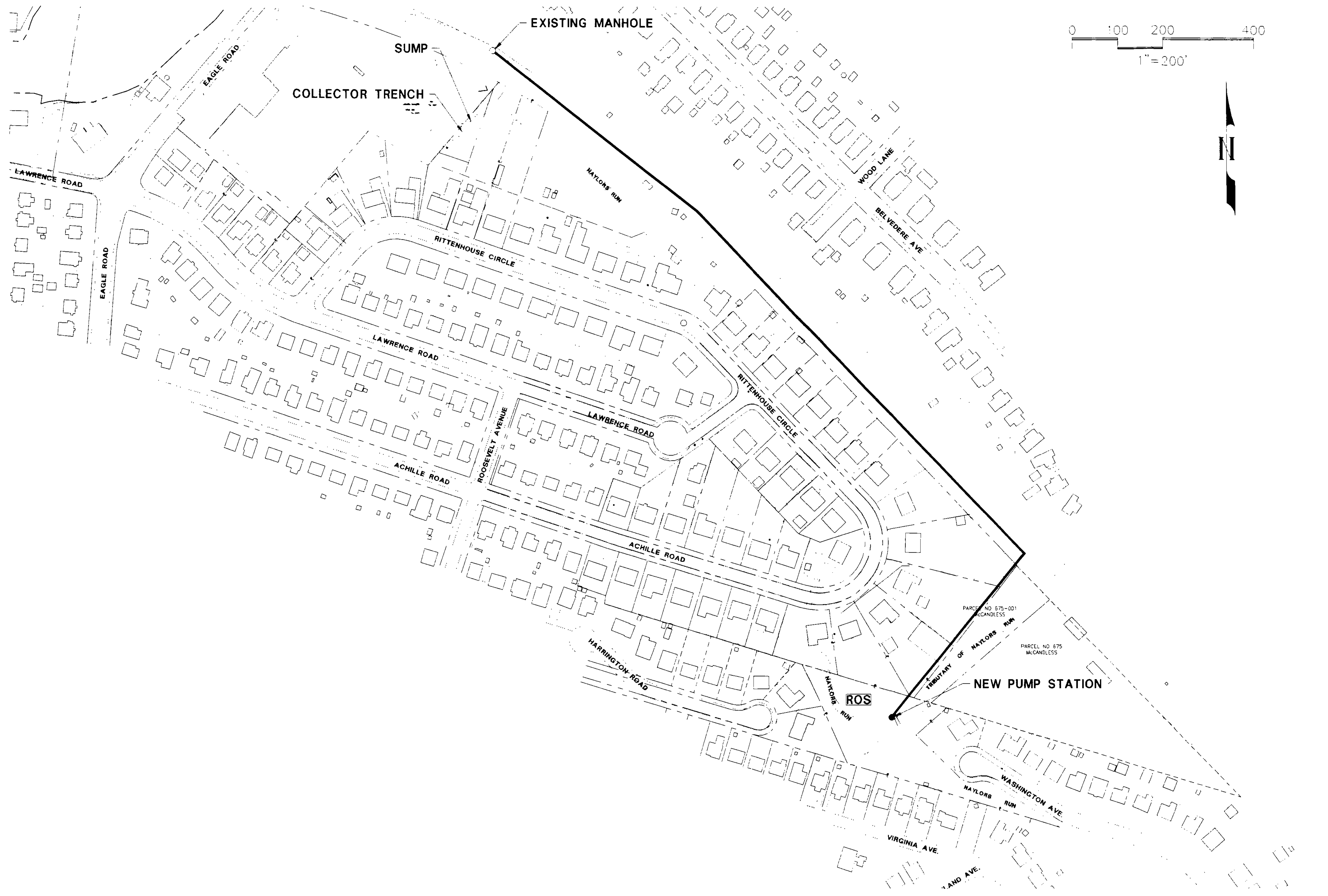

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TRENCHING & PIPING
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Figure 11
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