Human Health Risk Assessment

Cheat River Rail-Trail Corridor
Rowlesburg to Manheim, Preston County, West Virginia

VRP#20018

February 2022

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Attachment 1 COPC Identification
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List of Acronyms

ABS	absorption fraction
ADAF	Age Dependent Adjustment Factor
AECOM	AECOM Technical Services, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
B&O	Baltimore and Ohio
bgs	below ground surface
Cal EPA	California Environmental Protection Agency
CDI	Chronic Daily Intake
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSEM	Conceptual Site Exposure Model
CSF	Cancer Slope Factor
CSR	Code of State Regulations
CSX	CSX Transportation, Inc
DAD	dermally absorbed dose
DAF	Dilution-Attenuation Factor
DNA	deoxyribonucleic acid
DQO	Data Quality Objective
DSA	data sensitivity analysis
EC	exposure concentration
ELCR	Excess Lifetime Cancer Risk
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
FOC	Friends of the Cheat
ft	feet or foot
GIABS	gastrointestinal absorption factors
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
IUR	Inhalation Unit Risk
LLC	Limited Liability Company
LRS	Licensed Remediation Specialist
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
mg/kg-day	milligrams per kilogram-day

mg/m^3	milligrams per cubic meter
MRL	Minimal Risk Level
ND	Non-detect
NJDEP	New Jersey Department of Environmental Protection
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbon
pCOC	Potential Chemical of Concern
PPRTV	Provisional Peer Reviewed Toxicity Value
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RBA	relative bioavailability factor
RBR	RBR Consulting, Inc.
RfC	reference concentration
RfD	reference dose
RL	Reporting Limit
RME	Reasonable Maximum Exposure
ROW	Right-of-Way
RSL	Regional Screening Level
SAR	Site Assessment Report
SL	Screening Level
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semi-Volatile Organic Compound
TCR	Target Cancer Risk
Triad	Triad Engineering, Inc.
UCL	upper confidence limit
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
VRP	Voluntary Remediation Program
VURAM	Virginia Unified Risk Assessment Model
WV	West Virginia
WVDEP	West Virginia Department of Environmental Protection
WVSRA	West Virginia State Rail Authority

1. Executive Summary

AECOM Technical Services, Inc. (AECOM), on behalf of the Friends of the Cheat (FOC), prepared a Human Health Risk Assessment (HHRA) for the Cheat River Rail-Trail Corridor (the "Site") in Preston County, West Virginia (WV). This HHRA is being completed based on the results discussed in the Supplemental Site Assessment Report (SAR), which concluded that further evaluation/investigation for the Site should include an HHRA to examine the potential for unacceptable risks and be used for risk-management decisions (AECOM, 2021). The SAR concluded that no additional action is recommended for ecological receptors based on the results of the De Minimis Ecological Screening Evaluation.

This HHRA presents a site-specific, quantitative analysis of the Site under current and future land use scenarios from exposure to chemicals in Site media. **Figure 1-1** presents the final version of the site-specific conceptual site exposure model (CSEM) that was revised since the SAR (AECOM, 2021).

This HHRA has been organized into the following sections:

- **Section 1.0 Executive Summary**
- **Section 2.0 Site Description and History**
  - Site Location and Description
  - General History and Land Use
  - Geology
  - Hydrogeology
  - Previous Site Investigations
- **Section 3.0 Site Assessment and Identification of Chemicals of Concern**
  - Data Evaluation
  - Sample Treatment
  - Site Assessment and Supplemental Site Assessment
  - Chemicals of Concern (COCs)
  - Conceptual Site Exposure Model (CSEM)
  - Checklist to Determine Applicable Remediation Standards
- **Section 4.0 Human Health Exposure and Risk Assessment**
  - Exposure Assessment
  - Toxicity Assessment
  - Risk Characterization
- **Section 5.0 Ecological Risk Assessment**
- **Section 6.0 Uncertainty Analysis**
  - Data and Exposure Point Concentrations
  - Toxicity Values
  - Chemical Interactions
  - Exposure Factors

    - Data Sensitivity Analysis (DSA)
- **Section 7.0 Conclusions**
    - Summary
    - Conclusions
    - Recommendations
- **Section 9.0 References**

The following attachments are included with this HHRA:

- **Attachment 1** presents the screening results for the detected chemicals as well as a screening of the reporting limits (RLs).
- **Attachment 2** presents the calculation of the exposure point concentrations (EPCs).
- **Attachment 3** provides the forward risk calculations and toxicity data.

Attachment tables are denoted with the letter "A" before the Attachment number (e.g., Table A2-1).

The HHRA is compliant with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, as amended by the Superfund Amendments and Reauthorization Act of 1986. The HHRA also follows the United States Environmental Protection Agency (EPA) "Risk Assessment Guidance for Superfund (RAGS)" Part A (EPA, 1989) and subsequent RAGS guidance. The HHRA follows state-specific requirements and guidance, specifically, the requirements of WV Department of Environmental Protection (WVDEP) Voluntary Remediation and Redevelopment Rule (WV Legislative Rule 60 Code of State Regulations [CSR] 3), Voluntary Remediation and Redevelopment Act (WV Code § 22-22-1, et seq.), and the WVDEP Voluntary Remediation Program (VRP) Guidance Manual (WVDEP, 2020). Per WVDEP VRP guidance, a Licensed Remediation Specialist (LRS), licensed by WVDEP, has been engaged to oversee all investigation/remediation activities.

The HHRA addressed the following exposure media: surface soil (0 to 2 feet [ft] below ground surface [bgs]), subsurface soil (2 to 8 ft bgs), and sediment. Future excavation activities could result in the subsurface soil being brought to the surface and "mixed" together. Therefore, a total soil data set (surface and subsurface data combined) was derived. Sediment samples were collected in a ponded area that is mostly dry during the year; therefore, sediment samples were treated as soil samples in the HHRA.

Groundwater and surface water exposure media were also evaluated during this HHRA. The SAR ecological and human health risk evaluations concluded that surface water and groundwater were not impacted by soil or sediment constituents at the Site and should be eliminated as exposure media of concern (AECOM, 2021).

Identifying the chemicals of potential concern (COPCs) at the Site is an important step in the risk assessment process. Screening levels (SLs), such as those used in this HHRA, serve to focus the HHRA on COPCs that have the potential to significantly contribute to the calculated risks. Chemicals present at concentrations higher than the selected SL should be carried forward as a COC and then quantitatively evaluated in a site-specific HHRA.

The HHRA risk-based screening used maximum detected concentrations in soil to compare with selected WV Department of Environmental Protection (WVDEP) soil SLs. Five soil COPCs were identified: arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. The WVDEP guidance manual (WVDEP, 2020) recommends deriving a 95% upper confidence limit (UCL) and rescreening the data. The rescreen results identified arsenic, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene as soil COCs that were carried forward in the HHRA.

The HHRA evaluated a current and future recreational user (child/adult), industrial outdoor worker, and construction worker (which is also protective of a utility worker). All three receptors were exposed to surface soil (current; existing site conditions) and total soil (future; assuming land redevelopment occurs).

Forward risk calculations were performed for the recreational user (child/adult) and industrial outdoor worker using the United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) online risk calculator (ORNL, 2022). The Virginia Department of Environmental Quality (VDEQ) Virginia Unified Risk Assessment Model (VURAM) was used to evaluate risk for the construction worker (VDEQ, 2022). **Table 1-1** presents the HHRA cumulative excess lifetime cancer risk (ELCR) and non-cancer hazard index (HI) results.

Table 1-1: Summary of Cancer Risk and Non-Cancer Hazards

Exposure Medium	Cumulative ELCR	Cumulative HI
Surface Soil		
Child Recreational User	1E-05	0.2
Adult Recreational User	1E-05	0.02
Industrial Outdoor Worker	1E-05	0.06
Construction Worker	1E-06	0.2
Total Soil		
Child Recreational User	1E-05	0.2
Adult Recreational User	1E-05	0.02
Industrial Outdoor Worker	9E-06	0.05
Construction Worker	1E-06	0.2
Notes: ELCR = excess lifetime cancer risk; HI = hazard index		

The chemical-specific cancer risk estimates for industrial outdoor worker and construction worker did not exceed WVDEP's threshold of 1E-05 for industrial/commercial sites. Therefore, the ELCR is acceptable and public notification is not required for the industrial outdoor worker and the construction worker (WVDEP, 2020). The potential ELCR results for the recreational user (child/adult) were within the EPA and WVDEP acceptable cancer risk range of 1E-04 to 1E-06 (EPA, 1991 and WVDEP, 2020). However, since the potential ELCR results are above 1E-06, public notification will be required for the recreational user scenario (WVDEP, 2020).

The cumulative HI results for all receptors were below the EPA and WVDEP non-cancer HI threshold of 1. Therefore, no adverse noncarcinogenic health effects are likely for all scenarios.

The results of the HHRA indicate that no additional assessment or risk management options are recommended. The Site is believed to have an acceptable level of risk without further remedial actions.

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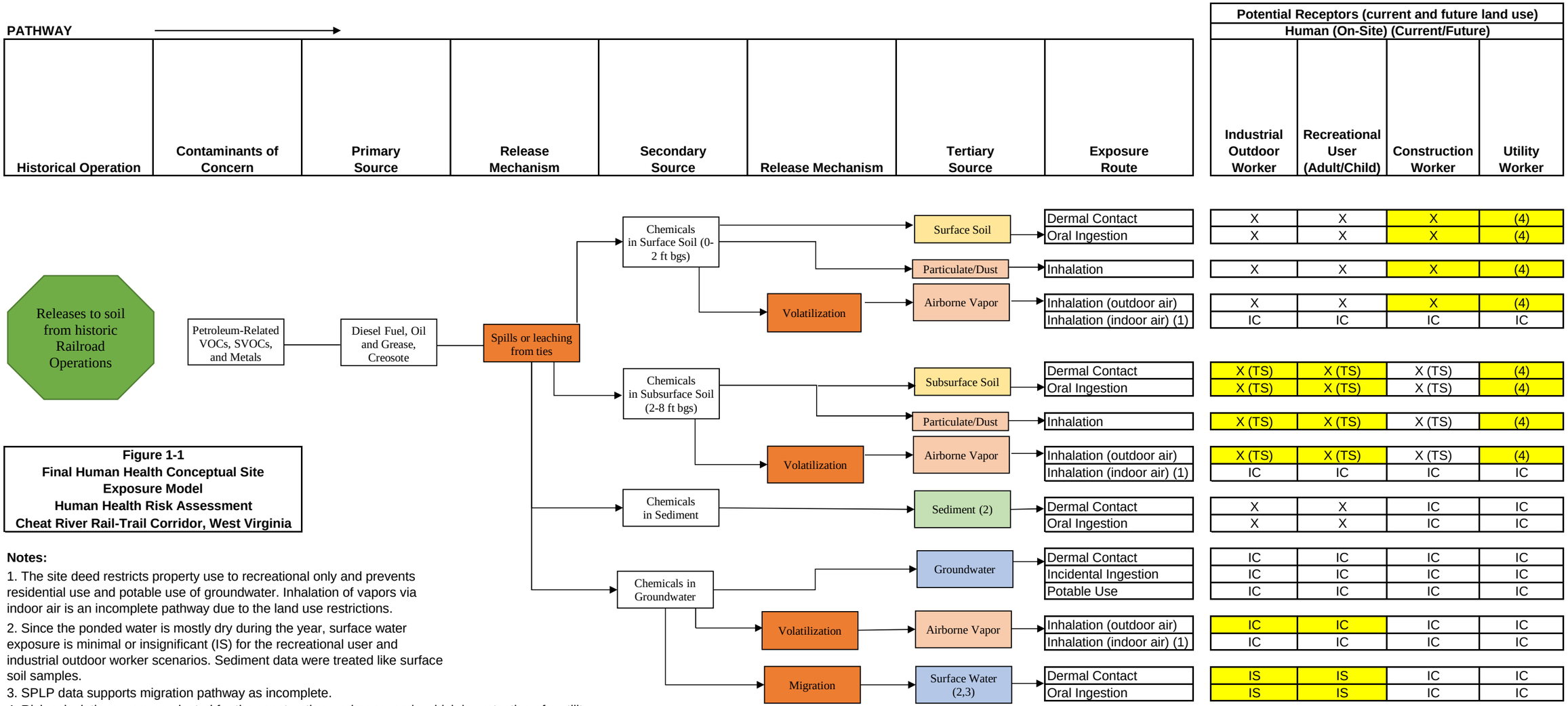

Figure 1-1
Final Human Health Conceptual Site Exposure Model
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Notes:

1. The site deed restricts property use to recreational only and prevents residential use and potable use of groundwater. Inhalation of vapors via indoor air is an incomplete pathway due to the land use restrictions.
2. Since the ponded water is mostly dry during the year, surface water exposure is minimal or insignificant (IS) for the recreational user and industrial outdoor worker scenarios. Sediment data were treated like surface soil samples.
3. SPLP data supports migration pathway as incomplete.
4. Risk calculations were conducted for the construction worker scenario which is protective of a utility worker. If the cancer risk and/or non-cancer hazard results for the construction worker indicate unacceptable risk, then the utility worker scenario will be evaluated in the HHRA.

Indicates that a change was made since the supplemental site assessment investigation.

X = Complete Exposure Pathway
IC = Incomplete Exposure Pathway
IS = Insignificant Exposure Pathway
TS = Total soil (surface soil and surbsurface soil combined)
ft bgs = feet below ground surface

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2. Site Description and History

AECOM Technical Services, Inc. (AECOM), on behalf of the Friends of the Cheat (FOC), prepared a Human Health Risk Assessment (HHRA) for the Cheat River Rail-Trail Corridor (the "Site") in Preston County, West Virginia (WV).

This HHRA is being completed based on the results discussed in the Supplemental Site Assessment Report (SAR), which concluded that further evaluation/investigation for the Site should include an HHRA to examine the potential for unacceptable risks and inform risk-management decisions (AECOM, 2021). The SAR concluded that no additional action is recommended for ecological receptors based on the results of the De Minimis Ecological Screening Evaluation (AECOM, 2021).

The HHRA uses surface soil data, subsurface soil data, sediment data, and synthetic precipitation leaching procedure (SPLP) data. Data were collected during three investigations in 2011, 2018, and 2021. The SAR ecological and human health assessments concluded that surface water and groundwater were not impacted by the site and should be eliminated as exposure mediums of concern.

The HHRA addressed the following exposure media: surface soil (0 to 2 feet [ft] below ground surface [bgs]), subsurface soil (2 to 8 ft bgs), and sediment. Soil samples were taken at depths ranging from 0 to 8 ft bgs in anticipation that the excavation would be 8 ft deep. Future excavation activities could result in the subsurface soil being brought to the surface and "mixed" together. Therefore, a total soil data set (surface and subsurface data combined) was derived for the surface soil and/or subsurface soil COPCs, assuming future land re-development occurs. **Figures 2-2** through **2-5** present the locations for samples collected during the 2011, 2018 and 2021 events.

2.1 Site Location and Description

The Site property, a former railroad line right-of-way (ROW), is located in a mixed-use area of Preston County, WV. The location of the Site is shown on **Figure 2-1**. The project corridor begins south of Kingwood, starting near Caddell Bridge (milepost 11.7, adjacent to Allegheny Wood Products), runs south along the Cheat River, approximately 9 contiguous miles parallel to the Cheat River and State Route 72 to Rowlesburg, WV, and ends near milepost 3.0, adjacent to Greer Industries' Cheat River Limestone operations. The rail bed averages approximately 30 ft in width, and the ROW averages 80 ft in width along the entire length of the Site, totaling approximately 100 acres (AECOM, 2021).

Undeveloped land owned by either Allegheny Forestlands limited liability company (LLC) or FOC surrounds the majority of the Site; however, in several areas, the Site is adjacent to commercial/industrial properties, and limited residences and seasonal homes exist adjacent to the ROW. In the northern section of the Site, a site previously known as Chemetals Inc. (currently Volkstone Chemical), a former manganese plant, adjoins the ROW under investigation. The United States government owns land adjacent to the northern portion of the ROW and uses this land for training related to the Army National Guard's Camp Dawson. Further south, near Heather Run and the bridge crossing Cheat River, the west and east sides of the Site are adjacent to residential and seasonal properties (AECOM, 2021).

2.2 General History and Land Use

The Site is a former railroad ROW previously owned by CSX Transportation, Inc (CSX). The Site had been developed as a railroad since at least 1907 and was formerly called the Morgantown and Kingwood Railroad and the Baltimore and Ohio (B&O) Railroad. CSX removed the railroad tracks in 2008; however, creosote-treated railroad ties still remain on portions of the rail corridor.

The WV State Railway Authority currently owns the Site, which is currently leased by FOC (AECOM, 2021). The property deed restricts use of the Site to a recreational trail only. The use of the property for residential purposes, schools, daycares, agricultural purposes, and the use of the groundwater beneath the Site for human consumption, irrigation, or other purpose is prohibited (WV State Rail Authority [WVSRA], 2016). Accordingly, the Site has been proposed for redevelopment by the FOC for recreational use as a "Rails-to-Trails" hiking and biking trail – referred to as the "Cheat River Trail". As currently envisioned, redevelopment will include construction of a trail cover for the ease and benefit of future trail walkers and bikers and replacement of several drainage culverts (Triad Engineering, Inc. [Triad], 2012).

2.3 Geology

The Site lies within the Allegheny Highlands subsection of the Appalachian Plateau Physiographic Province. The Allegheny Highlands consists predominantly of deeply dissected, Pennsylvania-Mississippian (Lower-Middle Carboniferous) aged, clastic, sedimentary rocks such as sandstone, siltstone, and shale interbedded with coal and some limestone. The bedrock is gently folded, with the main structural features being the Kingwood Syncline and the Briery Anticline. The oldest rocks along the trail outcrop in the vicinity of Rowlesburg, WV, along the eastern flank of the Briery Anticline. The Mississippian aged Greenbrier Limestone is quarried in the area. The youngest rocks along the trail follow the axis of the Kingwood syncline represented by the Allegheny Group, which is noted for the presence of coal seams that have been extensively mined in the area (Hennen and Reger, 1914).

The unconsolidated materials at the Site are predominantly silt loams, with some sandy loams from the Dekalb, Buchanan, Ernest, Gilpin series, which consist of moderately deep, well-drained soils that formed in recent sandstone and shale residuum (United States Department of Agriculture [USDA], 2004 and 2020). Finer-grained materials grade to more gravelly deposits with depth. Soils are on nearly level to very steep uplands and ridges. Anthropogenic fill materials associated with the former railroad construction and maintenance activities are encountered along the roadways and other areas of modified land surface.

2.4 Hydrogeology

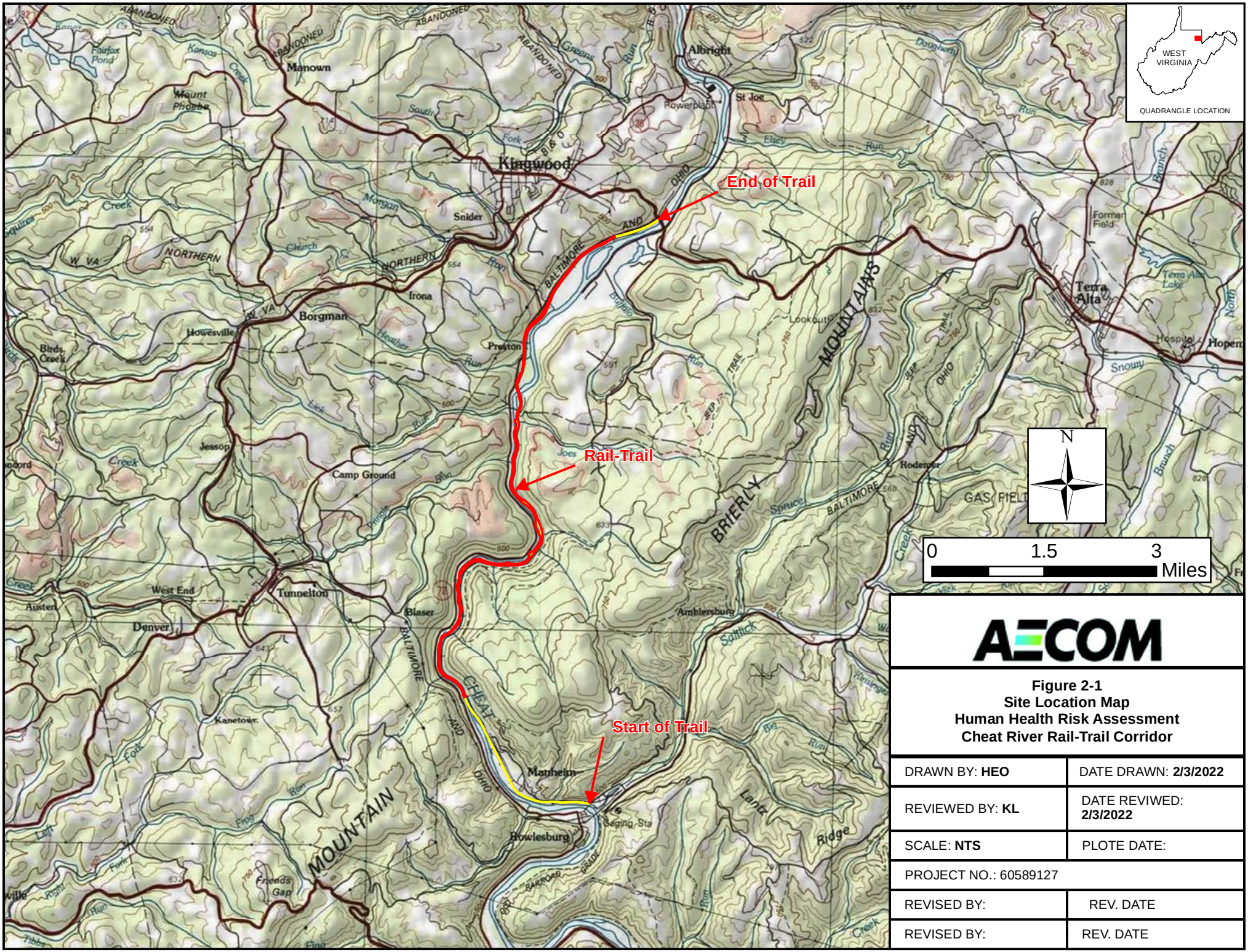
Groundwater in the colluvial material along the valley slopes and tributaries valleys is expected to occur along the soil-bedrock interface and flow down-slope following the bedrock surface topography. The groundwater within the alluvial material associated with the main Cheat River Valley and larger tributaries is expected to be encountered by course-grained alluvium with cobbles and boulders. Groundwater elevation and flow direction are expected to be highly influenced by the bedrock topography with a significant down valley component generally following the top of the underlying bedrock. At higher river stage conditions, local groundwater flow direction could vary temporarily away from the river.

The portion of the Cheat River that borders the site is classified by WVDEP as a "Tier 1" waterway. All waters in WV are assigned to specific tiers depending upon the level of protection necessary to maintain high quality and/or existing uses. The higher the tier, the more stringent the requirements are for protection. A Tier 1 waterway is considered impaired due to specific pollutant, which for this section of the Cheat River, is fecal coliform. In addition, various tributaries to the Cheat are impaired due to metals and pH (FOC, 2005).

2.5 Previous Site Investigations

Several phases of environmental investigations and reports have been completed along the rail corridor for various interested parties, including a *Phase II Environmental Site Assessment* (Triad, 2012), a *Human Health Risk Assessment* (RBR Consulting, Inc. [RBR], 2012), and a

Supplemental Sampling Report (AECOM, 2019). This HHRA follows the Revised Site Characterization Work Plan and SAR (AECOM, 2020 and 2021).



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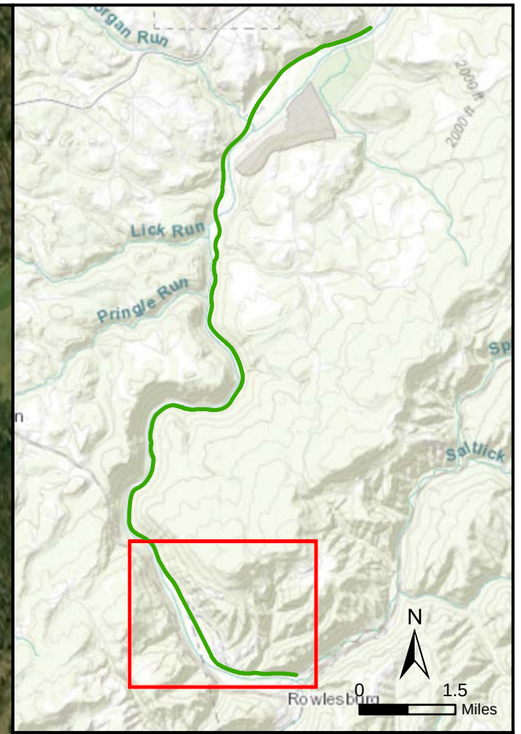

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Figure 2-2
Sample Locations
Human Health Risk Assessment
Cheat River Rail-Trail Corridor

Legend

- Sample Locations, 2021
- Sample Locations, 2011
- Site Boundary
- Rail-Trail
- 160+00 Station Location

0 0.25 0.5 Miles

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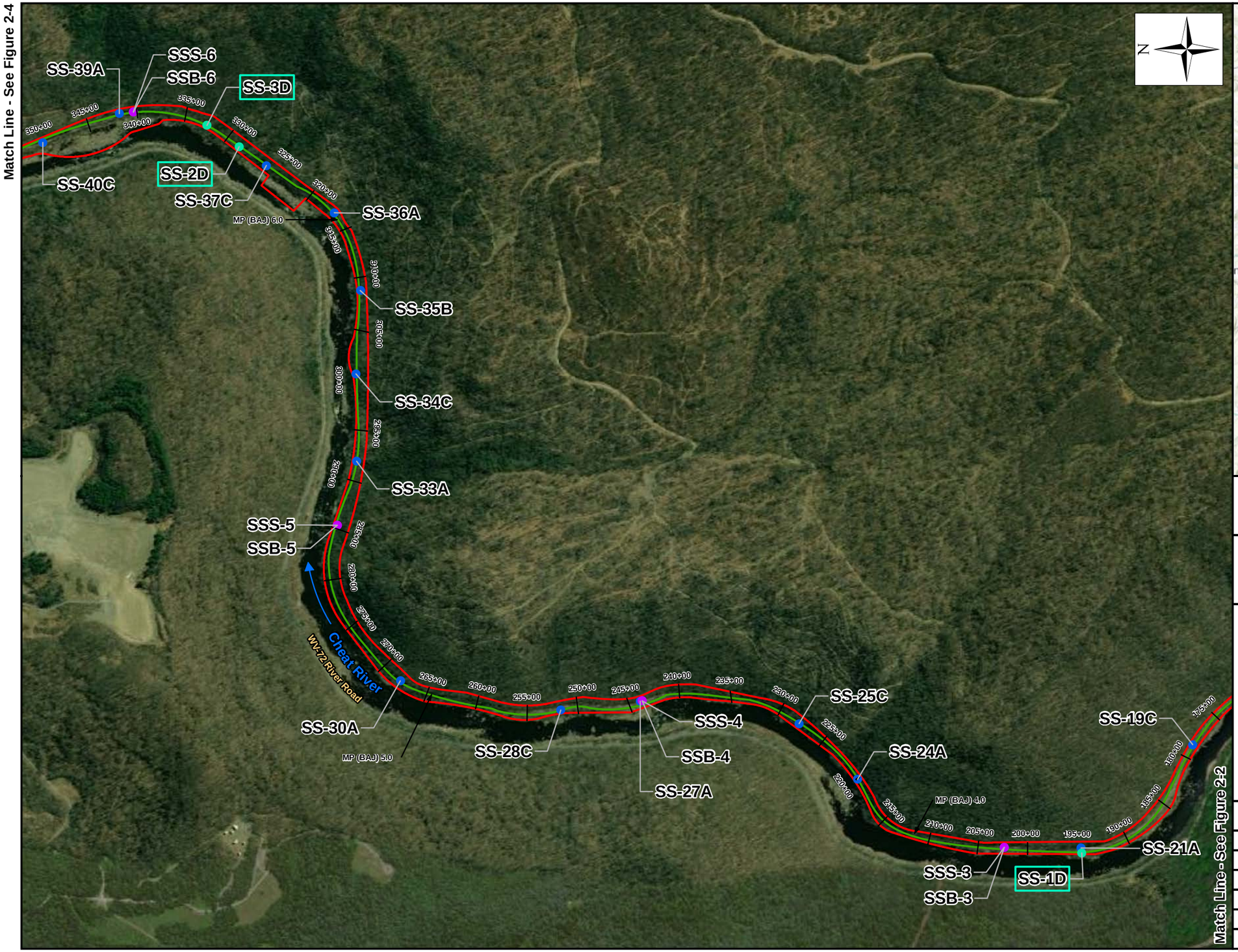

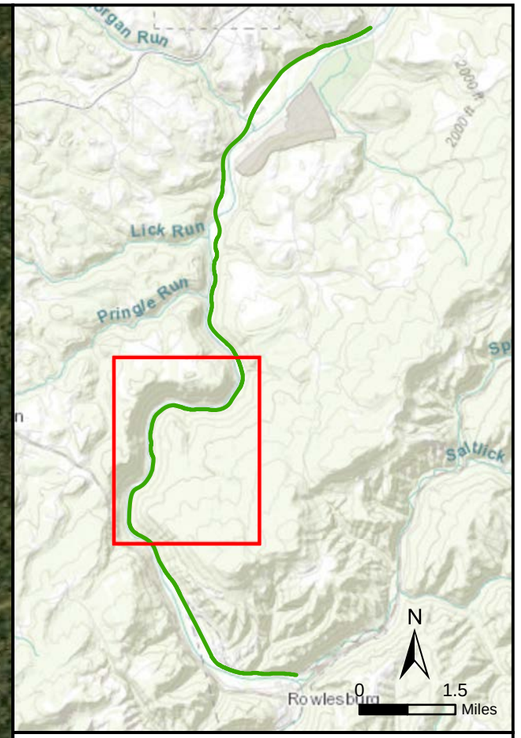

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Figure 2-3
Sample Locations
Human Health Risk Assessment
Cheat River Rail-Trail Corridor

Legend

- Sample Locations, 2021
- Sample Locations, 2011
- Sample Locations, 2011 - Excluded from Risk Evaluation
- Site Boundary
- Rail-Trail
- 175+00 Station Location

0 0.25 0.5 Miles

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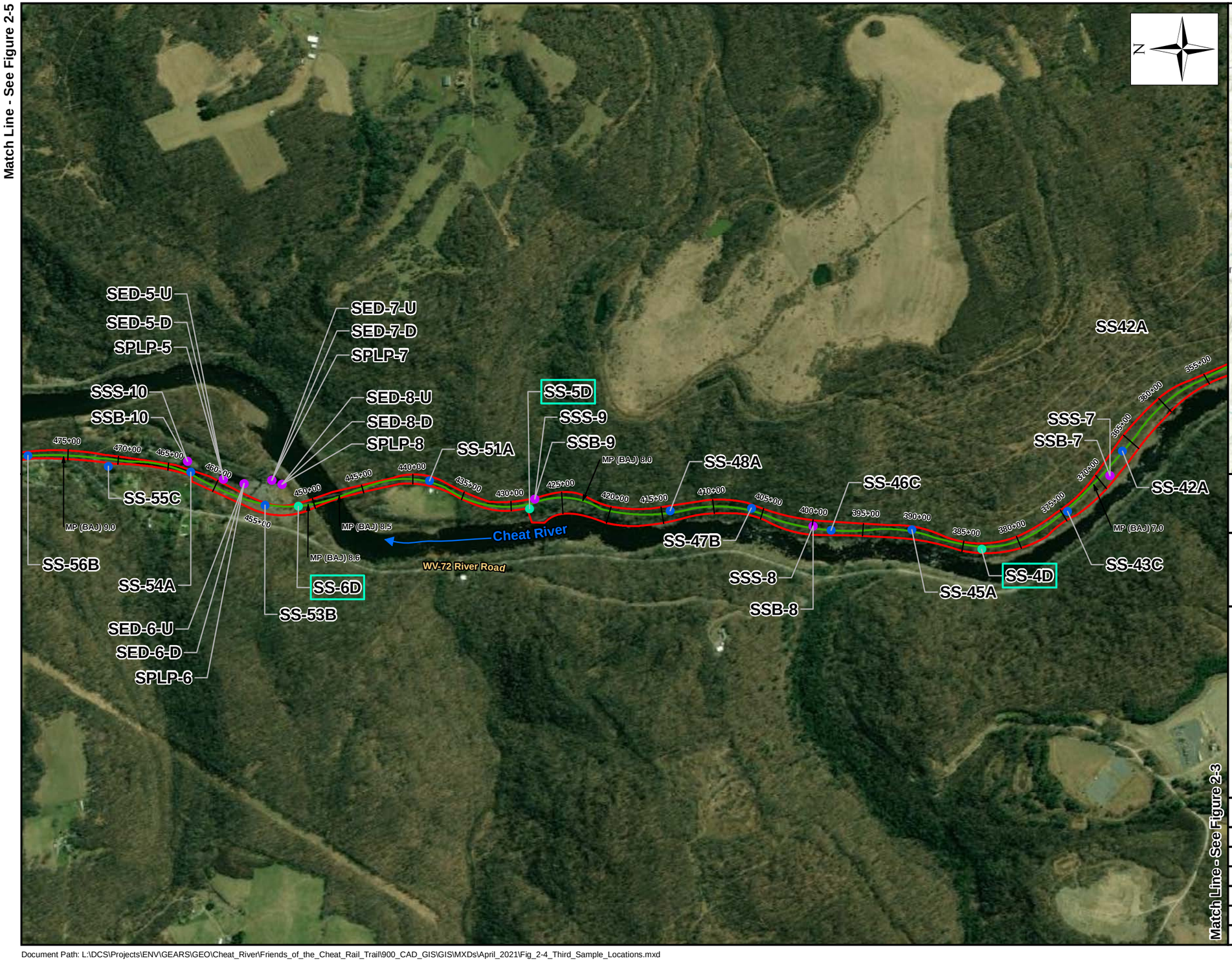

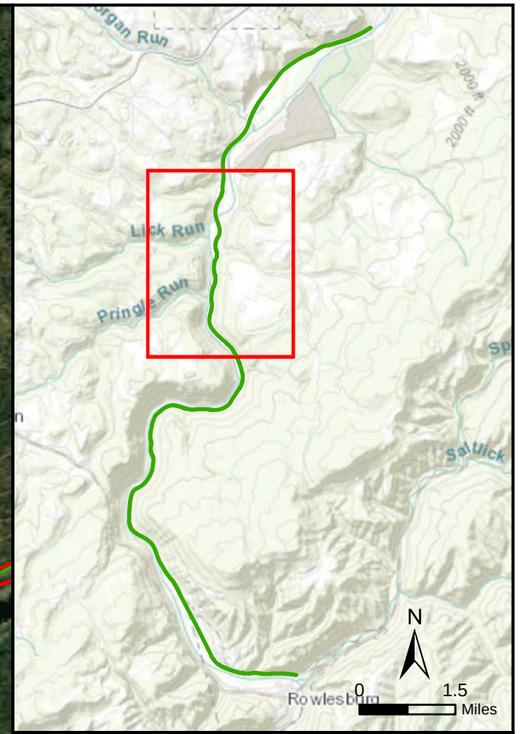

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Figure 2-4
Sample Locations
Human Health Risk Assessment
Cheat River Rail-Trail Corridor

Legend

- Sample Locations, 2021
- Sample Locations, 2011
- Sample Locations, 2011 - Excluded from Risk Evaluation
- Site Boundary
- Rail-Trail
- 355+00 Station Location

0 0.25 0.5 Miles

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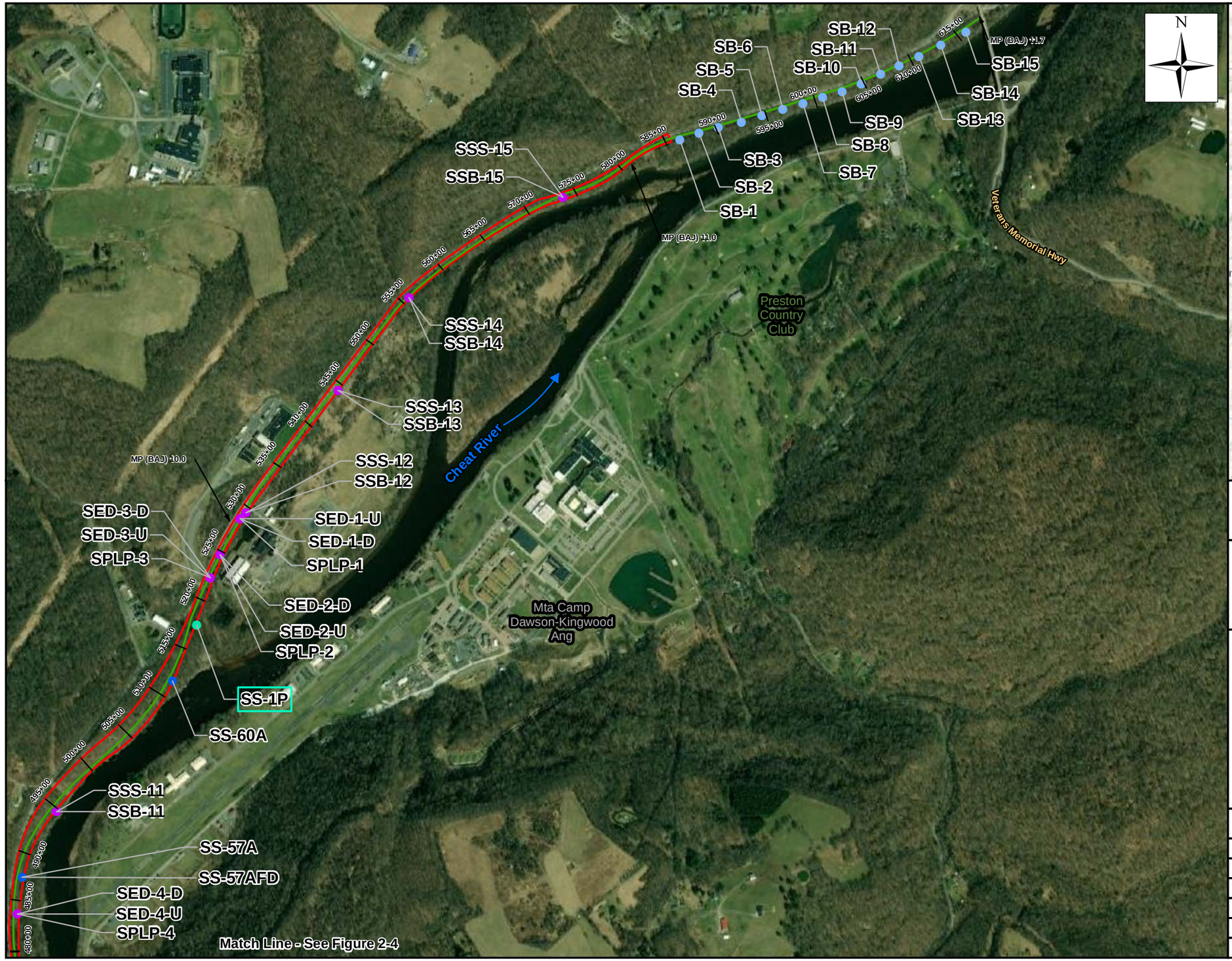

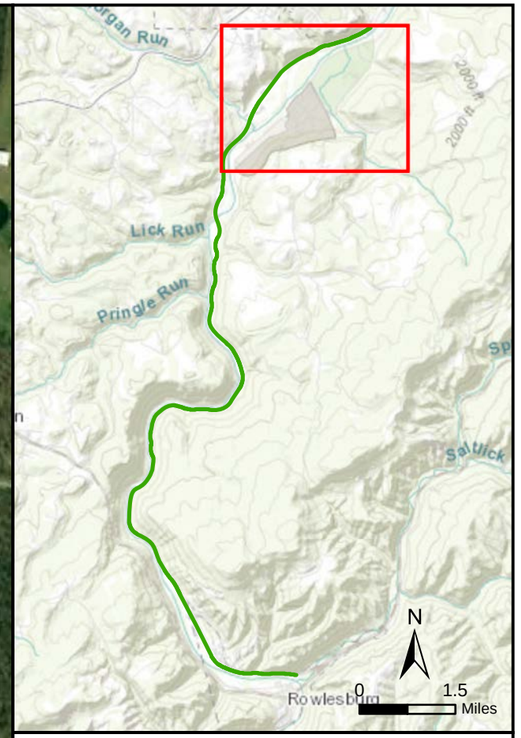

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Figure 2-5
Sample Locations
Human Health Risk Assessment
Cheat River Rail-Trail Corridor

Legend

- Sample Locations, 2021
- Sample Locations, 2018
- Sample Locations, 2011
- Sample Locations, 2011 - Excluded from Risk Evaluation
- Site Boundary
- Rail-Trail
- 480+00 Station Location

0 0.25 0.5 Miles

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3. Site Assessment and Identification of Chemicals of Concern

3.1 Data Evaluation

The Cheat River dataset includes surface soil, subsurface soil, sediment, and SPLP samples collected in 2021. Additionally, the dataset includes historical surface soil data taken from previous investigations in 2011 and 2018. Further details of sampling can be found in the SAR (AECOM, 2021).

The original sample set was revised to exclude several 2011 surface soil samples from screening that were classified as “off trail” in the Phase II Environmental Site Assessment (Triad, 2012). These samples included six off-trail samples (samples SS1D through SS6D) and one off-trail sample collected adjacent to the former Chemetals, Inc. property (sample SS1P). The exclusion of these samples was approved by WVDEP during a call on January 12, 2022. The remaining samples were categorized as either “on trail” or “near trail”. **Table 3-2** provides a list of all samples in the dataset and the reason for exclusion (if applicable). **Figures 2-2** through **2-5** present the locations for samples collected during the 2011, 2018 and 2021 events and indicate which samples were excluded based on location.

Neither groundwater nor surface water were sampled directly. Shallow groundwater does not occur and is not discharging to surface water at the Site, and surface water at the Site is ponded precipitation rather than exposed groundwater (AECOM, 2021).

In order to assess the possibility of the leaching of soil or sediment constituents to groundwater and surface migration of constituents from groundwater to surface water, SPLP samples were collected at drainage culverts (where ponded precipitation collects prior to discharge into the Cheat River) and selected surface soil sample locations.

The SAR ecological assessment concluded that no potential ecological risks are anticipated from soil or sediment constituents potentially migrating into surface water. There were no detected results in the SPLP results taken at sediment locations, and the few detections in the SPLP results taken at surface soil locations were below the ecological screening levels (SLs) (AECOM, 2021). The SAR human health evaluation determined that no SPLP results were above the adjusted groundwater standard (see **Section 3.4**).

Validation of objective field and technical data was performed at two different levels – Field and Technical Data Validation and Laboratory Data Review. The Data Quality Objectives (DQOs) discussed in the Site Characterization Work Plan were achieved. The data validation report and analytical data package were included in the SAR (AECOM, 2021).

3.2 Sample Treatment

Treatment of Non-Detects

Non-detect (ND) chemicals were included in the screening at the reporting limits (RL) to determine if laboratory analyses are protective of SLs for measuring potential chemical concentrations at a site. A quantitative data sensitivity analysis (DSA) was not done for cases where the RL exceeded the screening value; however, this is discussed further in the Uncertainty Analysis (**Section 6.5**).

Treatment of Duplicates

For sample locations in which a duplicate sample was also collected, the duplicate sample results for each chemical were processed for use in the calculation of summary statistics. The duplicates were handled according to WV VRP Guidance (WVDEP, 2020). Duplicates were resolved as follows: (1) where both the sample and the duplicate results are ND, the resulting value is the maximum of the RLs; (2) where both the sample and the duplicate result are detected, the

resulting value is the maximum of the detected results; and (3) where one of the pair is reported as ND and the other is detected, the detected concentration is used. The composite results followed the same sample name sequence with "_max" added to the end of the sample name. Parent samples and field duplicates were excluded from screening per WV VRP Guidance (WVDEP, 2020).

3.3 Site Assessment and Supplemental Site Assessment Activities

The site assessment activities and results are discussed in the SAR (AECOM, 2021).

3.4 Chemicals of Concern (COCs)

Identifying the COPCs at the Site is an important step in the risk assessment process. SLs, such as those used in this HHRA, serve to focus the HHRA on COPCs that have the potential to significantly contribute to the calculated risks. Chemicals present at concentrations higher than the selected SL should be carried forward as COCs and then quantitatively evaluated in a site-specific HHRA. A summary of all chemicals in the Cheat River dataset can be seen in **Table A1-1** of **Attachment 1**.

The SLs considered for each medium are listed in **Table 3-1**.

Table 3-1: Screening Levels

Exposure Medium	Screening Level Name	Notes
Surface Soil and Sediment	Site-specific recreational screening level (EPA, 2022)	Maximum concentrations of surface soil and sediment results were compared against this SL to identify COPCs that are carried forward as COCs in the HHRA.
	De Minimis Screening Level for Residential Soil (WVDEP, 2021)	EPCs were compared against this SL to determine whether the COPC would be carried forward as a COC in the risk evaluation.
	WV Soil Background (WVDEP, 2021)	Background values were only available for arsenic and lead. Therefore, background values were not part of the screening approach.
Subsurface Soil	De Minimis Screening Level for Industrial Soil (WVDEP, 2021)	Maximum concentrations of subsurface soil results were compared against this SL to identify COPCs that are carried forward as COCs in the HHRA. After EPCs were generated, they were compared against this SL to determine whether the COPC would be carried forward as a COC in the risk evaluation.
	WV Soil Background (WVDEP, 2021)	Background values were only available for arsenic and lead. Therefore, background values were not part of the screening approach.
Surface to Groundwater Migration (SPLP)	Adjusted Groundwater De Minimis Screening Level (WVDEP, 2021)	Maximum concentrations of SPLP results were compared against this SL to identify COPCs that are carried forward as COCs in the HHRA.

The site-specific recreational screening level (SL) was generated using the EPA's Regional Screening Level (RSL) calculator for all chemicals that were tested in the 2011, 2018, and 2021 datasets. The RSL calculator output is included in **Table A1-8** of **Attachment 1**. The HHRA uses a site-specific recreational exposure scenario that differs from the one evaluated in the SAR (AECOM, 2021). The SAR site-specific recreational SL assumes that the receptor camps at the site for 24 hours a day for 14 days a year; default EPA residential soil RSL values were used for the remaining exposure parameters. After the completion of the SAR, stakeholders agreed during a call with WVDEP on September 30, 2021 that the camping scenario was no longer relevant because camping is not allowed at the site by deed restriction. The site-specific recreational SL

for the HHRA assumes that the recreational user visits the site 4 hours a day for 70 days per year; again, default EPA residential soil RSL values were used for the remaining exposure parameters (EPA, 2022).

The SPLP results were screened against Groundwater WVDEP De Minimis standards multiplied by a site-specific Dilution-Attenuation Factor (DAF) of 20 (New Jersey Department of Environmental Protection [NJDEP], 2013). The DAF of 20 was applied to account for dilution which would occur if/when the leachate reaches groundwater. Further detail about the DAF value derivation can be found in the SAR (AECOM, 2021). The SPLP analysis did not identify any chemicals that were present at concentrations above the selected SL; therefore, no chemicals were carried forward as COCs in the HHRA.

Surrogates are chemicals with similar molecular structures that were selected to represent chemicals without readily available toxicity information to derive SLs. Surrogates are documented in **Table A1-7** of **Attachment 1**. A chemical with no SL (i.e., no toxicity data) and no appropriate surrogate toxicity value was not further evaluated if no appropriate surrogate chemical were available. If no SL or no appropriate surrogate toxicity value were available for a chemical, it was noted in the final column of the screening tables titled, “Rationale for Selection/Deletion” (**Tables A1-2** through **A1-6** of **Attachment 1**).

The HHRA risk-based screening used maximum detected concentrations in soil to compare with selected EPA and WVDEP soil SLs as shown in **Table 3-1**. Five soil COPCs were identified: arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. The WVDEP guidance manual (WVDEP, 2020) recommends deriving an upper confidence limit (UCL) and rescreening the data. The rescreen results identified arsenic, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene as soil COCs that were carried forward in the HHRA.

The screening results are provided in **Tables A1-2** through **A1-6** of **Attachment 1**. The derivations of the UCLs are described further in **Section 4.1.3** and are summarized in **Table 4-2** and **Attachment 2 Table A2-1**.

3.5 Conceptual Site Exposure Model

This HHRA includes the final site-specific CSEM that has been revised following the completion of the SAR. The CSEM is presented in **Figure 3-1**, which identifies the human receptors and the exposure pathways that are addressed in the HHRA. The CSEM presents the current understanding of the site conditions with respect to known and suspected chemical sources, potential transport mechanisms and migration pathways, and human receptors.

The following revisions were made to the CSEM after the completion of the SAR:

- All receptors are considered part of the current/future exposure scenario. The construction worker and utility worker had previously been considered future-only receptors, however since trail re-development will occur prior to recreational use of the trail, the current/future scenario seemed more appropriate for these two receptors.
- The CSEM was revised to add a new symbol: “IS”, which represents “insignificant exposure pathway”. An exposure pathway is insignificant if site conditions result in the pathway having minimal exposure to the receptor.
- The subsurface soil exposure pathways for the recreational user and industrial outdoor worker were changed from incomplete (represented on CSEM as “IC”) to complete for total soil (represented on CSEM as “X (TS)”), with the exception of inhalation via indoor air, which remained incomplete.
- The surface soil exposure pathways for the construction worker were changed from complete for total soil (represented on CSEM as “X (TS)”) to complete (represented on CSEM as “X”), with the exception of inhalation via indoor air which remained incomplete.

- The soil exposure pathways for utility worker were clarified to show that risk evaluation was done for the construction worker but not the utility worker because the construction worker scenario is assumed to be protective of a utility worker scenario because the utility worker's exposure frequency (i.e., days spent in an excavation trench) is expected to be less than a construction worker's exposure.
- The recreational user and industrial outdoor worker's exposure to groundwater via inhalation of outdoor air is an incomplete exposure pathway rather than a complete pathway. All exposure pathways related to direct (incidental ingestion and dermal contact) or indirect (inhalation) contact with groundwater at the site are incomplete because the results of the SPLP analysis did not identify any constituents that could leach to the groundwater.
- The recreational user and industrial outdoor worker's exposure to surface water via direct contact (incidental ingestion and dermal contact) is insignificant. Surface water at the Site is ponded precipitation rather than exposed groundwater and the SAR ecological and human health risk evaluations concluded that surface water and groundwater were not impacted by the Site and should be eliminated as exposure media of concern (AECOM, 2021).
- The CSEM was revised to clarify the treatment of sediment and surface water in relation to Site conditions. Sediment samples were treated like surface soil samples since ponded water is mostly dry during the year.

3.6 Checklist to Determine Applicable Remediation Standards

The completed Checklist to Determine Applicable Remediation Standards is discussed in the SAR and included in the SAR appendices.

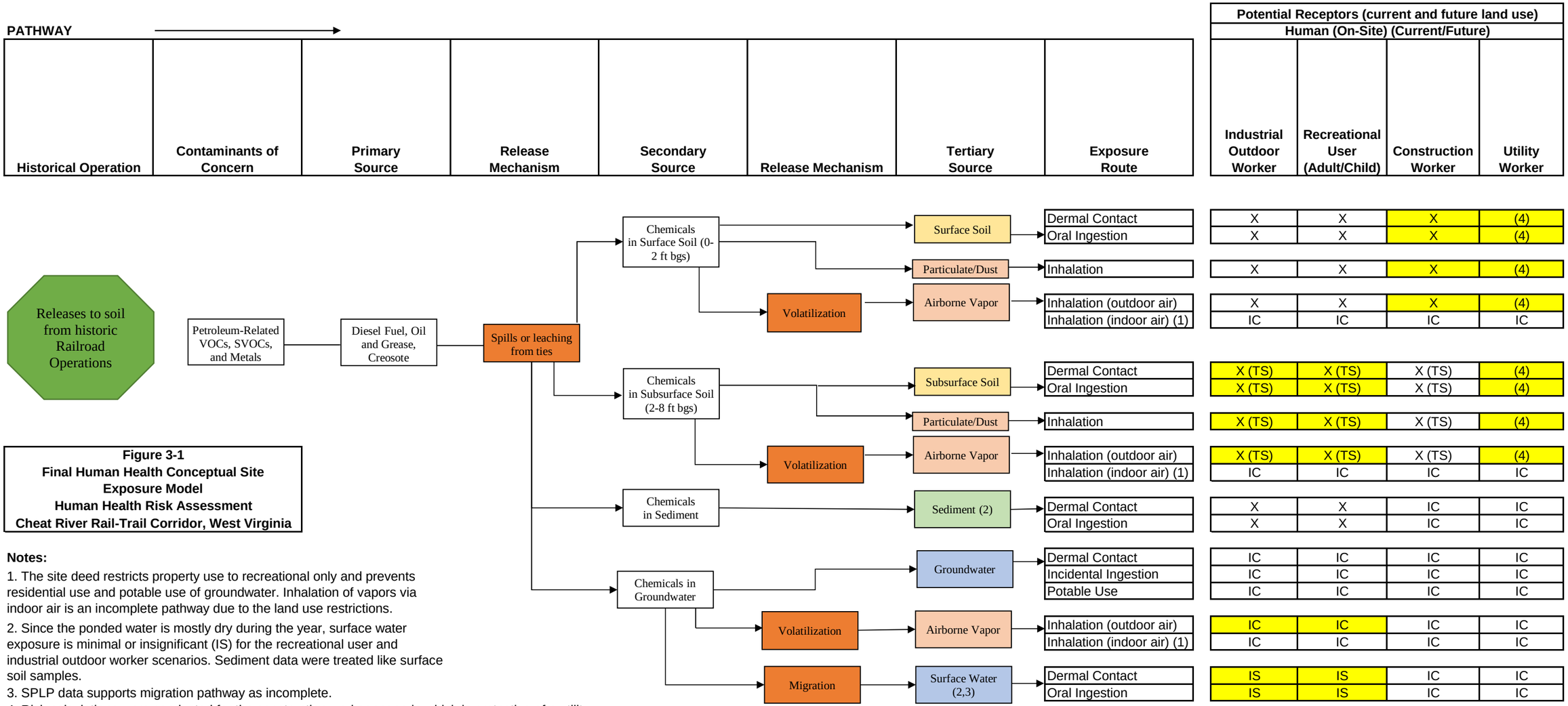

Figure 3-1
Final Human Health Conceptual Site Exposure Model
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Notes:

1. The site deed restricts property use to recreational only and prevents residential use and potable use of groundwater. Inhalation of vapors via indoor air is an incomplete pathway due to the land use restrictions.
2. Since the ponded water is mostly dry during the year, surface water exposure is minimal or insignificant (IS) for the recreational user and industrial outdoor worker scenarios. Sediment data were treated like surface soil samples.
3. SPLP data supports migration pathway as incomplete.
4. Risk calculations were conducted for the construction worker scenario which is protective of a utility worker. If the cancer risk and/or non-cancer hazard results for the construction worker indicate unacceptable risk, then the utility worker scenario will be evaluated in the HHRA.

Indicates that a change was made since the supplemental site assessment investigation.

X = Complete Exposure Pathway
IC = Incomplete Exposure Pathway
IS = Insignificant Exposure Pathway
TS = Total soil (surface soil and surbsurface soil combined)
ft bgs = feet below ground surface

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4. Human Health Exposure and Risk Assessment

The objectives of an exposure assessment are to:

- Identify populations that may be exposed to COPCs currently and in the future
- Identify pathways by which such exposures may occur
- Quantify chemical intakes or potential doses based on the magnitudes, frequencies, and durations of these potential exposures

A summary of the exposure parameters used in the risk evaluation are presented in **Table 4-1**, and all exposure parameters and assumptions can be found in **Attachment 3**.

The Site property, a former railroad line (ROW), is located in a mixed-use area of Preston County, WV. The location of the Site is shown on **Figure 2-1**. Undeveloped land owned by either Allegheny Forestlands LLC or FOC surrounds the majority of the Site; however, in several areas, the Site is adjacent to commercial/industrial properties, and limited residences and seasonal homes exist adjacent to the ROW. Upon completion of the trail, the Site will be used primarily for recreational purposes. The Site deed prevents residential use and potable use of groundwater.

The general ecological setting of the Site consists of typical Allegheny Highlands vegetation and landforms (hardwood forests interspersed with intermediate shrub wetlands and boulders). Compacted gravel (ballast) covers most portions of the trail throughout the Site. The ROW runs along the western side of the Cheat River on the northern portion and then crosses the river via a bridge and runs along the eastern side of the Cheat River. Several tributaries of the Cheat River intersect the Site. Approximately 94 drainage culverts channel surface runoff and connect the ROW to the downgradient Cheat River or adjacent wetlands. Within the ROW, shallow drainage depressions run parallel along portions of the trail. These drainage depressions either direct runoff into the culverts or, as seen in the northern portions of the ROW, act as vegetation buffers between State Route 72 and downgradient areas (AECOM, 2021).

Environmental media within the vicinity of the Site include soil, sediment, groundwater, and surface water. COPCs for the Site are polycyclic aromatic hydrocarbons (PAHs) and metals. COPCs may be presently adsorbed to soils, sediment and/or dissolved in groundwater/surface water. PAHs are typically of low volatility and solubility, thus lateral migration from source areas is generally limited. Metals are naturally occurring and may be ubiquitous at background concentrations in site media. Metals are typically of low solubility, thus their presence in dissolved phase and potential for migration in the subsurface is typically limited (AECOM, 2021).

Prior to the completion of the SAR, the human receptor was expected to be exposed to Site-related COPCs through direct contact (incidental ingestion, dermal contact, inhalation of dust or particulates) and indirect contact (inhalation of vapors via outdoor and indoor air). While surface water and groundwater were not directly collected or evaluated, pathways associated with surface water and groundwater were considered, specifically the leaching of constituents in soil to groundwater and the migration of dissolved constituents in groundwater to surface water. Over the course of the SAR and HHRA, the exposure pathways were revised to reflect the current understanding of the site conditions and ways in which the human receptors are expected to be impacted.

Surface water at the Site is represented as intermittent presence of ponded precipitation in drainage culverts after significant rain events (AECOM, 2021). Surface water and groundwater were not directly collected or evaluated. Instead, SPLP samples were collected to evaluate the potential for leaching of soil and sediment constituents into groundwater and migration of constituents from groundwater to surface water. The SAR concluded that shallow groundwater does not occur and is not discharging to surface water at the Site. The lack of shallow and exposed groundwater means that a receptor's exposure to groundwater through direct and indirect contact

(incidental ingestion, dermal contact, and inhalation through vapors) is minimal and insignificant. The SAR stated the surface water is standing water from ponded precipitation rather than exposed groundwater. Given that the ponded areas are frequently dry, surface water exposure is expected to be minimal and insignificant. SPLP sample data supported the pathway representing migration of constituents from groundwater to surface water as incomplete (no COCs were identified).

4.1 Exposure Assessment

The final CSEM (**Figure 3-1**) for the HHRA categorizes exposure pathways as complete, incomplete, or insignificant.

Soil-related exposure pathways include incidental ingestion, dermal contact, and inhalation of wind-blown particulates and/or vapors from soil. The subsurface soil exposure pathway is evaluated using total soil, which represents a future scenario where the surface (0 to 2 ft bgs) and subsurface (2 to 8 ft bgs) layers of soil are mixed. Receptors are not anticipated to be exposed to soil deeper than 8 ft bgs because the future excavation is not anticipated to be deeper than 8 ft bgs.

Sediment-related exposure pathways include incidental ingestion and dermal contact. Since ponded water areas at the Site are mostly dry throughout the year, sediment data were treated like surface soil data after identification of COPCs that are carried forward as COCs in the HHRA.

This HHRA addresses two theoretical scenario timeframes for potential receptors (current and future). The current scenario represents exposure to current site conditions; these conditions are assumed to not change in the future (i.e., no land re-development after the trail has been completed). The future scenario is used to address site conditions that have changed due to land re-development and/or other potential excavation activities.

The current and future on-site exposure land use scenarios consist of the recreational user (adult/child), industrial outdoor worker, construction worker, and utility worker. Exposure factors for each receptor are presented in **Table 4-1**.

4.1.1 Incomplete Exposure Pathways

Due to Site use restrictions, all pathways concerning inhalation of vapors via indoor air were considered incomplete because receptors are not expected to spend a significant time indoors while the property deed prohibits residential use of the site. Furthermore, no volatile constituents were carried forward as COCs in the HHRA. Therefore, exposure to soil and sediment through inhalation of vapors via indoor air were considered incomplete pathway.

All exposure pathways related to direct (incidental ingestion and dermal contact) or indirect (inhalation) contact with groundwater at the site are incomplete because the results of the SPLP analysis did not identify any constituents that could leach to the groundwater (no chemicals were carried forward as COCs in the HHRA). Exposure to groundwater and surface water through inhalation of vapors via indoor air were considered incomplete pathways because of Site use restrictions.

4.1.2 Complete Exposure Pathways

All surface soil and sediment pathways are complete and were evaluated for the recreator, outdoor worker, and construction worker scenarios. All subsurface soil pathways are complete and are addressed under the total soil risk evaluation, assuming that the soil at the Site is disturbed in the future during excavation activities. The exception is inhalation of vapors via indoor air, which was an incomplete exposure pathway for soil and sediment.

Current/future on-site recreational user (adult/child): The child (ages 0 to 6 years old) and adult recreational user visit the site for recreational purposes and are assumed to be exposed to surface soil (current) and total soil (future), as well as sediment. The exposure scenario was adjusted with site-specific values suggested by WVDEP during a call on September 30, 2021. The recreational user is expected to visit the site for 4 hours each day (exposure time), 70 days per year (exposure frequency). The exposure scenario assumes that the visits occur over the course of 6 years for children and 20 years for adults, which are the default EPA values for exposure duration. Other than the previously mentioned parameters, EPA default values were used (EPA, 2014).

Current/future on-site industrial outdoor worker: The industrial outdoor worker periodically visits the Site to inspect the property and conduct outdoor maintenance activities. The industrial outdoor worker is assumed to be exposed to surface soil (current) and total soil (future), as well as sediment. The EPA default exposure parameters assumed that the industrial outdoor worker is exposed 8 hours per day, 225 days per year, for 25 years (EPA, 2014).

Current/future on-site construction worker: The construction worker is assumed to be involved in a project at the Site lasting 6 months (8 hours per day, 120 days per year). The construction worker is assumed to be exposed to surface soil (current) and total soil (future). The excavation is estimated to extend to approximately 8 ft bgs.

Current/future on-site utility worker: The utility worker is assumed to be exposed to surface soil (current) and total soil (future). Risk calculations were conducted for the construction worker scenario which is protective of a utility worker. If the cancer risk and/or non-cancer hazard results for the construction worker indicate unacceptable risk, then the utility worker scenario will be evaluated in the HHRA.

4.1.3 Exposure Point Concentrations

The concentrations of constituents that a potential receptor may come into contact with are referred to as EPCs. EPA RAGS (EPA, 1989) recommends using the lower of the maximum detected concentration and the UCL of the mean as the EPC in cases where the exposure area is reasonably defined. EPCs were generated for chemicals that were present at concentrations higher than the selected SL. The EPCs were screened against applicable WV standards to identify the chemicals that would be carried forward as COCs in the HHRA, as discussed in **Section 3.4**.

The EPCs were derived using approved statistical methodologies for calculating the UCL of the mean. ProUCL Version 5.1 software, which was developed for EPA, was used to test the distribution of the data sets (EPA, 2016a). After testing, the program computes a conservative UCL based on the appropriate distribution of the data. For those data sets that do not fit the normal, lognormal, or gamma distributions, several parametric and distribution-free non-parametric methods are available to calculate an appropriate UCL (e.g., bootstrap methods). The ProUCL Version 5.1 program uses several statistical methods to handle data sets with and without ND results.

EPCs were generated for four PAHs that were present above the selected SL for surface soil: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. Additionally, EPCs were generated for arsenic (metal), which had been present in surface soil and sediment above the selected SL. Arsenic sediment results were combined with surface soil results to derive the surface soil 95% UCL. Given that these five compounds were identified as surface soil COPCs, separate EPCs were generated to represent surface soil and total soil. The total soil EPCs included subsurface soil results.

The EPC screening evaluation is summarized in **Table 4-2**. The EPC screening evaluation concluded with benzo(a)anthracene being eliminated from risk evaluation because the EPCs did not exceed the WV standards. Arsenic, benzo(a)pyrene, benzo(b)fluoranthene, and

dibenz(a,h)anthracene EPCs for surface soil and total soil exceeded the WV standards. Therefore, risk evaluation was completed for these four compounds.

Attachment 2 presents the ProUCL input and output tables, summary statistics, and EPC selection. **Table 4-2** summarizes the selected EPCs and the screening evaluation.

4.2 Toxicity Assessment

Risk assessments vary for different chemicals depending on whether noncarcinogenic or carcinogenic responses are used to assess potential risks. Some COCs may result in both noncarcinogenic and carcinogenic effects. Toxicity assessment involves determining whether exposures to a chemical can increase the incidence of a specific adverse effect (e.g., cancer, kidney damage) in humans, characterizing the nature and strength of evidence of causation and, if sufficient data are available, quantifying the relationship between the dose of the chemical and the incidence of adverse health effects in the exposed population. Toxicity assessments provide the basis for evaluating the acceptable exposure and the level of exposure that may adversely affect human health.

4.2.1 Selection of Toxicity Values

Table 4-3 presents the toxicity values used in the HHRA. The toxicity assessment was conducted in accordance with EPA guidance and considers chronic (long-term) and subchronic (less-than-lifetime) exposures for carcinogenic and noncarcinogenic COCs. The EPA's guidance regarding the hierarchy of sources of toxicity values in risk assessment was followed (EPA, 2003 and 2021a) and is presented below:

Tier 1 – EPA's Integrated Risk Information System (IRIS) (EPA, 2021b) – The IRIS program supports protection of human health and the environment by identifying and characterizing the health hazards of chemicals found in the environment. Each assessment can cover a chemical, a group of related chemicals, or a complex mixture.

Tier 2 – EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Superfund Remediation and Technology Innovation develops PPRTVs on a chemical-specific basis.

Tier 3 – Other Toxicity Values – Tier 3 includes additional EPA and non-EPA sources of toxicity information. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and that have been peer reviewed. Some examples of Tier 3 sources include the following:

- The California EPA (Cal EPA) toxicity values are peer reviewed and address both cancer and non-cancer effects (Cal EPA, 2021).
- The Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) are peer reviewed estimates of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure (ATSDR, 2021).
- Health Effects Assessment Summary Tables (HEAST) dated July 1997 (EPA, 1997).

Where toxicity values were not available for a chemical, toxicity values based on surrogate chemicals (i.e., chemicals with structural similarities) were identified in **Table A1-7** of **Attachment 1**. Toxicity information is summarized for the COCs evaluated in this HHRA in **Table 4-3**. Further toxicity information is included in the cancer risk and non-cancer hazard results in **Attachment 3** and in the United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs in **Tables A3-1** and **A3-2** in **Attachment 3**.

4.2.2 Absorption Factors

Dermal toxicity values are not available in the EPA's IRIS or other sources (EPA, 2021b). To evaluate risk/hazard from dermal routes of exposure, EPA dermal guidance documents (EPA, 2016b and 2004) were used. EPA (EPA, 2004) guidance recommends adjusting oral toxicity values using gastrointestinal absorption factors (GIABS) to evaluate dermal exposure routes for some chemicals. The oral-to-dermal adjustment is not required for all chemicals where 100% (GIABS of 1) absorption is assumed. For cancer toxicity data, the oral cancer slope factor (CSF) is divided by the GIABS to derive the dermal CSF. For non-cancer toxicity data, the oral RfD is multiplied by the GIABS to derive the dermal RfD. The GIABS values are in **Table A3-1** in **Attachment 3**.

For dermal contact with soil, an absorption fraction (ABS) is used to estimate desorption of a constituent from the soil and its absorption across the skin (EPA, 2016b and 2004). **Table 4-3** presents the soil ABS values used in the HHRA.

Not all chemicals are absorbed to the same extent. The relative bioavailability factor (RBA) is the fraction of an ingested dose that crosses the gastrointestinal epithelium and becomes available for distribution to internal target tissues and organs (EPA, 2007). An RBA of 1 is assumed for all soil and sediment COCs. The exception is arsenic, a COC for surface soil and sediment, which uses an RBA of 0.6 (EPA, 2007).

4.2.3 Noncarcinogenics

Evaluation of noncarcinogenic effects is based on the assumption that noncarcinogenic toxicological effects of chemicals occur only after a threshold dose is achieved. The reference dose (RfD) is used to evaluate ingestion and dermal exposure pathways, and the reference concentration (RfC) is used to evaluate the inhalation pathway. The RfD and RfC are estimates of the threshold dose (or concentration) at which the most sensitive human population may experience an observed adverse effect for that compound.

The EPA defines a chronic RfD/RfC as an estimate of a daily exposure level that is unlikely to result in deleterious effects during a lifetime for the human population (i.e., 70 years). A chronic RfD/RfC is used to evaluate the potential noncarcinogenic hazards associated with long-term chemical exposures. Chronic toxicity values are used to evaluate all scenarios in this HHRA except for the construction worker scenario. Subchronic toxicity values are applicable to the construction worker scenario, where exposures are expected to occur over a brief (i.e., 1 year) duration. The chronic and subchronic RfDs and RfCs are provided in **Table 4-3**.

4.2.4 Carcinogens

The EPA requires that potential carcinogens be evaluated as if minimum threshold doses do not exist (EPA, 1989). The EPA has established a weight-of-evidence approach to evaluating whether a particular chemical is a carcinogen (EPA, 1986). This weight-of-evidence classification is as follows:

- Group A chemicals are known carcinogens for which there is sufficient evidence to support a causal association between exposure to the agents in humans and cancer.
- Group B1 chemicals are probable human carcinogens for which there is limited evidence of carcinogenicity in humans.
- Group B2 chemicals are probable human carcinogens for which there is sufficient evidence of carcinogenicity in animals but inadequate or no human data.
- Group C chemicals are possible human carcinogens for which there is limited evidence of carcinogenicity in animals and inadequate or no human data.

- Group D chemicals are not classifiable as to human carcinogenicity, as there is inadequate human and animal evidence of carcinogenicity, or no data are available.
- Group E chemicals show evidence of non-carcinogenicity in humans, as there is no evidence of carcinogenicity from either human or animal studies.

In 2005, the EPA published new guidelines for carcinogenic risk assessment (EPA, 2005a). The 2005 guidelines recognize the growing sophistication of research methods; therefore, the EPA is revising the weight of evidence classification system. Weighing of the evidence includes addressing not only the likelihood of human carcinogenic effects of the agent but also the conditions under which such effects may be expressed to the extent that these are revealed in the toxicological and other biologically important features of the agent. There are five recommended standard hazard descriptors under the new guidance:

- "Carcinogenic to Humans"
- "Likely to Be Carcinogenic to Humans"
- "Suggestive Evidence of Carcinogenic Potential"
- "Inadequate Information to Assess Carcinogenic Potential"
- "Not Likely to Be Carcinogenic to Humans"

The EPA is currently re-examining the carcinogenic classification for numerous chemicals; where available, the new classification is provided in **Table A3-1** in **Attachment 3** for the COCs evaluated in this HHRA.

The CSF is used to estimate the incremental risk from exposure to carcinogenic COCs. CSFs are developed based on a dose response curve for carcinogenicity of the specific chemical. In estimating risks posed by potential carcinogens, the EPA generally assumes that any exposure level is associated with a finite probability, however minute, of producing a carcinogenic response. This mechanism for carcinogenicity is referred to as "non-threshold" because there is theoretically no level of exposure for a substance that does not pose a small, though finite, probability of producing a carcinogenic response.

The CSF, expressed in units of 1/milligram per kilogram-day $(mg/kg\text{-}day)^{-1}$, is used to convert the chronic daily intake (CDI) of a chemical from ingestion and dermal exposures, normalized over a lifetime, directly to a cancer risk. To evaluate inhalation exposure, the CSF is expressed as an inhalation unit risk (IUR) in units of 1/microgram per cubic meter $(\mu g/m^3)^{-1}$ and is used to convert the adjusted exposure concentration (EC) in units of $\mu g/m^3$ directly to a cancer risk. Cancer toxicity data are derived for those chemicals in classes A, B1, and B2. The CSFs and IURs are summarized in **Table 4-3**.

Some chemicals are identified as mutagens. A mutagen adversely affects the deoxyribonucleic acid (DNA) of a receptor; the mutated DNA causes malfunctioning or loss of function for a particular gene(s), and the accumulation of mutations may lead to cancer. EPA has developed equations to address mutagenic health effects, especially for age-sensitive or developmental stages where mutagenic health effects are likely to occur (EPA, 2005b). EPA recommends using age dependent adjustment factors (ADAFs) to quantify potential cancer risks for child receptors (EPA, 2005b). An ADAF of 10 is used for exposures that occur for receptors less than 2 years of age, an ADAF of 3 was used for exposures that occur for receptors between 2 and fewer than 16 years of age, and an ADAF of 1 is used for exposures that occur for a receptor after 16 years of age (EPA, 2005b). These ADAFs are used to quantify potential cancer risks for the on-site child/adult recreational user for all exposure pathways (i.e., ingestion, dermal contact, and inhalation). Mutagenic chemicals evaluated in the HHRA include benzo(e)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene.

4.3 Risk Characterization

Risk characterization summarizes the nature and magnitude of the potential for occurrence of adverse health effects under a specific set of conditions. The exposure assessment and the toxicity assessment are integrated into quantitative estimates of potential health risks to potential receptors.

Potential carcinogenic and noncarcinogenic human health risks are calculated and summarized individually for each receptor exposed to COCs. Estimated risks are combined across COCs and exposure pathways, as appropriate.

4.3.1 Risk Estimation Methods

Target Risk Levels

Various state and federal regulatory agencies mandate target or “acceptable” carcinogenic risk and noncarcinogenic hazard levels. The EPA identifies the acceptable cancer risk range to be 1×10^{-4} to 1×10^{-6} (1E-04 to 1E-06). In effect, estimated excess lifetime cancer risk (ELCR) that are less than 1×10^{-6} (1E-06) are generally considered negligible. Potential ELCR in the intermediate range between 1×10^{-4} to 1×10^{-6} (1E-04 to 1E-06) can be considered acceptable on a case-by-case basis. The cancer risk of 1×10^{-6} is used as the risk goal for individual carcinogens, with a not-to-exceed ELCR of 1×10^{-4} for all carcinogens. The EPA accepts a noncarcinogenic hazard target level, or hazard index (HI), of 1 (EPA, 1991).

WVDEP guidance defines the commercial/industrial target cancer risk (TCR) as 1E-05 and the residential TCR as 1E-06 (WVDEP, 2020). For industrial/commercial sites, public notification is required if the cumulative cancer risk exceeds 1E-05 (WVDEP, 2020). Public notification is required if cumulative cancer risk exceeds the TCR of 1E-06 at residential sites (residential land use includes recreational activities) (WVDEP, 2020).

Attachment 3 presents the cancer risk and non-cancer hazard results calculated for each receptor in this HHRA. **Table 4-4** summarizes the cancer and non-cancer risk results. **Section 6.0** summarizes the uncertainties associated with the calculation of risk levels in this HHRA.

Carcinogenic Risks

The CSF converts estimated daily intakes to an estimate of incremental cancer risk. The cancer risk estimate, which is unitless, represents an estimation of an upper-bound incremental lifetime probability that an individual will develop cancer as a result of exposure to a potential carcinogen.

Carcinogenic risk is calculated for each chemical and exposure pathway (ingestion and dermal) by multiplying the estimated CDI by the CSF, as follows:

Equation 1:

$$\text{Carcinogenic Risk (unitless)} = \text{CDI (mg/kg-day)} \times \text{oral CSF (mg/kg-day)}^{-1}$$

For the dermal contact pathway, the dermally absorbed dose (DAD) is multiplied by the dermal CSF:

Equation 2:

$$\text{Carcinogenic Risk (unitless)} = \text{DAD (mg/kg-day)} \times \text{dermal CSF (mg/kg-day)}^{-1}$$

For the inhalation pathway, the IUR and the adjusted EC (in units of concentration in air) are used:

Equation 3:

$$\text{Carcinogenic Risk (unitless)} = \text{EC } (\mu g/m^3) \times \text{IUR } (\mu g/m^3)^{-1}$$

Chemical-specific risks for all chemicals associated with a specific pathway are summed to assess exposure to multiple chemicals. The pathway-specific risks for all pathways are then

summed to determine the potential ELCR for each exposure scenario. The potential ELCR assumes that different carcinogens affect the same target organ to produce a cancer response, ignoring potential antagonistic or synergistic effects or disparate effects on different target organs.

The EPA regulations establish a target cumulative risk level (i.e., from all pathways for a single receptor group) of 1×10^{-4} for carcinogenic risks.

Noncarcinogenic Risks

To characterize potential noncarcinogenic effects, comparisons are made between projected intakes of substances over a specified time period and toxicity values, primarily RfDs and RfCs. The ratio of exposure to toxicity value is the hazard quotient (HQ). The HQ is calculated for each chemical and exposure pathway (ingestion and dermal) by dividing the CDI by the RfD as follows:

Equation 4:

Non-cancer HQ (unitless) = CDI (mg/kg-day)/oral RfD (mg/kg-day)

For the dermal contact pathway, the DAD is divided by the dermal RfD.

Equation 5:

Non-cancer HQ (unitless) = DAD (mg/kg-day)/dermal RfD (mg/kg-day)

For inhalation exposures, a similar comparison is made using the RfC, the adjusted EC, and a unit's conversion factor:

Equation 6:

Non-cancer HQ = EC ($\mu g/m^3$)/(RfC (milligrams per cubic meter [mg/m^3])× 1000 µg/mg)

Estimated HQs for noncarcinogenic effects are generated on a chemical-by-chemical basis for each relevant pathway of exposure. The chemical-specific HQs are summed for all chemicals associated with a specific pathway to determine the pathway-specific HI. The HQs for all pathways are then summed to determine the cumulative HI for each exposure scenario.

The HQ is not a statistical probability of a noncarcinogenic effect occurring. If the exposure level is less than the appropriate toxicity value (i.e., the HQ is less than 1), adverse health effects are not likely, even with a lifetime of exposure.

If the cumulative HI for an exposure scenario is greater than 1, indicating potential cause for concern, the HI is segregated by critical effect and mechanism of action (EPA, 1989). HQs for chemicals that affect the same target organ are summed to derive target organ-specific HIs. The EPA regulations establish a target HI (i.e., from all pathways for a single receptor group) of 1 for non-cancer HI.

4.3.2 Risk Assessment Results

Forward risk calculations were performed using the ORNL RAIS online risk calculator for the recreational user (child/adult) and industrial outdoor worker (ORNL, 2022). The Virginia Department of Environmental Quality (VDEQ) Virginia Unified Risk Assessment Model (VURAM) was used to evaluate risk for the construction worker (VDEQ, 2022). Separate calculations were conducted for surface soil and total soil using the EPCs (EPCs shown in **Table 4-2**). The three soil COCs that were evaluated in the risk calculations were arsenic, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene. The calculations used the EPA default exposure parameters unless site-specific values were required, as shown in **Table 4-1**.

For each exposure scenario (i.e., receptor and exposure area) with a potential ELCR/HI above the EPA target levels, potential chemicals of concern (pCOCs) were identified as COCs that contributed to the cumulative ELCR to exceed 1E-04 and/or the target organ endpoint HI to exceed 1, at one significant figure.

The results are discussed below and summarized in **Table 4-4**. The full results are included in **Attachment 3**.

Cancer Risk Results:

The chemical-specific cancer risk estimate exceeded 1E-06 for arsenic and benzo(a)pyrene for the recreational user (child/adult) for surface soil and total soil results. Therefore, arsenic and benzo(a)pyrene were identified as carcinogenic pCOCs for the recreational user (child/adult).

The chemical-specific cancer risk estimates for industrial outdoor worker and construction worker did not exceed WVDEP's threshold of 1E-05 for industrial/commercial sites. Therefore, the ELCR is acceptable and public notification is not required for the industrial/commercial scenario (WVDEP, 2020).

The potential ELCR for the industrial outdoor worker is likely overestimated since the exposure scenario uses the EPA's default exposure parameters, which assume that the industrial outdoor worker is exposed 225 days per year, 8 hours per day, for 25 years. The industrial outdoor worker is not expected to spend that much time at the Site.

The potential ELCR results for the recreational user (child/adult) were within the range of 1E-05 to 1E-06. Given that WVDEP guidance states that cancer risk is acceptable within the range of 1E-04 to 1E-06, the ELCR thresholds have not been exceeded from exposure to surface soil or total soil exposure media. However, since the potential ELCR results for the recreational users exceeded 1E-06, public notification will be required per WVDEP guidance (WVDEP, 2020).

Non-Cancer Hazard Results:

The cumulative HI results for all receptors exposed to surface soil and total soil were below the EPA's non-cancer HI threshold of 1. Therefore, no target organ analysis was necessary, and no non-carcinogenic pCOCs were identified. The cumulative HI results are acceptable for all scenarios.

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5. Ecological Risk Assessment

The SAR ecological assessment concluded that no potential ecological risks are anticipated from soil or sediment constituents potentially migrating into surface water. There were no detected results in the SPLP results taken at sediment locations, and the few detections in the SPLP results taken at surface soil locations were below the ecological SLs (AECOM, 2021). The SAR ecological and human health assessments concluded that surface water and groundwater were not impacted by the site and should be eliminated as exposure mediums of concern. The SAR concluded that no additional action is recommended for ecological receptors based on the results of the De Minimis Ecological Screening Evaluation (AECOM, 2021). Therefore, no ecological risk assessment was done.

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6. Uncertainty Analysis

Uncertainties are inherent in every aspect of a quantitative risk assessment. Certain assumptions are made as part of the risk assessment process, and these assumptions may lead to an over- or underestimation of the actual risks associated with the site.

This section provides a brief summary of the key uncertainties in this assessment and qualifies the level of effect that each uncertainty has on the assessment. Almost all major assumptions used in the assessment of risk for this site are anticipated to overestimate the actual risks posed by site conditions.

WVDEP categorizes uncertainty in a risk assessment into three types: scenario uncertainty, parameter uncertainty, and model uncertainty (WVDEP, 2020). Below is a table containing a summary of the sources of risk. The sources of uncertainties are explained in detail in the following subsections.

Table 6-1: Summary of Sources of Uncertainty

Type of Uncertainty	Sources	Sources of Uncertainty
Scenario Uncertainty	Aggregation errors	Sufficient samples were collected in the soil medium to characterize the risk for all potential receptors; no aggregation errors were identified.
	Descriptive errors	Exposure parameters were changed to reflect a recreational user walking along the trail rather than assuming a camping scenario; exposure was more accurately represented in the HHRA.
	Incomplete analysis	All direct contact soil exposure pathways were addressed for each potential receptor; SPLP results indicate that soil leaching to groundwater is minimal (i.e., no SPLP COCs were identified). The exposure pathway and risk analysis are deemed complete.
	Judgement errors	RfDs are frequently derived from animal studies that have unknown quantitative bearing on potential adverse health effects in humans. Both EPA (2021b) and WVDEP (2020) risk assessment guidance recognizes uncertainty associated with these toxicity values; modifying factors are used to adjust the RfDs to account for this uncertainty.
Parameter Uncertainty	Measurement errors	Flagged results, such as “J” flags (i.e., estimated values), were treated as detections and carried forward into the HHRA.
	Sampling errors	The original sample set was revised to exclude several 2011 surface soil samples that were classified as “off trail” from screening. These samples included six off-trail samples (samples SS1D through SS6D) and one off-trail sample collected adjacent to the former Chemetals, Inc. property (sample SS1P). The exclusion of these samples was approved by WVDEP during a call on January 12, 2022.
	Surrogate data	A surrogate SL was used if an SL were not available for a particular chemical.
	Variability	The HHRA focused on reasonable maximum exposure (RME) evaluation and did not generate central tendency exposure calculations to provide a range of risk results. Risk management decisions are based on RME exposure which is more protective of the public and potential sensitive receptors (e.g., children elderly, etc.).
Model Uncertainty	Modeling errors	Conservative exposure parameters and modeling parameters were selected to estimate exposure to the potential human receptors. Cancer risk and/or non-cancer hazards may be overestimated.

6.1 Data and Exposure Point Concentrations

Source of Uncertainty: Unbiased soil samples were collected in a manner that is representative of exposure at the Site.

Effect on Risk/Hazard Estimates: Representative.

Potential Magnitude: Low.

Rationale for Assumptions: Unbiased samples provide better data to derive representative EPCs for evaluating ELCR and/or non-cancer hazards.

Source of Uncertainty: Flagged results such as "J" flags (i.e., estimated values) were carried forward into the HHRA.

Effect on Risk/Hazard Estimates: Under- or overestimate.

Potential Magnitude: Low.

Rationale for Assumptions: EPA guidance recommends treating "J"-flagged results as detected concentrations (EPA, 1989). The statistical calculations of EPCs take into account detect and ND results to derive representative concentrations. A "J"-flagged result indicates that the analyte was positively identified, and the associated numerical value is an estimated quantity with an unknown bias. In other words, the "J"-flagged result was treated as a detected concentration even though the chemical's true concentration was unknown (EPA, 1989). Therefore, if the J-flagged chemical were identified as a COPC, it is unknown if the estimated risk were under- or overestimated because the bias in calculating the EPC using J-flagged results is unknown. In this dataset, the laboratory did not have any qualifiers other than "U" for NDs. The validation qualifiers were explained in the data validation report and analytical data package included in the SAR (AECOM, 2021).

Source of Uncertainty: Handling of duplicate data in the HHRA data set.

Effect on Risk Hazard Estimates: Representative

Magnitude: Low

Rationale: The primary and duplicate samples taken during the 2021 investigation were compared for representativeness during the SAR (AECOM, 2021). The relative percent difference evaluation was part of the DQOs evaluation and data validation process completed in the SAR (AECOM, 2021). The three 2011 duplicate pairs were assessed in the *Phase II Environmental Site Assessment* (Triad, 2012). The level of uncertainty is reduced due to the selected methods and quality assurance/quality control (QA/QC) procedures that were used to assess the precision and accuracy of analytical data.

Source of Uncertainty: Sampling locations, sampling procedures, and the number of samples collected, affects what concentrations of chemicals are found at the site. The two phases of the screening approach were done with SLs that are protective of human health.

Effect on Risk/Hazard Estimates: Over- or underestimate.

Potential Magnitude: Moderate.

Rationale for Assumptions: EPA (EPA, 1989 and 2021a) guidance recommends using conservative generic SLs and maximum detected concentrations for screening. Per WVDEP guidance, site-specific standards and WV De Minimis standards were used for screening (WVDEP, 2020).

Source of Uncertainty: Soil samples were limited to depths ranging from 0 to 8 ft bgs.

Effect on Risk/Hazard Estimates: Underestimate.

Potential Magnitude: Moderate.

Rationale for Assumptions: WVDEP guidance assumes an excavation scenario up to 10 ft deep (WVDEP, 2020). However, this HHRA assumed that the construction worker would only be exposed to soil within the 0 to 8 ft bgs range because a future excavation at the Site is not anticipated to be deeper than 8 ft. Furthermore, the existing soil samples are expected to be representative of all soil at the Site regardless of depth due to the nature of the Site COCs.

COCs for the Site are PAHs and metals, which may be presently adsorbed to soil particulates. PAHs are typically of low volatility and solubility, thus migration from source areas is generally limited (Agency for Toxic Substances and Disease Registry [ATSDR], 1995). Metals are typically of low solubility, thus their potential for migration from surface soil to subsurface soil is typically limited (AECOM, 2021).

Source of Uncertainty: If the analytical methods used do not apply to some chemicals that are present at the site, risk could be underestimated.

Effect on Risk/Hazard Estimates: Underestimate.

Potential Magnitude: Low.

Rationale for Assumptions: Since the analytical methods at the site were selected to address all chemicals that are known or suspected to be present on the basis of the history of the Site, the potential for not identifying a COC is reduced.

Source of Uncertainty: Identify whether RLs are low enough (i.e., below SLs) to capture detected concentrations in the affected media. A data sensitivity analysis was included in the screening tables (see **Tables A1-2** through **A1-6** in **Attachment 1**).

Effect on Risk/Hazard Estimates: Underestimate.

Potential Magnitude: Low.

Rationale for Assumptions: Analytes that were not detected were screened using the RL. The data sensitivity analysis is discussed further in **Section 6.5**.

Source of Uncertainty: A surrogate SL was used if an SL were not available for a particular chemical.

Effect on Risk Hazard Estimates: Over- or underestimate.

Magnitude: Low

Rationale: Attachment 1 Tables A1-2 through **A1-6** document when surrogates were used in the screening, and **Table A1-7** lists the surrogates used for each chemical. Where possible, the chemicals selected as surrogates had similar molecular structure and/or toxicity information available. Since peer-reviewed toxicity data are not available, the effect upon the cancer risk and/or non-cancer hazard results for these chemicals is unknown.

Source of Uncertainty: With the exception of lead, the EPA recommends using the lower of the UCL of the mean concentration and the maximum detected concentration as the EPC in cases where the study area is reasonably defined (EPA, 1989 and 2016a). However, USEPA's ProUCL guidance recommends using the 95% UCL over a maximum detected value except in cases where the sample size is small (e.g., less than 10 to 20 data points), the distribution is positively skewed, and the UCL was calculated by assuming a lognormal distribution (USEPA, 2015). In which case, the sample maximum detected value would likely underestimate the population mean. If the calculated UCL were used as the EPC, then the risk results would be less likely to be biased high. If the maximum detected concentration were used as the EPC, then the risk results would be likely biased high.

Effect on Risk/Hazard Estimates: Overestimate.

Potential Magnitude: Low-Moderate, EPC-dependent.

Rationale for Assumptions: UCLs were calculated, where possible, and used in the risk/hazard calculations. Some chemicals required using the maximum detected concentration as the EPC (see **Table 4-2** and **Attachment 2 Table A2-1**) due to a small data set or low detection frequency. The cancer risk/non-cancer hazards for COCs where maximum detected concentrations were used as EPCs may be overestimated.

6.2 Toxicity Values

Source of Uncertainty: RfDs are frequently derived from animal studies that have unknown quantitative bearing on potential adverse health effects in humans.

Effect on Risk/Hazard Estimates: Under- or overestimate.

Potential Magnitude: Unknown.

Rationale for Assumptions: The fate and mechanism of action of a chemical may differ in animals and humans and the effects observed in animals may not be observed in humans. The unknown differences in toxicity between animals and humans could either underestimate or overestimate the potential adverse health effects.

Source of Uncertainty: Third tier toxicity data (e.g., ATSDR, Cal EPA, and HEAST toxicity values) were used to estimate the cancer risk and/or non-cancer hazards for some COCs (see **Table 4-3 and Attachment 3**).

Effect on Risk/Hazard Estimates: Under- or overestimate.

Potential Magnitude: Unknown.

Rationale for Assumptions: A Cal EPA RfC of 1.5E-05 mg/m^3 was used to estimate inhalation of wind-blown dust for arsenic. The incidental ingestion and dermal contact exposure pathways tend to be exposure pathways of concern for arsenic. Also, the cumulative HI results were below the threshold of 1, so the level of uncertainty is reduced. Third tier toxicity values are still undergoing intensive scientific review and have not been verified by IRIS (EPA, 2021b). It is unknown if the cumulative non-cancer hazards are under- or overestimated.

6.3 Chemical Interactions

Source of Uncertainty: Risk characterization uncertainties include possible synergistic or antagonistic effects of exposure to multiple chemicals and applicability of cancer risk estimation methodology to less than lifetime exposure durations.

Effect on Risk/Hazard Estimates: Under- or overestimate.

Potential Magnitude: Low.

Rationale for Assumptions: These uncertainties are generic to the risk assessment process and not specific to the site.

6.4 Exposure Factors

Source of Uncertainty: Conservative exposure parameters were used to estimate exposure to the potential human receptors. The default exposure factors that are incorporated for the various exposure scenarios are typically much higher than are realized in practice.

Effect on Risk/Hazard Estimates: Overestimate.

Potential Magnitude: Moderate.

Rationale for Assumptions: Conservative EPA (EPA, 2014) default exposure parameters were used to estimate exposure to human receptors. The exposure parameters are summarized in **Table 4-1** and documented in full in **Attachment 3**. When default parameters were not available, site knowledge, best professional judgment, and EPA (EPA, 2011) data were used to derive representative exposure parameters.

6.5 Data Sensitivity Analysis

As part of the COPC identification process, a DSA was conducted. The maximum RL was compared to the selected human health SLs to determine whether analytical RLs were adequate for risk assessment purposes. The purpose of this screening was to determine if the laboratory analytical methods were sensitive enough to detect potential COCs. If the chemical's RL was higher than the SL, then the laboratory analysis could not have detected concentrations that are lower than the RL but higher than the SL. If a chemical was all ND and had a maximum RL lower than the SL, then the chemical was eliminated from further evaluation in the HHRA. If the maximum RL was greater than the selected SL, then it was identified as a DSA COPC.

Results of the DSA identified only one chemical (naphthalene) that had an RL that exceeded the DAF-adjusted groundwater standard in the SPLP sample screening. The SPLP analysis tested naphthalene as a volatile organic compound (VOC) using method 8260B and as a semi-volatile organic compound (SVOC) using method 8270E. Naphthalene VOC was not detected above the RL in any of the SPLP samples and the RL (5 micrograms per liter [µg/L]) exceeded the DAF-adjusted groundwater SL of 2.4 µg/L. However, naphthalene SVOC was detected above the RL (0.1 µg/L) at 0.22 µg/L in one SPLP sample, which was below 2.4 µg/L. The migration from soil to groundwater exposure pathway is considered minimal because vapors from naphthalene that may migrate to the surface likely will be quickly dispersed into outdoor air via wind flow along the trail and the SPLP screen results for naphthalene SVOC were below the selected SL. The DSA indicates that the data evaluated for the risk assessments are of sufficient quality to identify COPCs in all media.

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7. Conclusions and Recommendations

The HHRA has fulfilled the objective discussed in **Section 1.2**, which was to conduct a site-specific, quantitative analysis of the Site under current and future land use scenarios and determine the degree to which exposure may cause adverse human health effects. The evaluation is based on the nature of the constituents detected at the Site and on the potential exposure pathways to potential human receptors.

7.1 Summary

The SAR concluded that no additional action is recommended for ecological receptors based on the results of the De Minimis Ecological Screening Evaluation. Therefore, no ecological risk assessment was done.

The HHRA addressed the following exposure media: surface soil (0 to 2 ft bgs), subsurface soil (2 to 8 ft bgs), and sediment. Future excavation activities could result in the subsurface soil being brought to the surface and "mixed" together. Therefore, a total soil data set (surface and subsurface data combined) was derived. Sediment samples were collected in a ponded area that is mostly dry during the year; therefore, sediment samples were treated as soil samples in the HHRA.

Groundwater and surface water exposure media were also evaluated during this HHRA. The SAR ecological and human health risk evaluations concluded that surface water and groundwater were not impacted by soil or sediment constituents at the Site and should be eliminated as exposure media of concern (AECOM, 2021).

The HHRA risk-based screening used maximum detected concentrations in soil to compare with selected WVDEP soil SLs. Five soil COPCs were identified: arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. The WVDEP guidance manual (WVDEP, 2020) recommends deriving a 95% UCL and rescreening the data. The rescreen results identified arsenic, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene as soil COCs that were carried forward in the HHRA.

The HHRA evaluated a current and future recreational user (child/adult), industrial outdoor worker, and construction worker (which is also protective of a utility worker). All three receptors were exposed to surface soil (current; existing site conditions) and total soil (future; assuming land redevelopment occurs).

Forward risk calculations were performed using the ORNL RAIS online risk calculator for the recreational user (child/adult) and industrial outdoor worker and VURAM was used to evaluate risk for the construction worker (ORNL, 2022 and VDEQ, 2022).

7.2 Conclusions

The results of the risk evaluation are summarized below:

Table 7-1: Summary of Cancer Risk and Non-Cancer Hazards

Exposure Medium	ELCR	Cumulative HI
Surface Soil		
Child Recreational User	1E-05	0.2
Adult Recreational User	1E-05	0.02
Industrial Outdoor Worker	1E-05	0.06
Construction Worker	1E-06	0.2
Total Soil		
Child Recreational User	1E-05	0.2

Adult Recreational User	1E-05	0.02
Industrial Outdoor Worker	9E-06	0.05
Construction Worker	1E-06	0.2
Notes: ELCR = excess lifetime cancer risk; HI = hazard index		

The potential ELCR results for the recreational user (child/adult) were within the EPA and WVDEP acceptable cancer risk range of 1E-04 to 1E-06 (EPA, 1991 and WVDEP, 2020). However, since the potential ELCR results are above 1E-06 for the recreational user scenario, public notification will be required (WVDEP, 2020). The chemical-specific cancer risk estimates for industrial outdoor worker and construction worker did not exceed WVDEP's threshold of 1E-05 for industrial/commercial sites, therefore public notification is not required for this scenario and adverse carcinogenic health effects for the industrial outdoor and construction worker scenarios are not likely. Overall, none of the carcinogenic and/or noncarcinogenic results were above EPA target cumulative levels.

7.3 Recommendations

The HHRA results indicate that no additional assessment or risk management options other than the administrative controls already imposed are recommended because the Site is believed to have an acceptable level of risk without further remedial actions.

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Tables

Table 3-2
Sample Information
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Sample Name	Sample Location	Medium	Date	Sample Code	Include Sample?	Reason for Exclusion (a,b)	Depth (ft bgs)
SSS-01 (0'-2')	SSS-01	SSS	02/12/2021	N	Yes	--	0-2
SSS-02(0'-2')	SSS-02	SSS	02/10/2021	N	Yes	--	0-2
SSS-03(0'-2')	SSS-03	SSS	02/10/2021	N	Yes	--	0-2
SSS-04(0'-2')	SSS-04	SSS	02/10/2021	N	Yes	--	0-2
SSS-05(0'-2')	SSS-05	SSS	02/10/2021	N	Yes	--	0-2
SSS-06 (0'-2')	SSS-06	SSS	02/11/2021	N	Yes	--	0-2
SSS-07 (0'-2')	SSS-07	SSS	02/11/2021	N	Yes	--	0-2
SSS-08 (0'-2')	SSS-08	SSS	02/11/2021	N	Yes	--	0-2
SSS-9 (0-2)	SSS-9	SSS	02/09/2021	N	NO	Parent sample	2-8
SSS-9 (0-2) Dup	SSS-9	SSS	02/09/2021	FD	NO	Field duplicate	2-8
SSS-9 (0-2)_max	SSS-9	SSS	02/09/2021	N	Yes	--	2-8
SSS-10 (0'-2')	SSS-10	SSS	02/09/2021	N	Yes	--	0-2
SSS-11(0'-2')	SSS-11	SSS	02/08/2021	N	Yes	--	0-2
SSS-12(0'-2')	SSS-12	SSS	02/08/2021	N	Yes	--	0-2
SSS-13(0'-2')	SSS-13	SSS	02/08/2021	N	Yes	--	0-2
SSS-14(0'-2')	SSS-14	SSS	02/08/2021	N	Yes	--	0-2
SSS-15(0'-2')	SSS-15	SSS	02/08/2021	N	Yes	--	0-2
SSB-01 (2'-8')	SSB-01	SSB	02/12/2021	N	NO	Parent sample	0-2
SSB-01 (2'-8') Dup	SSB-01	SSB	02/12/2021	FD	NO	Field duplicate	0-2
SSB-01 (2'-8')_max	SSB-01	SSB	02/12/2021	N	Yes	--	2-8
SSB-02(2'-8')	SSB-02	SSB	02/10/2021	N	Yes	--	2-8
SSB-03(2'-8')	SSB-03	SSB	02/10/2021	N	NO	Parent sample	2-8
SSB-03(2'-8')DUP	SSB-03	SSB	02/10/2021	FD	NO	Field duplicate	2-8
SSB-03(2'-8')_max	SSB-03	SSB	02/10/2021	N	Yes	--	2-8
SSB-04(2'-8')	SSB-04	SSB	02/10/2021	N	Yes	--	2-8
SSB-05(2'-8')	SSB-05	SSB	02/10/2021	N	Yes	--	2-8
SSB-06 (2'-8')	SSB-06	SSB	02/11/2021	N	Yes	--	2-8
SSB-07 (2'-8')	SSB-07	SSB	02/11/2021	N	NO	Parent sample	2-8
SSB-07 (2'-8')DUP	SSB-07	SSB	02/11/2021	FD	NO	Field duplicate	2-8
SSB-07 (2'-8')_max	SSB-07	SSB	02/11/2021	N	Yes	--	2-8
SSB-08 (2'-8')	SSB-08	SSB	02/11/2021	N	Yes	--	2-8
SSB-9 (2-8)	SSB-9	SSB	02/09/2021	N	Yes	--	2-8
SSB-10 (2'-8')	SSB-10	SSB	02/09/2021	N	Yes	--	2-8
SSB-11(2'-8')	SSB-11	SSB	02/08/2021	N	Yes	--	2-8
SSB-12(2'-8')	SSB-12	SSB	02/08/2021	N	Yes	--	2-8
SSB-13(2'-8')	SSB-13	SSB	02/08/2021	N	Yes	--	2-8
SSB-14(2'-8')	SSB-14	SSB	02/08/2021	N	NO	Parent sample	2-8
SSB-14(2'-8') Dup	SSB-14	SSB	02/08/2021	FD	NO	Field duplicate	2-8
SSB-14(2'-8')_max	SSB-14	SSB	02/08/2021	N	Yes	--	2-8
SSB-15(2'-8')	SSB-15	SSB	02/08/2021	N	Yes	--	2-8
SED-1-U (0-0.5)	SED-1-U	SD	03/16/2021	N	Yes	--	0-0.5
SED-1-D (0-0.5)	SED-1-D	SD	03/16/2021	N	Yes	--	0-0.5
SED-2-U (0-0.5)	SED-2-U	SD	03/17/2021	N	Yes	--	0-0.5
SED-2-D (0-0.5)	SED-2-D	SD	03/17/2021	N	NO	Parent sample	0-0.5
SED-2-D (0-0.5) Dup	SED-2-D	SD	03/17/2021	FD	NO	Field duplicate	0-0.5
SED-2-D (0-0.5)_max	SED-2-D	SD	03/17/2021	N	Yes	--	0-0.5

Table 3-2
Sample Information
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Sample Name	Sample Location	Medium	Date	Sample Code	Include Sample?	Reason for Exclusion (a,b)	Depth (ft bgs)
SED-3-U (0-0.5)	SED-3-U	SD	03/17/2021	N	Yes	--	0-0.5
SED-3-D (0-0.5)	SED-3-D	SD	03/17/2021	N	Yes	--	0-0.5
SED-4-U (0-0.5)	SED-4-U	SD	03/17/2021	N	Yes	--	0-0.5
SED-5-U (0-0.5)	SED-5-U	SD	03/17/2021	N	Yes	--	0-0.5
SED-5-D (0-0.5)	SED-5-D	SD	03/17/2021	N	Yes	--	0-0.5
SED-6-U (0-0.5)	SED-6-U	SD	03/17/2021	N	Yes	--	0-0.5
SED-7-U (0-0.5)	SED-7-U	SD	03/17/2021	N	Yes	--	0-0.5
SSS-02(0'-2')(SPLP)	SSS-02	SPLP-SSS	02/17/2021	N	Yes	--	0-0.5
SSS-05(0'-2')(SPLP)	SSS-05	SPLP-SSS	02/17/2021	N	Yes	--	0-0.5
SSS-08 (0'-2')(SPLP)	SSS-08	SPLP-SSS	02/17/2021	N	Yes	--	0-0.5
SSS-10 (0'-2')(SPLP)	SSS-10	SPLP-SSS	02/17/2021	N	Yes	--	0-0.5
SSS-12(0'-2')(SPLP)	SSS-12	SPLP-SSS	02/17/2021	N	Yes	--	0-0.5
SPLP-1 (0-0.5)	SPLP-1	SPLP-SD	03/16/2021	N	Yes	--	0-0.5
SPLP-2 (0-0.5)	SPLP-2	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SPLP-3 (0-0.5)	SPLP-3	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SPLP-4 (0-0.5)	SPLP-4	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SPLP-5- (0-0.5)	SPLP-5	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SPLP-6 (0-0.5)	SPLP-6	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SPLP-7 (0-0.5)	SPLP-7	SPLP-SD	03/17/2021	N	Yes	--	0-0.5
SS1C	SS1C	SSS	09/01/2011	N	Yes	--	0-2
SS3A	SS3A	SSS	09/01/2011	N	Yes	--	0-2
SS4C	SS4C	SSS	09/01/2011	N	Yes	--	0-2
SS06A	SS06A	SSS	09/01/2011	N	Yes	--	0-2
SS8B	SS8B	SSS	09/01/2011	N	Yes	--	0-2
SS9A	SS9A	SSS	09/01/2011	N	NO	Parent sample	0-2
SS9A FD	SS9A	SSS	09/01/2011	FD	NO	Field duplicate	0-2
SS9A_max	SS9A	SSS	09/01/2011	N	Yes	--	0-2
SS10C	SS10C	SSS	09/01/2011	N	Yes	--	0-2
SS12A	SS12A	SSS	09/01/2011	N	Yes	--	0-2
SS13C	SS13C	SSS	09/01/2011	N	Yes	--	0-2
SS14B	SS14B	SSS	09/01/2011	N	Yes	--	0-2
SS15A	SS15A	SSS	09/01/2011	N	Yes	--	0-2
SS16C	SS16C	SSS	09/02/2011	N	NO	Parent sample	0-2
SS16C FD	SS16C	SSS	09/02/2011	FD	NO	Field duplicate	0-2
SS16C_max	SS16C	SSS	09/02/2011	N	Yes	--	0-2
SS17B	SS17B	SSS	09/02/2011	N	Yes	--	0-2
SS18A	SS18A	SSS	09/02/2011	N	Yes	--	0-2
SS19C	SS19C	SSS	09/02/2011	N	Yes	--	0-2
SS21A	SS21A	SSS	09/02/2011	N	Yes	--	0-2
SS1D	SS1D	SSS	09/02/2011	N	NO	Off trail	0-2
SS24A	SS24A	SSS	09/02/2011	N	Yes	--	0-2
SS25C	SS25C	SSS	09/02/2011	N	Yes	--	0-2
SS27A	SS27A	SSS	09/02/2011	N	Yes	--	0-2
SS28C	SS28C	SSS	09/02/2011	N	Yes	--	0-2
SS30A	SS30A	SSS	09/02/2011	N	Yes	--	0-2
SS33A	SS33A	SSS	09/02/2011	N	Yes	--	0-2

Table 3-2
Sample Information
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Sample Name	Sample Location	Medium	Date	Sample Code	Include Sample?	Reason for Exclusion (a,b)	Depth (ft bgs)
SS34C	SS34C	SSS	09/02/2011	N	Yes	--	0-2
SS35B	SS35B	SSS	09/02/2011	N	Yes	--	0-2
SS36A	SS36A	SSS	09/02/2011	N	Yes	--	0-2
SS37C	SS37C	SSS	09/02/2011	N	Yes	--	0-2
SS2D	SS2D	SSS	09/02/2011	N	NO	Off trail	0-2
SS3D	SS3D	SSS	09/02/2011	N	NO	Off trail	0-2
SS39A	SS39A	SSS	09/02/2011	N	Yes	--	0-2
SS40C	SS40C	SSS	09/02/2011	N	Yes	--	0-2
SS42A	SS42A	SSS	09/02/2011	N	Yes	--	0-2
SS43C	SS43C	SSS	09/02/2011	N	Yes	--	0-2
SS4D	SS4D	SSS	09/02/2011	N	NO	Off trail	0-2
SS45A	SS45A	SSS	09/02/2011	N	Yes	--	0-2
SS46C	SS46C	SSS	09/02/2011	N	Yes	--	0-2
SS47B	SS47B	SSS	09/02/2011	N	Yes	--	0-2
SS48A	SS48A	SSS	09/02/2011	N	Yes	--	0-2
SS5D	SS5D	SSS	09/02/2011	N	NO	Off trail	0-2
SS51A	SS51A	SSS	09/02/2011	N	Yes	--	0-2
SS6D	SS6D	SSS	09/02/2011	N	NO	Off trail	0-2
SS53B	SS53B	SSS	09/08/2011	N	Yes	--	0-2
SS54A	SS54A	SSS	09/08/2011	N	Yes	--	0-2
SS55C	SS55C	SSS	09/08/2011	N	Yes	--	0-2
SS56B	SS56B	SSS	09/08/2011	N	Yes	--	0-2
SS60A	SS60A	SSS	09/08/2011	N	Yes	--	0-2
SS1P	SS1P	SSS	09/08/2011	N	NO	Off trail	0-2
SS57A	SS57A	SSS	09/08/2011	N	NO	Parent sample	0-2
SS57A FD	SS57A	SSS	09/08/2011	FD	NO	Field duplicate	0-2
SS57A_max	SS57A	SSS	09/08/2011	N	Yes	--	0-2
SB 1	SB 1	SSS	12/06/2018	N	Yes	--	0-0.5
SB 2	SB 2	SSS	12/06/2018	N	Yes	--	0-0.5
SB 3	SB 3	SSS	12/06/2018	N	Yes	--	0-0.5
SB 4	SB 4	SSS	12/06/2018	N	Yes	--	0-0.5
SB 5	SB 5	SSS	12/06/2018	N	Yes	--	0-0.5
SB 6	SB 6	SSS	12/06/2018	N	Yes	--	0-0.5
SB 7	SB 7	SSS	12/06/2018	N	Yes	--	0-0.5
SB 8	SB 8	SSS	12/06/2018	N	Yes	--	0-0.5
SB 9	SB 9	SSS	12/06/2018	N	Yes	--	0-0.5
SB 10	SB 10	SSS	12/06/2018	N	Yes	--	0-0.5
SB 11	SB 11	SSS	12/06/2018	N	Yes	--	0-0.5
SB 12	SB 12	SSS	12/06/2018	N	Yes	--	0-0.5
SB 13	SB 13	SSS	12/06/2018	N	Yes	--	0-0.5
SB 14	SB 14	SSS	12/06/2018	N	Yes	--	0-0.5
SB 15	SB 15	SSS	12/06/2018	N	Yes	--	0-0.5

Notes:
(a) Per duplicate handling procedure, parent samples and field duplicates were excluded from risk evaluation after the composite sample (denoted with "_max") was created.
(b) Samples classified as "off trail" in the 2011 investigation were excluded from screening.

Table 3-2
Sample Information
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Sample Name	Sample Location	Medium	Date	Sample Code	Include Sample?	Reason for Exclusion (a,b)	Depth (ft bgs)

FD = field duplicate
ft bgs = feet below ground surface
N = normal
SSS = surface soil
SSB = subsurface soil
SD = sediment
SPLP-SSS = SPLP sample taken at surface soil sample location
SPLP-SD = SPLP sample taken at sediment sample location

Table 4-1
Exposure Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

		Recreational User				Industrial Outdoor Worker		Construction Worker	
		Child		Adult					
Variable	**Units**	**Value**	**Source**	**Value**	**Source**	**Value**	**Source**	**Value**	**Source**
Skin Adherence Factor (AF)	mg/cm^2	0.2	EPA Default	0.07	EPA Default	0.12	EPA Default	0.3	EPA Default
Skin Surface Area (SA)	cm^2/day	2373	EPA Default	6032	EPA Default	3527	EPA Default	3527	EPA Default
Averaging Time (AT)	days	365	EPA Default	365	EPA Default	365	EPA Default	365	EPA Default
Body Weight (BW)	kg	15	EPA Default	80	EPA Default	80	EPA Default	80	EPA Default
Soil-Ingestion Rate (IRS)	mg/day	200	EPA Default	100	EPA Default	100	EPA Default	330	EPA Default
Exposure Duration (ED)	years	6	EPA Default	20	EPA Default	25	EPA Default	1	EPA Default
Exposure Frequency (EF)	days/year	70	Site-Specific (a)	70	Site-Specific (a)	225	EPA Default	250	EPA Default
Exposure Time (ET)	hours/day	4	Site-Specific (a)	4	Site-Specific (a)	8	EPA Default	8	EPA Default

Notes:
Forward risk calculations for recreational user (child/adult) and industrial outdoor worker were done using the ORNL RAIS online risk calculator. VURAM was used to evaluate risk for the construction worker.
Oak Ridge National Laboratory (ORNL), 2022. United States Department of Energy ORNL Risk Assessment Information System (RAIS) risk calculator.
Virginia Department of Environmental Quality (VDEQ), 2022. Virginia Unified Risk Assessment Model (VURAM) Version 3.2. Januar

(a) Recreational user is assumed to spend 70 days per year at the trail for 4 hours each day. Site-specific scenario was suggested by West Virginia Department of Environmental Protection (WVDEP).
EPA = United States Environmental Protection Agency
cm^2 = square centimeters
kg = kilograms
mg = milligrams

Table 4-2
Summary Statistics for the Chemicals of Concern
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Exposure Media and COPCs [3]	Detection Frequency	Summary Statistics						Selected EPC		Selected WV Screening Criteria [4]		Rationale for Risk Evaluation [5]
		Minimum Detection	Maximum Detection	Maximum Sample Location	KM Mean [2]	95% UCL (Distribution) [1,2]						
Surface Soil												
Arsenic	76/79	4.29	107	SS54A (09/08/2011)	19.65	29.33	NP	29.33	UCL	0.68	RES	**Risk evaluation required**
Benzo(a)anthracene	51/68	0.0124	8.99	SS33A (09/02/2011)	0.663	1.294	L	1.294	UCL	1.5	RES	No further action
Benzo(a)pyrene	49/68	0.0156	8.58	SS17B (09/02/2011)	0.762	2.042	L	2.042	UCL	0.11	RES	**Risk evaluation required**
Benzo(b)fluoranthene	55/68	0.0088	15	SS33A (09/02/2011)	1.299	2.031	G	2.031	UCL	1.1	RES	**Risk evaluation required**
Dibenz(a,h)anthracene	40/68	0.0098	1.3	SS17B (09/02/2011)	0.17	0.241	G	0.241	UCL	0.11	RES	**Risk evaluation required**
Total Soil												
Arsenic	91/94	2.8	107	SS54A (09/08/2011)	18.44	26.74	NP	26.74	UCL	0.68	RES	**Risk evaluation required**
Benzo(a)anthracene	57/83	0.0124	8.99	SS33A (09/02/2011)	0.585	0.914	G	0.914	UCL	1.5	RES	No further action
Benzo(a)pyrene	55/83	0.0123	8.58	SS17B (09/02/2011)	0.664	1.013	G	1.013	UCL	0.11	RES	**Risk evaluation required**
Benzo(b)fluoranthene	63/83	0.0088	15	SS33A (09/02/2011)	1.158	1.764	G	1.764	UCL	1.1	RES	**Risk evaluation required**
Dibenz(a,h)anthracene	45/83	0.0098	1.3	SS17B (09/02/2011)	0.145	0.205	G	0.205	UCL	0.11	RES	**Risk evaluation required**

Notes:

COC = Chemical of Concern
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
KM = Kaplan-Meier
UCL = Upper Confidence Limit
WVDEP = West Virginia Department of Environmental Protection

Distribution Key [1]:

Normal	(N)
Gamma	(G)
Lognormal	(L)
Non-Parametric	(NP)

(1) A minimum of five (5) samples with two (2) distinct detects are needed to calculate summary statistics and UCLs but may not be adequate to compute meaningful and reliable results. Therefore, summary statistics and UCLs are only shown if total samples are eight (8) or more.
(2) If the dataset contains nondetects, summary statistics and UCLs are estimated by the KM method.
(3) Chemicals that are not eliminated during the screening evaluation are identified as chemicals of concern (COCs) and carried forward to risk evaluation.
(4) WVDEP De Minimis Screening Levels for Residential Soil (RES) and Industrial Soil (IND), WVDEP 60CSR3 Table 60-3B De Minimis Screening Levels, (December 2021). For total soil, the more conservative of the RES and IND criteria was used for screening (which was RES in all cases).
(5) If any EPCs exceed their relevant benchmark (WVDEP De Minimis Screening Levels), then risk evaluation is required and the chemical is classified as a COC.

Table 4-3
Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Fractional Absorption Factor	Oral RfD (mg/kg-day)	Oral RfD Source	Dermal RfD (mg/kg-day) (1)	Inhalation RfC (mg/m^3)	Inhalation RfC Source	Oral CSF $(mg/kg\text{-}day)^{-1}$	Oral CSF Source	Dermal CSF $(mg/kg\text{-}day)^{-1}$ (2)	Target Organ/ Critical Effects	IUR $(\mu g/m^3)^{-1}$	IUR Source
Arsenic, Inorganic	1	0.0003	IRIS	0.0003	0.000015	CALEPA	1.5	IRIS	1.5	DM, HM, RS	0.0043	IRIS
Benzo[a]pyrene	1	0.0003	IRIS	0.0003	0.000002	IRIS CURRENT	1	IRIS	1	DV, GI, RS	0.0006	IRIS
Benzo(b)fluoranthene	1	NA	NA	NA	NA	NA	0.1	EPA/RPF	0.1	NA	0.00006	EPA/RPF
Dibenz[a,h]anthracene	NA	NA	NA	NA	NA	NA	1	EPA/RPF	NA	NA	0.0006	EPA/RPF

Notes

Chronic toxicity values used for recreational user and industrial outdoor worker in RAIS calculations.
Toxicity values used for construction worker in VURAM documented in **Attachment 3**.
(1) Dermal RfD are calculated by multiplying the oral RfDs by the fractional absorption value.
(2) Dermal CSF are calculated by dividing the oral CSF by the fractional absorption value.
Further toxicity information is available in **Attachment 3**.
NA = not available
RfD = Reference Dose
RfC = Reference Concentration
CSF = Oral Cancer Slope Factor
IUR = Inhalation Unit Risk
CALEPA = California Environmental Protection Agency (https://oehha.ca.gov/chemicals)
IRIS = Integrated Risk Information System (https://www.epa.gov/iris)
PPRTV = Provisional Peer-Reviewed Toxicity Values (https://www.hhpprtv.ornl.gov/)
EPA = United States Environmental Protection Agency
RPF = Relative Potency Factor

Target Organ Systems:
DM = Dermal
DV = Developmental
GI = Gastrointestinal
HM = Hematological
RS = Respiratory

mg/kg-day = milligrams per kilogram-day
$(mg/kg\text{-}day)^{-1}$ = one over milligrams per kilogram-day
$\mu g/m^3$ = micrograms per cubic meter
$(\mu g/m^3)^{-1}$ = one over micrograms per cubic meter
mg/m^3 = milligrams per cubic meter

Table 4-4
Cumulative Non-Cancer Hazard and Cancer Risk Results
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Cumulative Non-Cancer Hazard and Cancer Risk	Recreational User		Industrial Outdoor Worker	Construction Worker
	Child	Adult		
Surface Soil				
Arsenic	0.2	0.02	0.06	0.2
Benzo[a]pyrene	0.02	0.003	0.008	0.03
Benzo(b)fluoranthene	(a)	(a)	(a)	(a)
Dibenz[a,h]anthracene	(a)	(a)	(a)	(a)
Cumulative Non-Cancer HI:	**0.2**	**0.02**	**0.06**	**0.2**
Arsenic	**9E-06**		9E-06	1E-06
Benzo[a]pyrene	**4E-06**		9E-07	1E-07
Benzo(b)fluoranthene	4E-07		9E-08	1E-08
Dibenz[a,h]anthracene	4E-07		1E-07	1E-08
ELCR:	**1E-05**		**1E-05**	**1E-06**
Total Soil				
Arsenic	0.2	0.02	0.05	0.2
Benzo[a]pyrene	0.01	0.001	0.004	0.01
Benzo(b)fluoranthene	(a)	(a)	(a)	(a)
Dibenz[a,h]anthracene	(a)	(a)	(a)	(a)
Cumulative Non-Cancer HI:	**0.2**	**0.02**	**0.05**	**0.2**
Arsenic	**8E-06**		8E-06	1E-06
Benzo[a]pyrene	**2E-06**		4E-07	6E-08
Benzo(b)fluoranthene	3E-07		8E-08	1E-08
Dibenz[a,h]anthracene	4E-07		9E-08	1E-08
ELCR:	**1E-05**		**9E-06**	**1E-06**

Notes:

WVDEP guidance defines the commercial/industrial target cancer risk (TCR) as 1E-05 and the residential TCR as 1E-06 (WVDEP, 2020).

Bold red values indicate that the cancer risk exceeded the TCR.

(a) No oral non-cancer toxicity data (i.e. reference dose) or inhalation non-cancer toxicity data (i.e. reference concentration) is available for the chemical to calculate a hazard quotient.

ELCR = Excess Lifetime Cancer Risk; HI = hazard index

Cheat River HHRA Attachments: Table of Contents

Attachment 1 COPC Identification	
Table A1-1	Summary of Chemicals Analyzed
Table A1-2	Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Surface Soil (0-2 ft bgs)
Table A1-3	Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Subsurface Soil (2-8 ft bgs)
Table A1-4	Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Sediment (0-0.5 ft bgs)
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	Total Soil Construction Worker Risk Calculations
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Attachment 1
COPC Identification

Table A1-1
Summary of Chemicals Analyzed
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

		Number of Samples per Medium				
Analyte	**Class**	**Surface Soil**	**Subsurface Soil**	**Sediment**	**SPLP-Surface Soil**	**SPLP-Sediment**
Naphthalene	VOC	12	15	11	--	--
Chlorobenzene	VOC-SPLP	--	--	--	3	7
Naphthalene	VOC-SPLP	--	--	--	5	7
Tetrachloroethene	VOC-SPLP	--	--	--	3	7
1,2,4-Trichlorobenzene	SVOC	41	0	0	--	--
1,2-Dichlorobenzene	SVOC	41	0	0	--	--
1,3-Dichlorobenzene	SVOC	41	0	0	--	--
1,4-Dichlorobenzene	SVOC	41	0	0	--	--
1-Methylnaphthalene	SVOC	41	0	0	--	--
2,4,5-Trichlorophenol	SVOC	41	0	0	--	--
2,4,6-Trichlorophenol	SVOC	41	0	0	--	--
2,4-Dichlorophenol	SVOC	41	0	0	--	--
2,4-Dimethylphenol	SVOC	41	0	0	--	--
2,4-Dinitrophenol	SVOC	41	0	0	--	--
2,4-Dinitrotoluene	SVOC	41	0	0	--	--
2,6-Dinitrotoluene	SVOC	41	0	0	--	--
2-Chloronaphthalene	SVOC	41	0	0	--	--
2-Chlorophenol	SVOC	41	0	0	--	--
2-Methylnaphthalene	SVOC	41	0	0	--	--
2-Methylphenol	SVOC	41	0	0	--	--
2-Nitroaniline	SVOC	41	0	0	--	--
2-Nitrophenol	SVOC	41	0	0	--	--
3 & 4-Methylphenol	SVOC	41	0	0	--	--
3,3'-Dichlorobenzidine	SVOC	41	0	0	--	--
3-Nitroaniline	SVOC	41	0	0	--	--
4,6-Dinitro-2-methylphenol	SVOC	41	0	0	--	--
4-Bromophenyl phenyl ether	SVOC	41	0	0	--	--
4-Chloro-3-methylphenol	SVOC	41	0	0	--	--
4-Chloroaniline	SVOC	41	0	0	--	--
4-Chlorophenyl phenyl ether	SVOC	41	0	0	--	--
4-Nitroaniline	SVOC	41	0	0	--	--
4-Nitrophenol	SVOC	41	0	0	--	--
Acenaphthene	SVOC	68	15	11	--	--
Acenaphthylene	SVOC	68	15	11	--	--
Anthracene	SVOC	68	15	11	--	--
Benzo(a)anthracene	SVOC	68	15	11	--	--
Benzo(a)pyrene	SVOC	68	15	11	--	--
Benzo(b)fluoranthene	SVOC	68	15	11	--	--
Benzo(g,h,i)perylene	SVOC	68	15	11	--	--
Benzo(k)fluoranthene	SVOC	67	15	11	--	--
bis(2-Chloroethoxy)methane	SVOC	41	0	0	--	--
bis(2-Chloroethyl)ether	SVOC	41	0	0	--	--

Table A1-1
Summary of Chemicals Analyzed
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

		Number of Samples per Medium				
Analyte	**Class**	**Surface Soil**	**Subsurface Soil**	**Sediment**	**SPLP-Surface Soil**	**SPLP-Sediment**
bis(2-Chloroisopropyl)ether	SVOC	41	0	0	--	--
bis(2-Ethylhexyl)phthalate	SVOC	41	0	0	--	--
Butyl benzyl phthalate	SVOC	41	0	0	--	--
Carbazole	SVOC	41	0	0	--	--
Chrysene	SVOC	68	15	11	--	--
Dibenz(a,h)anthracene	SVOC	68	15	11	--	--
Dibenzofuran	SVOC	41	0	0	--	--
Diethyl phthalate	SVOC	41	0	0	--	--
Dimethyl phthalate	SVOC	41	0	0	--	--
Di-n-butyl phthalate	SVOC	41	0	0	--	--
Di-n-octyl phthalate	SVOC	41	0	0	--	--
Fluoranthene	SVOC	68	15	11	--	--
Fluorene	SVOC	68	15	11	--	--
Hexachlorobenzene	SVOC	41	0	0	--	--
Hexachlorobutadiene	SVOC	41	0	0	--	--
Hexachlorocyclopentadiene	SVOC	41	0	0	--	--
Hexachloroethane	SVOC	41	0	0	--	--
Indeno(1,2,3-cd)pyrene	SVOC	68	15	11	--	--
Isophorone	SVOC	41	0	0	--	--
Naphthalene	SVOC	68	15	11	--	--
Nitrobenzene	SVOC	41	0	0	--	--
N-Nitroso-di-n-propylamine	SVOC	41	0	0	--	--
N-Nitrosodiphenylamine	SVOC	41	0	0	--	--
Pentachlorophenol	SVOC	41	0	0	--	--
Phenanthrene	SVOC	68	15	11	--	--
Phenol	SVOC	41	0	0	--	--
Pyrene	SVOC	68	15	11	--	--
Acenaphthene	SVOC-SPLP	--	--	--	5	7
Acenaphthylene	SVOC-SPLP	--	--	--	5	7
Anthracene	SVOC-SPLP	--	--	--	5	7
Benzo(a)anthracene	SVOC-SPLP	--	--	--	5	7
Benzo(a)pyrene	SVOC-SPLP	--	--	--	5	7
Benzo(b)fluoranthene	SVOC-SPLP	--	--	--	5	7
Benzo(g,h,i)perylene	SVOC-SPLP	--	--	--	5	7
Benzo(k)fluoranthene	SVOC-SPLP	--	--	--	5	7
Chrysene	SVOC-SPLP	--	--	--	5	7
Dibenz(a,h)anthracene	SVOC-SPLP	--	--	--	5	7
Fluoranthene	SVOC-SPLP	--	--	--	5	7
Fluorene	SVOC-SPLP	--	--	--	5	7
Indeno(1,2,3-cd)pyrene	SVOC-SPLP	--	--	--	5	7
Naphthalene	SVOC-SPLP	--	--	--	5	7
Phenanthrene	SVOC-SPLP	--	--	--	5	7

Table A1-1
Summary of Chemicals Analyzed
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

		Number of Samples per Medium				
Analyte	**Class**	**Surface Soil**	**Subsurface Soil**	**Sediment**	**SPLP-Surface Soil**	**SPLP-Sediment**
Pyrene	SVOC-SPLP	--	--	--	5	7
2,4,5-T	PEST	5	0	0	--	--
2,4,5-TP (Silvex)	PEST	5	0	0	--	--
2,4-D	PEST	5	0	0	--	--
2,4-DB	PEST	5	0	0	--	--
Dinoseb	PEST	5	0	0	--	--
Arsenic	MET	68	15	11	--	--
Lead	MET	68	15	11	--	--
Arsenic	MET-SPLP	--	--	--	5	7
Lead	MET-SPLP	--	--	--	5	7
Percent Moisture	GC	15	15	11	--	--
TPH	GC	15	0	0	--	--

Notes:
Analytes tested with SPLP methods were kept separate since the units differed from the solid matrix.
"--" = not applicable
GC = General Chemistry
MET = Metals
PCB = Polychlorinated Biphenyls
PEST = Pesticides
SVOC = Semi-Volatile Organic Compounds
TPH = total petroleum hydrocarbons
VOC = Volatile Organic Compounds

Table A1-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Surface Soil (0-2 ft bgs)
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
Volatile Organic Compounds (VOC)												
Naphthalene	91-20-3	mg/kg	1/12	0.0149	0.0149	0.0044 - 0.0094	0.0149	MDC	17.9		No	MDC below SL
Semi-volatile Organic Compounds (SVOC)												
1,2,4-Trichlorobenzene	120-82-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	120		No	RL below SL
1,2-Dichlorobenzene	95-50-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	23800		No	RL below SL
1,3-Dichlorobenzene	541-73-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	23800	*	No	RL below SL
1,4-Dichlorobenzene	106-46-7	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	71.1		No	RL below SL
1-Methylnaphthalene	90-12-0	mg/kg	11/41	0.0501	0.387	0.0711 - 1.79	0.387	MDC	87.8		No	MDC below SL
2,4,5-Trichlorophenol	95-95-4	mg/kg	0/41	All ND	All ND	0.924 - 3.49	3.49	RL	31600		No	RL below SL
2,4,6-Trichlorophenol	88-06-2	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	247		No	RL below SL
2,4-Dichlorophenol	120-83-2	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	948		No	RL below SL
2,4-Dimethylphenol	105-67-9	mg/kg	0/41	All ND	All ND	0.213 - 1.79	1.79	RL	6320		No	RL below SL
2,4-Dinitrophenol	51-28-5	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	632		No	MDC below SL
2,4-Dinitrotoluene	121-14-2	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	8.71		No	RL below SL
2,6-Dinitrotoluene	606-20-2	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	1.81		No	RL below SL
2-Chloronaphthalene	91-58-7	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	23900		No	RL below SL
2-Chlorophenol	95-57-8	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	1960		No	RL below SL
2-Methylnaphthalene	91-57-6	mg/kg	17/41	0.0416	0.635	0.0743 - 0.281	0.635	MDC	1200		No	MDC below SL
2-Methylphenol	95-48-7	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	15800		No	RL below SL
2-Nitroaniline	88-74-4	mg/kg	0/41	All ND	All ND	0.924 - 3.49	3.49	RL	3160		No	RL below SL
2-Nitrophenol	88-75-5	mg/kg	0/41	All ND	All ND	0.217 - 1.79	1.79	RL	31.6	*	No	RL below SL
3 & 4-Methylphenol	106-44-5	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	6320		No	RL below SL
3,3'-Dichlorobenzidine	91-94-1	mg/kg	0/41	All ND	All ND	0.384 - 2.79	2.79	RL	6.03		No	RL below SL
3-Nitroaniline	99-09-2	mg/kg	0/41	All ND	All ND	0.404 - 3.49	3.49	RL	3160	*	No	RL below SL
4,6-Dinitro-2-methylphenol	534-52-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	25.3		No	RL below SL
4-Bromophenyl phenyl ether	101-55-3	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	782	*	No	RL below SL
4-Chloro-3-methylphenol	35421-08-0	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	No SL		No	MDC below SL
4-Chloroaniline	106-47-8	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	13.6		No	MDC below SL
4-Chlorophenyl phenyl ether	7005-72-3	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	782	*	No	MDC below SL
4-Nitroaniline	100-01-6	mg/kg	1/41	1.08	1.08	0.924 - 3.49	1.08	MDC	136		No	MDC below SL
4-Nitrophenol	100-02-7	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	31.6	*	No	MDC below SL
Acenaphthene	83-32-9	mg/kg	31/68	0.00333	0.252	0.0073 - 0.281	0.252	MDC	17900		No	MDC below SL
Acenaphthylene	208-96-8	mg/kg	44/68	0.0201	1.72	0.0073 - 0.281	1.72	MDC	17900	*	No	MDC below SL
Anthracene	120-12-7	mg/kg	42/68	0.0114	2.23	0.0073 - 0.281	2.23	MDC	89700		No	MDC below SL
Benzo(a)anthracene	56-55-3	mg/kg	51/68	0.0124	8.99	0.0073 - 0.736	8.99	MDC	5.73		Yes	MDC exceeds SL
Benzo(a)pyrene	50-32-8	mg/kg	49/68	0.0156	8.58	0.0073 - 0.927	8.58	MDC	0.574		Yes	MDC exceeds SL
Benzo(b)fluoranthene	205-99-2	mg/kg	55/68	0.0088	15	0.0073 - 1.36	15	MDC	5.74		Yes	MDC exceeds SL
Benzo(g,h,i)perylene	191-24-2	mg/kg	46/68	0.0087	6.22	0.0073 - 0.598	6.22	MDC	8970	*	No	MDC below SL
Benzo(k)fluoranthene	207-08-9	mg/kg	49/67	0.0074	7.58	0.0073 - 0.938	7.58	MDC	57.4		No	MDC below SL
bis(2-Chloroethoxy)methane	111-91-1	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	948		No	MDC below SL

Table A1-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Surface Soil (0-2 ft bgs)
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
bis(2-Chloroethyl)ether	111-44-4	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	2.45		No	MDC below SL
bis(2-Chloroisopropyl)ether	108-60-1	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	15600		No	MDC below SL
bis(2-Ethylhexyl)phthalate	117-81-7	mg/kg	2/41	0.227	0.433	0.369 - 1.79	0.433	MDC	194		No	MDC below SL
Butyl benzyl phthalate	85-68-7	mg/kg	1/41	0.433	0.433	0.209 - 1.79	0.433	MDC	1430		No	MDC below SL
Carbazole	86-74-8	mg/kg	2/41	0.56	2.17	0.209 - 1.79	2.17	MDC	12000	*	No	MDC below SL
Chrysene	218-01-9	mg/kg	55/68	0.0084	17.1	0.0073 - 0.281	17.1	MDC	574		No	MDC below SL
Dibenz(a,h)anthracene	53-70-3	mg/kg	40/68	0.0098	1.3	0.0073 - 0.281	1.3	MDC	0.574		Yes	MDC exceeds SL
Dibenzofuran	132-64-9	mg/kg	2/41	0.224	0.579	0.209 - 1.79	0.579	MDC	391		No	MDC below SL
Diethyl phthalate	84-66-2	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	253000		No	RL below SL
Dimethyl phthalate	131-11-3	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	253000	*	No	RL below SL
Di-n-butyl phthalate	84-74-2	mg/kg	1/41	0.209	0.209	0.209 - 1.79	0.209	MDC	31600		No	MDC below SL
Di-n-octyl phthalate	117-84-0	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	3160		No	RL below SL
Fluoranthene	206-44-0	mg/kg	59/68	0.0141	33.3	0.0073 - 0.281	33.3	MDC	12000		No	MDC below SL
Fluorene	86-73-7	mg/kg	34/68	0.00732	0.295	0.0073 - 0.281	0.295	MDC	12000		No	MDC below SL
Hexachlorobenzene	118-74-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	1.85		No	RL below SL
Hexachlorobutadiene	87-68-3	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	21.4		No	RL below SL
Hexachlorocyclopentadiene	77-47-4	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	52.1		No	RL below SL
Hexachloroethane	67-72-1	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	35.9		No	RL below SL
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	46/68	0.0101	5.68	0.0073 - 0.281	5.68	MDC	5.74		No	MDC below SL
Isophorone	78-59-1	mg/kg	1/41	0.537	0.537	0.209 - 1.79	0.537	MDC	2860		No	MDC below SL
Naphthalene	91-20-3	mg/kg	41/68	0.0082	0.779	0.0073 - 0.281	0.779	MDC	17.9		No	MDC below SL
Nitrobenzene	98-95-3	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	154		No	RL below SL
N-Nitroso-di-n-propylamine	621-64-7	mg/kg	0/41	All ND	All ND	0.209 - 1.79	1.79	RL	0.388		See DSA	RL exceeds SL
N-Nitrosodiphenylamine	86-30-6	mg/kg	0/41	All ND	All ND	0.203 - 1.79	1.79	RL	554		No	RL below SL
Pentachlorophenol	87-86-5	mg/kg	0/41	All ND	All ND	0.371 - 3.49	3.49	RL	5.1		No	RL below SL
Phenanthrene	85-01-8	mg/kg	48/68	0.0211	3.29	0.0073 - 0.281	3.29	MDC	89700	*	No	MDC below SL
Phenol	108-95-2	mg/kg	1/41	1.79	1.79	0.209 - 1.39	1.79	MDC	94800		No	MDC below SL
Pyrene	129-00-0	mg/kg	58/68	0.0135	31	0.0073 - 0.281	31	MDC	8970		No	MDC below SL
Pesticides (PEST)												
2,4,5-T	93-76-5	mg/kg	5/5	0.0428	0.0551	0.0445 - 0.0445	0.0551	MDC	3160		No	MDC below SL
2,4,5-TP (Silvex)	93-72-1	mg/kg	5/5	0.022	0.0897	0.0229 - 0.0229	0.0897	MDC	2530		No	MDC below SL
2,4-D	94-75-7	mg/kg	5/5	0.0865	0.111	0.09 - 0.09	0.111	MDC	3500		No	MDC below SL
2,4-DB	94-82-6	mg/kg	5/5	0.0865	0.12	0.09 - 0.09	0.12	MDC	No SL		No	MDC below SL
Dinoseb	88-85-7	mg/kg	5/5	0.0865	0.111	0.09 - 0.09	0.111	MDC	316		No	MDC below SL
Metals (MET)												
Arsenic	7440-38-2	mg/kg	66/68	4.29	107	0.98 - 20.9	107	MDC	3.39		Yes	MDC exceeds SL
Lead	7439-92-1	mg/kg	66/68	7.32	55.6	0.98 - 40.4	55.6	MDC	400		No	MDC below SL
General Chemistry (GC)												
Percent Moisture	--	%	15/15	10.7	27.6	0.1 - 0.1	27.6	MDC	No SL		No	MDC below SL
TPH	--	mg/kg	15/15	20.8	202	--	202	MDC	No SL		No	MDC below SL

Table A1-2
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Surface Soil (0-2 ft bgs)
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration	Selected Screening Level (1,2)	COPC Flag (Yes/No)	Rationale for Selection/ Deletion

Notes:
CASRN = Chemical Abstract Services Registry Number
COPC = chemical of potential concern
ft bgs = feet below ground surface
EPA = United States Environmental Protection Agency
MDC = maximum detected concentration
ND = non-detect
RL = reporting limit
SL = screening level
TPH = total petroleum hydrocarbons
mg/kg = milligrams per kilogram
(1) Surface soil samples were screened against site-specific recreational user screening levels (EPA, 2022).
(2) An asterisk "*" indicates that surrogate toxicity information was used to derive a screening level (see **Table A1-7**).
EPA, 2022. Regional Screening Level Calculator dated May 2022.

Table A1-3
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Subsurface Soil (2-8 ft bgs)
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
Volatile Organic Compounds (VOC)												
Naphthalene	91-20-3	mg/kg	1/15	0.0057	0.0057	0.0039 - 0.0105	0.0057	MDC	110		No	MDC below SL
Semi-volatile Organic Compounds (SVOC)												
Acenaphthene	83-32-9	mg/kg	7/15	0.0144	0.836	0.0071 - 0.0102	0.836	MDC	47000		No	MDC below SL
Acenaphthylene	208-96-8	mg/kg	4/15	0.0243	0.77	0.0071 - 0.0102	0.77	MDC	51000		No	MDC below SL
Anthracene	120-12-7	mg/kg	5/15	0.029	0.967	0.0071 - 0.0102	0.967	MDC	350000		No	MDC below SL
Benzo(a)anthracene	56-55-3	mg/kg	6/15	0.0379	2.01	0.0071 - 0.081	2.01	MDC	320		No	MDC below SL
Benzo(a)pyrene	50-32-8	mg/kg	6/15	0.0123	1.8	0.0071 - 0.081	1.8	MDC	21		No	MDC below SL
Benzo(b)fluoranthene	205-99-2	mg/kg	8/15	0.0088	4.58	0.0072 - 0.081	4.58	MDC	210		No	MDC below SL
Benzo(g,h,i)perylene	191-24-2	mg/kg	5/15	0.0462	0.616	0.0071 - 0.0102	0.616	MDC	23000		No	MDC below SL
Benzo(k)fluoranthene	207-08-9	mg/kg	8/15	0.0082	1.21	0.0071 - 0.0102	1.21	MDC	2100		No	MDC below SL
Chrysene	218-01-9	mg/kg	11/15	0.0084	2.36	0.0071 - 0.081	2.36	MDC	21000		No	MDC below SL
Dibenz(a,h)anthracene	53-70-3	mg/kg	5/15	0.018	0.322	0.0071 - 0.0102	0.322	MDC	21		No	MDC below SL
Fluoranthene	206-44-0	mg/kg	10/15	0.008	4.74	0.0072 - 0.081	4.74	MDC	30000		No	MDC below SL
Fluorene	86-73-7	mg/kg	7/15	0.0153	0.896	0.0071 - 0.0757	0.896	MDC	37000		No	MDC below SL
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	5/15	0.0237	0.736	0.0071 - 0.0102	0.736	MDC	210		No	MDC below SL
Naphthalene	91-20-3	mg/kg	8/15	0.0088	0.775	0.0071 - 0.0102	0.775	MDC	110		No	MDC below SL
Phenanthrene	85-01-8	mg/kg	15/15	0.0091	4.7	0.0072 - 0.081	4.7	MDC	350000		No	MDC below SL
Pyrene	129-00-0	mg/kg	9/15	0.0135	4.21	0.0072 - 0.081	4.21	MDC	34000		No	MDC below SL
Metals (MET)												
Arsenic	7440-38-2	mg/kg	15/15	2.8	30.1	0.99 - 1.5	30.1	MDC	30		Yes	MDC exceeds SL
Lead	7439-92-1	mg/kg	15/15	4.4	41	0.99 - 1.5	41	MDC	800		No	MDC below SL
General Chemistry (GC)												
Percent Moisture	--	%	15/15	7.2	35.1	0.1 - 0.1	35.1	MDC	No SL		No	MDC below SL

Notes:
CASRN = Chemical Abstract Services Registry Number
COPC = chemical of potential concern
ft bgs = feet below ground surface
MDC = maximum detected concentration
ND = non-detect
RL = reporting limit
SL = screening level
TPH = total petroleum hydrocarbons
WVDEP = West Virginia Department of Environmental Protection
mg/kg = milligrams per kilogram
(1) Subsurface soil samples were screened against De Minimis Screening Level for Industrial Soil (WVDEP, 2021).
(2) An asterisk "*" indicates that surrogate toxicity information was used to derive a screening level (see **Table A1-7**).
WVDEP, 2021. WVDEP 60CSR3 Table 60-3B De Minimis Screening Levels. December.

Table A1-4
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: Sediment (0-0.5 ft bgs)
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
Volatile Organic Compounds (VOC)												
Naphthalene	91-20-3	mg/kg	0/11	All ND	All ND	0.008 - 0.0214	0.0214	RL	17.9		No	RL below SL
Semi-volatile Organic Compounds (SVOC)												
Acenaphthene	83-32-9	mg/kg	2/11	0.0288	0.116	0.0103 - 0.0325	0.116	MDC	17900		No	MDC below SL
Acenaphthylene	208-96-8	mg/kg	4/11	0.0182	0.0484	0.0103 - 0.0325	0.0484	MDC	17900	*	No	MDC below SL
Anthracene	120-12-7	mg/kg	5/11	0.0331	0.0704	0.0103 - 0.0325	0.0704	MDC	89700		No	MDC below SL
Benzo(a)anthracene	56-55-3	mg/kg	9/11	0.0223	0.241	0.0103 - 0.0325	0.241	MDC	5.73		No	MDC below SL
Benzo(a)pyrene	50-32-8	mg/kg	9/11	0.0262	0.278	0.0103 - 0.0325	0.278	MDC	0.574		No	MDC below SL
Benzo(b)fluoranthene	205-99-2	mg/kg	10/11	0.0268	0.564	0.0103 - 0.0325	0.564	MDC	5.74		No	MDC below SL
Benzo(g,h,i)perylene	191-24-2	mg/kg	9/11	0.0159	0.202	0.0103 - 0.0325	0.202	MDC	8970	*	No	MDC below SL
Benzo(k)fluoranthene	207-08-9	mg/kg	9/11	0.0174	0.175	0.0103 - 0.0325	0.175	MDC	57.4		No	MDC below SL
Chrysene	218-01-9	mg/kg	10/11	0.0203	0.321	0.0103 - 0.0325	0.321	MDC	574		No	MDC below SL
Dibenz(a,h)anthracene	53-70-3	mg/kg	5/11	0.0194	0.0576	0.0103 - 0.0325	0.0576	MDC	0.574		No	MDC below SL
Fluoranthene	206-44-0	mg/kg	10/11	0.0201	0.434	0.0103 - 0.0325	0.434	MDC	12000		No	MDC below SL
Fluorene	86-73-7	mg/kg	2/11	0.0328	0.0391	0.0103 - 0.0325	0.0391	MDC	12000		No	MDC below SL
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	9/11	0.0149	0.174	0.0103 - 0.0325	0.174	MDC	5.74		No	MDC below SL
Naphthalene	91-20-3	mg/kg	8/11	0.0132	0.0855	0.0103 - 0.0325	0.0855	MDC	17.9		No	MDC below SL
Phenanthrene	85-01-8	mg/kg	9/11	0.0378	0.253	0.0103 - 0.0325	0.253	MDC	89700	*	No	MDC below SL
Pyrene	129-00-0	mg/kg	10/11	0.0181	0.485	0.0103 - 0.0325	0.485	MDC	8970		No	MDC below SL
Metals (MET)												
Arsenic	7440-38-2	mg/kg	10/11	5.8	23.9	1.5 - 4.6	23.9	MDC	3.39		Yes	MDC exceeds SL
Lead	7439-92-1	mg/kg	11/11	12.6	43.1	1.5 - 4.6	43.1	MDC	400		No	MDC below SL
General Chemistry (GC)												
Percent Moisture	--	%	11/11	36	79.7	0.1 - 0.1	79.7	MDC	No SL		No	MDC below SL

Notes:
CASRN = Chemical Abstract Services Registry Number
COPC = chemical of potential concern
ft bgs = feet below ground surface
EPA = United States Environmental Protection Agency
MDC = maximum detected concentration
ND = non-detect
RL = reporting limit
SL = screening level
TPH = total petroleum hydrocarbons
mg/kg = milligrams per kilogram
(1) Sediment samples were screened against site-specific recreational user screening levels (EPA, 2022).
(2) An asterisk "*" indicates that surrogate toxicity information was used to derive a screening level (see **Table A1-7**).
EPA, 2022. Regional Screening Level Calculator dated May 2022.

Table A1-5
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: SPLP-Surface Soil
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
Volatile Organic Compounds (VOC) - SPLP												
Chlorobenzene	108-90-7	µg/L	0/3	All ND	All ND	50 - 50	50	RL	2000		No	RL below SL
Naphthalene	91-20-3	µg/L	0/5	All ND	All ND	50 - 50	50	RL	2.4		See DSA	RL exceeds SL
Tetrachloroethene	127-18-4	µg/L	0/3	All ND	All ND	50 - 50	50	RL	100		No	RL below SL
Semi-Volatile Organic Compounds (SVOC) - SPLP												
Acenaphthene	83-32-9	µg/L	1/5	0.1	0.1	0.1 - 0.1	0.1	RL	4800		No	RL below SL
Acenaphthylene	208-96-8	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	4800		No	RL below SL
Anthracene	120-12-7	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	36000		No	RL below SL
Benzo(a)anthracene	56-55-3	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	0.6		No	RL below SL
Benzo(a)pyrene	50-32-8	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	4		No	RL below SL
Benzo(b)fluoranthene	205-99-2	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	5		No	RL below SL
Benzo(g,h,i)perylene	191-24-2	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	12000		No	RL below SL
Benzo(k)fluoranthene	207-08-9	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	50		No	RL below SL
Chrysene	218-01-9	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	500		No	RL below SL
Dibenz(a,h)anthracene	53-70-3	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	0.5		No	RL below SL
Fluoranthene	206-44-0	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	16000		No	RL below SL
Fluorene	86-73-7	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	3000		No	RL below SL
Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	5		No	RL below SL
Naphthalene	91-20-3	µg/L	1/5	0.22	0.22	0.1 - 0.1	0.22	MDC	2.4		No	MDC below SL
Phenanthrene	85-01-8	µg/L	1/5	0.14	0.14	0.1 - 0.1	0.14	MDC	34000		No	MDC below SL
Pyrene	129-00-0	µg/L	0/5	All ND	All ND	0.1 - 0.1	0.1	RL	1580		No	RL below SL
Metals (MET) - SPLP												
Arsenic	7440-38-2	µg/L	0/5	All ND	All ND	25 - 25	25	RL	200		No	RL below SL
Lead	7439-92-1	µg/L	0/5	All ND	All ND	25 - 25	25	RL	300		No	RL below SL

Notes:
CASRN = Chemical Abstract Services Registry Number
COPC = chemical of potential concern
MDC = maximum detected concentration
ND = non-detect
RL = reporting limit
SL = screening level
TPH = total petroleum hydrocarbons
WVDEP = West Virginia Department of Environmental Protection
µg/L = micrograms per liter
(1) SPLP samples were screened using the De Minimis Screening Level for Groundwater multiplied by a factor of 20 to represent the dilution attenuation factor (DAF) (WVDEP, 2021).
(2) An asterisk "*" indicates that surrogate toxicity information was used to derive a screening level (see **Table A1-7**).
WVDEP, 2021. WVDEP 60CSR3 Table 60-3B De Minimis Screening Levels. December.

Table A1-6
Occurrence, Distribution, and Selection of Chemicals of Potential Concern: SPLP-Sediment
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Units	Detection Frequency	Minimum Detected Concentration	Maximum Detected Concentration	Range of Reporting Limits (RLs)	Screening Concentration		Selected Screening Level (1,2)		COPC Flag (Yes/No)	Rationale for Selection/ Deletion
Volatile Organic Compounds (VOC) - SPLP												
Chlorobenzene	108-90-7	µg/L	0/7	All ND	All ND	50 - 50	50	RL	2000		No	RL below SL
Naphthalene	91-20-3	µg/L	0/7	All ND	All ND	50 - 50	50	RL	2.4		See DSA	RL exceeds SL
Tetrachloroethene	127-18-4	µg/L	0/7	All ND	All ND	50 - 50	50	RL	100		No	RL below SL
Semi-Volatile Organic Compounds (SVOC) - SPLP												
Acenaphthene	83-32-9	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	4800		No	RL below SL
Acenaphthylene	208-96-8	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	4800		No	RL below SL
Anthracene	120-12-7	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	36000		No	RL below SL
Benzo(a)anthracene	56-55-3	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	0.6		No	RL below SL
Benzo(a)pyrene	50-32-8	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	4		No	RL below SL
Benzo(b)fluoranthene	205-99-2	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	5		No	RL below SL
Benzo(g,h,i)perylene	191-24-2	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	12000		No	RL below SL
Benzo(k)fluoranthene	207-08-9	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	50		No	RL below SL
Chrysene	218-01-9	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	500		No	RL below SL
Dibenz(a,h)anthracene	53-70-3	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	0.5		No	RL below SL
Fluoranthene	206-44-0	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	16000		No	RL below SL
Fluorene	86-73-7	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	3000		No	RL below SL
Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	5		No	RL below SL
Naphthalene	91-20-3	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	2.4		No	RL below SL
Phenanthrene	85-01-8	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	34000		No	RL below SL
Pyrene	129-00-0	µg/L	0/7	All ND	All ND	0.1 - 0.1	0.1	RL	1580		No	RL below SL
Metals (MET) - SPLP												
Arsenic	7440-38-2	µg/L	0/7	All ND	All ND	25 - 25	25	RL	200		No	RL below SL
Lead	7439-92-1	µg/L	0/7	All ND	All ND	25 - 25	25	RL	300		No	RL below SL
General Chemistry (GC)												
Percent Moisture	--	%	7/7	48.9	80.5	0.1 - 0.1	80.5	MDC	No SL		No	MDC below SL

Notes:
CASRN = Chemical Abstract Services Registry Number
COPC = chemical of potential concern
MDC = maximum detected concentration
ND = non-detect
RL = reporting limit
SL = screening level
TPH = total petroleum hydrocarbons
WVDEP = West Virginia Department of Environmental Protection
µg/L = micrograms per liter
(1) SPLP samples were screened using the De Minimis Screening Level for Groundwater multiplied by a factor of 20 to represent the dilution attenuation factor (DAF) (WVDEP, 2021).
(2) An asterisk "*" indicates that surrogate toxicity information was used to derive a screening level (see **Table A1-7**).
WVDEP, 2021. WVDEP 60CSR3 Table 60-3B De Minimis Screening Levels. December.

Table A1-7
Surrogate Toxicity Used Within HHRA
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Analyte	CASRN	Surrogate	Surrogate CASRN
1,3-Dichlorobenzene	541-73-1	1,2-Dichlorobenzene	95-50-1
2-Nitrophenol	88-75-5	2-Amino-4,6-dinitrophenol	96-91-3
3-Nitroaniline	99-09-2	2-Nitroaniline	88-74-4
4-Bromophenyl phenyl ether	101-55-3	Pentabromodiphenyl ether	32534-81-9
4-Chlorophenyl phenyl ether	7005-72-3	Pentabromodiphenyl ether	32534-81-9
4-Nitrophenol	100-02-7	2-Amino-4,6-dinitrophenol	96-91-3
Acenaphthylene	208-96-8	Acenaphthene	83-32-9
Benzo(g,h,i)perylene	191-24-2	Pyrene	129-00-0
Carbazole	86-74-8	Fluorene	86-73-7
Dimethyl phthalate	131-11-3	Diethyl phthalate	84-66-2
Phenanthrene	85-01-8	Anthracene	120-12-7

CASRN = Chemical Abstracts Service Registry Number

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-Specific Recreator Soil/Sediment Screening Level Inputs

Variable	Recreator Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_b (dry soil bulk density) g/cm^3	1.5	1.5
p_b (dry soil bulk density - mass limit) g/cm^3	1.5	1.5
PEF (particulate emission factor) m^3/kg	1359344438	1359344438
p_s (soil particle density) g/cm^3	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm^2	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm^2	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm^2	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm^2	0.2	0.2
AT_{rec} (averaging time)	365	365
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	0	20678
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	0	85652
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-Specific Recreator Soil/Sediment Screening Level Inputs

Variable	Recreator Soil Default Value	Site-Specific Value
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	0	70
EF_{0-2} (exposure frequency) days/year	0	70
EF_{2-6} (exposure frequency) days/year	0	70
EF_{6-16} (exposure frequency) days/year	0	70
EF_{16-30} (exposure frequency) days/year	0	70
EF_{rec-a} (exposure frequency - adult) days/year	0	70
EF_{rec-c} (exposure frequency - child) days/year	0	70
ET_{rec} (exposure time - recreator) hours/day	0	4
ET_{0-2} (exposure time) hours/day	0	4
ET_{2-6} (exposure time) hours/day	0	4
ET_{6-16} (exposure time) hours/day	0	4
ET_{16-30} (exposure time) hours/day	0	4
ET_{rec-a} (adult exposure time) hours/day	0	4
ET_{rec-c} (child exposure time) hours/day	0	4
THQ (target hazard quotient) unitless	0.1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	0	7350
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	0	33366.667
IRS_{0-2} (soil intake rate) mg/day	200	200
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
TR (target risk) unitless	0.000001	0.000001
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA
Acenaphthene	83-32-9	No	Yes	Organics	-		-		6.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00
Acenaphthylene	208-96-8	No	Yes	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00
Anthracene	120-12-7	No	Yes	Organics	-		-		3.00E-01	I	-		1.00E+00	1.30E-01	1.00E+00
Aroclor 1016	12674-11-2	No	Yes	Organics	7.00E-02	G	2.00E-05	G	7.00E-05	I	-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1221	11104-28-2	No	Yes	Organics	2.00E+00	G	5.71E-04	G	-		-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1232	11141-16-5	No	Yes	Organics	2.00E+00	G	5.71E-04	G	-		-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1242	53469-21-9	No	Yes	Organics	2.00E+00	G	5.71E-04	G	-		-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1248	12672-29-6	No	Yes	Organics	2.00E+00	G	5.71E-04	G	-		-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1254	11097-69-1	No	Yes	Organics	2.00E+00	G	5.71E-04	G	2.00E-05	I	-		1.00E+00	1.40E-01	1.00E+00
Aroclor 1260	11096-82-5	No	Yes	Organics	2.00E+00	G	5.71E-04	G	-		-		1.00E+00	1.40E-01	1.00E+00
Arsenic, Inorganic	7440-38-2	No	No	Inorganics	1.50E+00	I	4.30E-03	I	3.00E-04	I	1.50E-05	C	1.00E+00	3.00E-02	6.00E-01
Benz[a]anthracene	56-55-3	Yes	Yes	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00
Benzo[a]pyrene	50-32-8	Yes	No	Organics	1.00E+00	I	6.00E-04	I	3.00E-04	I	2.00E-06	I	1.00E+00	1.30E-01	1.00E+00
Benzo[b]fluoranthene	205-99-2	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00
Benzo[g,h,i]perylene	191-24-2	No	No	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00
Benzo[k]fluoranthene	207-08-9	Yes	No	Organics	1.00E-02	E	6.00E-06	E	-		-		1.00E+00	1.30E-01	1.00E+00
Bis(2-chloro-1-methylethyl) ether	108-60-1	No	Yes	Organics	-		-		4.00E-02	I	-		1.00E+00	-	1.00E+00
Bis(2-chloroethoxy)methane	111-91-1	No	No	Organics	-		-		3.00E-03	P	-		1.00E+00	1.00E-01	1.00E+00
Bis(2-chloroethyl)ether	111-44-4	No	Yes	Organics	1.10E+00	I	3.30E-04	I	-		-		1.00E+00	-	1.00E+00
Bis(2-ethylhexyl)phthalate	117-81-7	No	No	Organics	1.40E-02	I	2.40E-06	C	2.00E-02	I	-		1.00E+00	1.00E-01	1.00E+00
Bromodiphenyl Ether, p-	101-55-3	No	Yes	Organics	-		-		-		-		1.00E+00	-	1.00E+00

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA
Butanoic acid, 4-(2,4-dichlorophenoxy)-	94-82-6	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Butyl Benzyl Phthalate	85-68-7	No	No	Organics	1.90E-03	P	-		2.00E-01	I	-		1.00E+00	1.00E-01	1.00E+00
Carbazole	86-74-8	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Chloro-4-methylphenol	35421-08-0	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Chloroaniline, p-	106-47-8	No	No	Organics	2.00E-01	P	-		5.00E-04	P	-		1.00E+00	1.00E-01	1.00E+00
Chlorobenzene	108-90-7	No	Yes	Organics	-		-		2.00E-02	I	5.00E-02	P	1.00E+00	-	1.00E+00
Chloronaphthalene, Beta-	91-58-7	No	Yes	Organics	-		-		8.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00
Chlorophenol, 2-	95-57-8	No	Yes	Organics	-		-		5.00E-03	I	-		1.00E+00	-	1.00E+00
Chlorophenyl phenyl ether, 4-	7005-72-3	No	Yes	Organics	-		-		-		-		1.00E+00	-	1.00E+00
Chrysene	218-01-9	Yes	No	Organics	1.00E-03	E	6.00E-07	E	-		-		1.00E+00	1.30E-01	1.00E+00
Cresol, o-	95-48-7	No	No	Organics	-		-		5.00E-02	I	6.00E-01	C	1.00E+00	1.00E-01	1.00E+00
Cresol, p-	106-44-5	No	No	Organics	-		-		2.00E-02	P	6.00E-01	C	1.00E+00	1.00E-01	1.00E+00
Dibenz[a,h]anthracene	53-70-3	Yes	No	Organics	1.00E+00	E	6.00E-04	E	-		-		1.00E+00	1.30E-01	1.00E+00
Dibenzofuran	132-64-9	No	Yes	Organics	-		-		1.00E-03	X	-		1.00E+00	-	1.00E+00
Dibutyl Phthalate	84-74-2	No	No	Organics	-		-		1.00E-01	I	-		1.00E+00	1.00E-01	1.00E+00
Dichlorobenzene, 1,2-	95-50-1	No	Yes	Organics	-		-		9.00E-02	I	2.00E-01	H	1.00E+00	-	1.00E+00
Dichlorobenzene, 1,3-	541-73-1	No	Yes	Organics	-		-		-		-		1.00E+00	-	1.00E+00
Dichlorobenzene, 1,4-	106-46-7	No	Yes	Organics	5.40E-03	C	1.10E-05	C	7.00E-02	A	8.00E-01	I	1.00E+00	-	1.00E+00
Dichlorobenzidine, 3,3'-	91-94-1	No	No	Organics	4.50E-01	I	3.40E-04	C	-		-		1.00E+00	1.00E-01	1.00E+00
Dichlorophenol, 2,4-	120-83-2	No	No	Organics	-		-		3.00E-03	I	-		1.00E+00	1.00E-01	1.00E+00
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	No	No	Organics	-		-		1.00E-02	I	-		1.00E+00	5.00E-02	1.00E+00

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA
Diethyl Phthalate	84-66-2	No	No	Organics	-		-		8.00E-01	I	-		1.00E+00	1.00E-01	1.00E+00
Dimethylphenol, 2,4-	105-67-9	No	No	Organics	-		-		2.00E-02	I	-		1.00E+00	1.00E-01	1.00E+00
Dimethylphthalate	131-11-3	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Dinitro-o-cresol, 4,6-	534-52-1	No	No	Organics	-		-		8.00E-05	X	-		1.00E+00	1.00E-01	1.00E+00
Dinitrophenol, 2,4-	51-28-5	No	No	Organics	-		-		2.00E-03	I	-		1.00E+00	1.00E-01	1.00E+00
Dinitrotoluene, 2,4-	121-14-2	No	No	Organics	3.10E-01	C	8.90E-05	C	2.00E-03	I	-		1.00E+00	1.02E-01	1.00E+00
Dinitrotoluene, 2,6-	606-20-2	No	No	Organics	1.50E+00	P	-		3.00E-04	X	-		1.00E+00	9.90E-02	1.00E+00
Dinoseb	88-85-7	No	No	Organics	-		-		1.00E-03	I	-		1.00E+00	1.00E-01	1.00E+00
Fluoranthene	206-44-0	No	No	Organics	-		-		4.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00
Fluorene	86-73-7	No	Yes	Organics	-		-		4.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00
Hexachlorobenzene	118-74-1	No	Yes	Organics	1.60E+00	I	4.60E-04	I	1.00E-05	P	-		1.00E+00	-	1.00E+00
Hexachlorobutadiene	87-68-3	No	Yes	Organics	7.80E-02	I	2.20E-05	I	1.00E-03	P	-		1.00E+00	-	1.00E+00
Hexachlorocyclopentadiene	77-47-4	No	Yes	Organics	-		-		6.00E-03	I	2.00E-04	I	1.00E+00	-	1.00E+00
Hexachloroethane	67-72-1	No	Yes	Organics	4.00E-02	I	1.10E-05	C	7.00E-04	I	3.00E-02	I	1.00E+00	-	1.00E+00
Indeno[1,2,3-cd]pyrene	193-39-5	Yes	No	Organics	1.00E-01	E	6.00E-05	E	-		-		1.00E+00	1.30E-01	1.00E+00
Isophorone	78-59-1	No	No	Organics	9.50E-04	I	-		2.00E-01	I	2.00E+00	C	1.00E+00	1.00E-01	1.00E+00
Lead and Compounds	7439-92-1	No	No	Inorganics	-		-		-		-		1.00E+00	-	1.00E+00
Methylnaphthalene, 1-	90-12-0	No	Yes	Organics	2.90E-02	P	-		7.00E-02	A	-		1.00E+00	1.30E-01	1.00E+00
Methylnaphthalene, 2-	91-57-6	No	Yes	Organics	-		-		4.00E-03	I	-		1.00E+00	1.30E-01	1.00E+00
Naphthalene	91-20-3	No	Yes	Organics	1.20E-01	C	3.40E-05	C	2.00E-02	I	3.00E-03	I	1.00E+00	1.30E-01	1.00E+00

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	CAS Number	Mutagen?	Volatile?	Chemical Type	SF_o(mg/kg-day)$^{-1}$	SF_o Ref	IUR (ug/m^3)$^{-1}$	IUR Ref	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	GIABS	ABS	RBA
Nitroaniline, 2-	88-74-4	No	No	Organics	-		-		1.00E-02	X	5.00E-05	X	1.00E+00	1.00E-01	1.00E+00
Nitroaniline, 3-	99-09-2	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Nitroaniline, 4-	100-01-6	No	No	Organics	2.00E-02	P	-		4.00E-03	P	6.00E-03	P	1.00E+00	1.00E-01	1.00E+00
Nitrobenzene	98-95-3	No	Yes	Organics	-		4.00E-05	I	2.00E-03	I	9.00E-03	I	1.00E+00	-	1.00E+00
Nitrophenol, 2-	88-75-5	No	Yes	Organics	-		-		-		-		1.00E+00	-	1.00E+00
Nitrophenol, 4-	100-02-7	No	No	Organics	-		-		-		-		1.00E+00	1.00E-01	1.00E+00
Nitroso-di-N-propylamine, N-	621-64-7	No	No	Organics	7.00E+00	I	2.00E-03	C	-		-		1.00E+00	1.00E-01	1.00E+00
Nitrosodiphenylamine, N-	86-30-6	No	No	Organics	4.90E-03	I	2.60E-06	C	-		-		1.00E+00	1.00E-01	1.00E+00
Octyl Phthalate, di-N-	117-84-0	No	No	Organics	-		-		1.00E-02	P	-		1.00E+00	1.00E-01	1.00E+00
Pentachlorophenol	87-86-5	No	No	Organics	4.00E-01	I	5.10E-06	C	5.00E-03	I	-		1.00E+00	2.50E-01	1.00E+00
Phenanthrene	85-01-8	No	Yes	Organics	-		-		-		-		1.00E+00	1.30E-01	1.00E+00
Phenol	108-95-2	No	No	Organics	-		-		3.00E-01	I	2.00E-01	C	1.00E+00	1.00E-01	1.00E+00
Pyrene	129-00-0	No	Yes	Organics	-		-		3.00E-02	I	-		1.00E+00	1.30E-01	1.00E+00
Tetrachloroethylene	127-18-4	No	Yes	Organics	2.10E-03	I	2.60E-07	I	6.00E-03	I	4.00E-02	I	1.00E+00	-	1.00E+00
Trichlorobenzene, 1,2,4-	120-82-1	No	Yes	Organics	2.90E-02	P	-		1.00E-02	I	2.00E-03	P	1.00E+00	-	1.00E+00
Trichlorophenol, 2,4,5-	95-95-4	No	No	Organics	-		-		1.00E-01	I	-		1.00E+00	1.00E-01	1.00E+00
Trichlorophenol, 2,4,6-	88-06-2	No	No	Organics	1.10E-02	I	3.10E-06	I	1.00E-03	P	-		1.00E+00	1.00E-01	1.00E+00
Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	No	No	Organics	-		-		1.00E-02	I	-		1.00E+00	1.00E-01	1.00E+00
Trichlorophenoxypropionic acid, -2,4,5	93-72-1	No	No	Organics	-		-		8.00E-03	I	-		1.00E+00	1.00E-01	1.00E+00

Output generated 20MAY2022:15:00:00
Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; max = ceiling limit exceeded; sat = Csat exceeded.

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)
Acenaphthene	-	3.90E+00	5.03E+03	3.02E+01	1.84E-04	7.52E-03	PHYSPROP	5.52E+02	PHYSPROP	8.03E+02	YAWS	PAH	5.06E-02
Acenaphthylene	-	1.61E+01	5.03E+03	3.02E+01	1.14E-04	4.66E-03	PHYSPROP	5.53E+02	PHYSPROP	7.92E+02	YAWS	PAH	4.50E-02
Anthracene	-	4.34E-02	1.64E+04	9.82E+01	5.56E-05	2.27E-03	PHYSPROP	6.13E+02	PHYSPROP	8.73E+02	YAWS	PAH	3.90E-02
Aroclor 1016	-	4.20E-01	4.77E+04	2.86E+02	2.00E-04	8.18E-03	EPI	6.14E+02	EPI	8.94E+02	Approx. from Tcrit=1.5xTBoil	PCB	2.54E-02
Aroclor 1221	-	1.50E+01	8.40E+03	5.04E+01	2.28E-04	9.32E-03	PHYSPROP	5.47E+02	EPI	8.45E+02	Approx. from Tcrit=1.5xTBoil	PCB	3.25E-02
Aroclor 1232	-	1.45E+00	8.40E+03	5.04E+01	7.36E-04	3.01E-02	EPI	5.47E+02	EPI	8.45E+02	Approx. from Tcrit=1.5xTBoil	PCB	3.34E-02
Aroclor 1242	-	2.77E-01	7.81E+04	4.69E+02	3.43E-04	1.40E-02	PHYSPROP	6.33E+02	EPI	8.97E+02	Approx. from Tcrit=1.5xTBoil	PCB	2.39E-02
Aroclor 1248	-	1.00E-01	7.65E+04	4.59E+02	4.40E-04	1.80E-02	PHYSPROP	6.13E+02	EPI	9.20E+02	Approx. from Tcrit=1.5xTBoil	PCB	2.41E-02
Aroclor 1254	-	4.30E-02	1.31E+05	7.83E+02	2.83E-04	1.16E-02	PHYSPROP	6.51E+02	EPI	9.57E+02	Approx. from Tcrit=1.5xTBoil	PCB	2.37E-02
Aroclor 1260	-	1.44E-02	3.50E+05	2.10E+03	3.36E-04	1.37E-02	PHYSPROP	6.89E+02	EPI	9.87E+02	Approx. from Tcrit=1.5xTBoil	PCB	2.20E-02
Arsenic, Inorganic	-	-	-	2.90E+01	-	-		8.88E+02	PHYSPROP	1.67E+03	CRC	INORGANIC	-
Benz[a]anthracene	-	9.40E-03	1.77E+05	1.06E+03	1.20E-05	4.91E-04	PHYSPROP	7.11E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02
Benzo[a]pyrene	-	1.62E-03	5.87E+05	-	4.57E-07	1.87E-05	PHYSPROP	7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	PAH	2.55E-02
Benzo[b]fluoranthene	-	1.50E-03	5.99E+05	-	6.57E-07	2.69E-05	PHYSPROP	7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	PAH	2.50E-02
Benzo[g,h,i]perylene	-	2.60E-04	1.95E+06	-	3.31E-07	1.35E-05	PHYSPROP	7.59E+02	EPI	1.09E+03	Jobak Method	PAH	2.39E-02
Benzo[k]fluoranthene	-	8.00E-04	5.87E+05	-	5.84E-07	2.39E-05	PHYSPROP	7.53E+02	PHYSPROP	1.02E+03	EPA 2001 Fact Sheet	PAH	2.50E-02
Bis(2-chloro-1-methylethyl) ether	1.02E+03	1.70E+03	8.29E+01	4.98E-01	7.42E-05	3.03E-03	EPI	4.60E+02	PHYSPROP	6.90E+02	Approx. from Tcrit=1.5xTBoil	VOC	3.99E-02
Bis(2-chloroethoxy)methane	-	7.80E+03	1.44E+01	-	3.85E-06	1.57E-04	EPI	4.91E+02	PHYSPROP	7.37E+02	Approx. from Tcrit=1.5xTBoil	SVOC	6.12E-02
Bis(2-chloroethyl)ether	5.05E+03	1.72E+04	3.22E+01	1.93E-01	1.70E-05	6.95E-04	EPI	4.52E+02	PHYSPROP	6.66E+02	YAWS	VOC	5.67E-02
Bis(2-ethylhexyl)phthalate	-	2.70E-01	1.20E+05	-	2.70E-07	1.10E-05	EPI	6.57E+02	PHYSPROP	8.35E+02	CRC	SVOC	1.73E-02
Bromodiphenyl Ether, p-	2.69E+01	1.45E+00	3.08E+03	1.85E+01	1.17E-04	4.78E-03	PHYSPROP	5.83E+02	PHYSPROP	-		VOC	2.78E-02

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)
Butanoic acid, 4-(2,4-dichlorophenoxy)-	-	4.60E+01	3.70E+02	-	2.29E-09	9.36E-08	PHYSPROP	5.98E+02	PHYSPROP	8.96E+02	Approx. from Tcrit=1.5xTBoil	HERB	2.58E-02
Butyl Benzyl Phthalate	-	2.69E+00	7.16E+03	-	1.26E-06	5.15E-05	EPI	6.43E+02	PHYSPROP	9.65E+02	Approx. from Tcrit=1.5xTBoil	SVOC	2.08E-02
Carbazole	-	1.80E+00	9.16E+03	-	1.16E-07	4.74E-06	PHYSPROP	6.28E+02	PHYSPROP	8.99E+02	YAWS	SVOC	4.17E-02
Chloro-4-methylphenol	-	-	-	-	-	-		-		-		SVOC	-
Chloroaniline, p-	-	3.90E+03	1.13E+02	-	1.16E-06	4.74E-05	EPI	5.05E+02	PHYSPROP	7.54E+02	YAWS	SVOC	7.04E-02
Chlorobenzene	7.61E+02	4.98E+02	2.34E+02	1.40E+00	3.11E-03	1.27E-01	PHYSPROP	4.05E+02	PHYSPROP	6.32E+02	CRC	VOC	7.21E-02
Chloronaphthalene, Beta-	-	1.17E+01	2.48E+03	1.49E+01	3.20E-04	1.31E-02	PHYSPROP	5.29E+02	PHYSPROP	7.85E+02	YAWS	PAH	4.47E-02
Chlorophenol, 2-	2.74E+04	1.13E+04	3.88E+02	2.33E+00	1.12E-05	4.58E-04	PHYSPROP	4.48E+02	PHYSPROP	6.75E+02	YAWS	VOC	6.61E-02
Chlorophenyl phenyl ether, 4-	-	3.30E+00	3.08E+03	1.85E+01	9.00E-05	3.68E-03	PHYSPROP	5.58E+02	PHYSPROP	-		VOC	2.69E-02
Chrysene	-	2.00E-03	1.81E+05	-	5.23E-06	2.14E-04	PHYSPROP	7.21E+02	PHYSPROP	9.79E+02	YAWS	PAH	2.61E-02
Cresol, o-	-	2.59E+04	3.07E+02	-	1.20E-06	4.91E-05	PHYSPROP	4.64E+02	PHYSPROP	6.98E+02	CRC	SVOC	7.28E-02
Cresol, p-	-	2.15E+04	3.00E+02	-	1.00E-06	4.09E-05	PHYSPROP	4.75E+02	PHYSPROP	7.05E+02	CRC	SVOC	7.24E-02
Dibenz[a,h]anthracene	-	2.49E-03	1.91E+06	-	1.41E-07	5.76E-06	EPI	7.97E+02	PHYSPROP	9.90E+02	EPA 2001 Fact Sheet	PAH	2.36E-02
Dibenzofuran	-	3.10E+00	9.16E+03	5.50E+01	2.13E-04	8.71E-03	EPI	5.60E+02	PHYSPROP	8.24E+02	CRC	FURAN	6.51E-02
Dibutyl Phthalate	-	1.12E+01	1.16E+03	-	1.81E-06	7.40E-05	PHYSPROP	6.13E+02	PHYSPROP	7.97E+02	CRC	SVOC	2.14E-02
Dichlorobenzene, 1,2-	3.76E+02	1.56E+02	3.83E+02	2.30E+00	1.92E-03	7.85E-02	PHYSPROP	4.53E+02	PHYSPROP	7.05E+02	YAWS	VOC	5.62E-02
Dichlorobenzene, 1,3-	2.97E+02	1.25E+02	3.75E+02	2.25E+00	2.63E-03	1.08E-01	PHYSPROP	4.46E+02	PHYSPROP	6.86E+02	CRC	VOC	5.58E-02
Dichlorobenzene, 1,4-	-	8.13E+01	3.75E+02	2.25E+00	2.41E-03	9.85E-02	PHYSPROP	4.47E+02	PHYSPROP	6.69E+02	CRC	VOC	5.50E-02
Dichlorobenzidine, 3,3'-	-	3.10E+00	3.19E+03	-	2.84E-11	1.16E-09	PHYSPROP	6.41E+02	PHYSPROP	9.62E+02	Approx. from Tcrit=1.5xTBoil	SVOC	4.75E-02
Dichlorophenol, 2,4-	-	5.55E+03	1.47E+02	-	4.29E-06	1.75E-04	EPI	4.83E+02	PHYSPROP	7.25E+02	Approx. from Tcrit=1.5xTBoil	SVOC	4.86E-02
Dichlorophenoxy Acetic Acid, 2,4-	-	6.77E+02	2.96E+01	-	3.54E-08	1.45E-06	EPI	4.33E+02	LANGE	6.50E+02	Approx. from Tcrit=1.5xTBoil	HERB	2.79E-02

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)
Diethyl Phthalate	-	1.08E+03	1.05E+02	-	6.10E-07	2.49E-05	EPI	5.68E+02	PHYSPROP	7.76E+02	CRC	SVOC	2.61E-02
Dimethylphenol, 2,4-	-	7.87E+03	4.92E+02	-	9.51E-07	3.89E-05	PHYSPROP	4.84E+02	PHYSPROP	7.08E+02	CRC	SVOC	6.22E-02
Dimethylphthalate	-	4.00E+03	3.16E+01	-	1.97E-07	8.05E-06	EPI	5.57E+02	PHYSPROP	7.72E+02	CRC	SVOC	2.99E-02
Dinitro-o-cresol, 4,6-	-	1.98E+02	7.54E+02	-	1.40E-06	5.72E-05	PHYSPROP	6.51E+02	PHYSPROP	9.77E+02	Approx. from Tcrit=1.5xTBoil	SVOC	5.59E-02
Dinitrophenol, 2,4-	-	2.79E+03	4.61E+02	-	8.60E-08	3.52E-06	PHYSPROP	6.05E+02	EPI	-		SVOC	4.07E-02
Dinitrotoluene, 2,4-	-	2.00E+02	5.76E+02	-	5.40E-08	2.21E-06	PHYSPROP	5.73E+02	PHYSPROP	8.14E+02	YAWS	SVOC	3.75E-02
Dinitrotoluene, 2,6-	-	1.82E+02	5.87E+02	-	7.47E-07	3.05E-05	EPI	5.73E+02	PHYSPROP	7.70E+02	YAWS	SVOC	3.70E-02
Dinoseb	-	5.20E+01	4.29E+03	-	4.56E-07	1.86E-05	EPI	6.05E+02	PHYSPROP	9.08E+02	Approx. from Tcrit=1.5xTBoil	HERB	2.53E-02
Fluoranthene	-	2.60E-01	5.55E+04	-	8.86E-06	3.62E-04	PHYSPROP	6.57E+02	PHYSPROP	9.05E+02	YAWS	PAH	2.76E-02
Fluorene	-	1.69E+00	9.16E+03	5.50E+01	9.62E-05	3.93E-03	PHYSPROP	5.68E+02	PHYSPROP	8.26E+02	YAWS	PAH	4.40E-02
Hexachlorobenzene	-	6.20E-03	6.20E+03	3.72E+01	1.70E-03	6.95E-02	PHYSPROP	5.98E+02	PHYSPROP	8.25E+02	YAWS	PEST	2.90E-02
Hexachlorobutadiene	1.68E+01	3.20E+00	8.45E+02	5.07E+00	1.03E-02	4.21E-01	PHYSPROP	4.88E+02	PHYSPROP	7.38E+02	YAWS	VOC	2.67E-02
Hexachlorocyclopentadiene	1.57E+01	1.80E+00	1.40E+03	8.42E+00	2.70E-02	1.10E+00	PHYSPROP	5.12E+02	PHYSPROP	7.46E+02	YAWS	PEST	2.72E-02
Hexachloroethane	-	5.00E+01	1.97E+02	1.18E+00	3.89E-03	1.59E-01	PHYSPROP	4.59E+02	PERRY	6.95E+02	YAWS	VOC	3.21E-02
Indeno[1,2,3-cd]pyrene	-	1.90E-04	1.95E+06	-	3.48E-07	1.42E-05	PHYSPROP	8.09E+02	PHYSPROP	1.08E+03	EPA 2001 Fact Sheet	PAH	2.47E-02
Isophorone	-	1.20E+04	6.52E+01	-	6.64E-06	2.71E-04	EPI	4.88E+02	PHYSPROP	7.15E+02	YAWS	SVOC	5.25E-02
Lead and Compounds	-	-	-	9.00E+02	-	-		2.02E+03	CRC	5.40E+03	YAWS	INORGANIC	-
Methylnaphthalene, 1-	3.94E+02	2.58E+01	2.53E+03	1.52E+01	5.14E-04	2.10E-02	PHYSPROP	5.18E+02	PHYSPROP	7.71E+02	CRC	PAH	5.28E-02
Methylnaphthalene, 2-	-	2.46E+01	2.48E+03	1.49E+01	5.18E-04	2.12E-02	PHYSPROP	5.14E+02	PHYSPROP	7.61E+02	CRC	PAH	5.24E-02
Naphthalene	-	3.10E+01	1.54E+03	9.26E+00	4.40E-04	1.80E-02	PHYSPROP	4.91E+02	PHYSPROP	7.48E+02	CRC	PAH	6.05E-02

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Soil Saturation Concentration (mg/kg)	S (mg/L)	K_{oc} (cm^3/g)	K_d (cm^3/g)	HLC (atm-m^3/mole)	Henry's Law Constant Used in Calcs (unitless)	H` and HLC Ref	Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	Chemical Type	D_{ia} (cm^2/s)
Nitroaniline, 2-	-	1.47E+03	1.11E+02	-	5.90E-08	2.41E-06	PHYSPROP	5.57E+02	PHYSPROP	7.84E+02	YAWS	SVOC	5.19E-02
Nitroaniline, 3-	-	1.20E+03	1.09E+02	-	7.91E-09	3.23E-07	PHYSPROP	5.79E+02	PHYSPROP	8.15E+02	YAWS	SVOC	5.19E-02
Nitroaniline, 4-	-	7.28E+02	1.09E+02	-	1.26E-09	5.15E-08	PHYSPROP	6.05E+02	PHYSPROP	8.51E+02	YAWS	SVOC	6.37E-02
Nitrobenzene	3.05E+03	2.09E+03	2.26E+02	1.36E+00	2.40E-05	9.81E-04	PHYSPROP	4.84E+02	PHYSPROP	7.19E+02	YAWS	VOC	6.81E-02
Nitrophenol, 2-	-	2.50E+03	2.97E+02	1.78E+00	1.28E-05	5.23E-04	PHYSPROP	4.89E+02	PHYSPROP	-		VOC	6.05E-02
Nitrophenol, 4-	-	1.16E+04	2.91E+02	-	4.15E-10	1.70E-08	PHYSPROP	5.52E+02	PHYSPROP	-		SVOC	6.41E-02
Nitroso-di-N-propylamine, N-	-	1.30E+04	2.75E+02	-	5.38E-06	2.20E-04	PHYSPROP	4.79E+02	PHYSPROP	-		SVOC	5.64E-02
Nitrosodiphenylamine, N-	-	3.50E+01	2.63E+03	-	1.21E-06	4.95E-05	PHYSPROP	6.32E+02	EPI	-		SVOC	5.59E-02
Octyl Phthalate, di-N-	-	2.20E-02	1.41E+05	-	2.57E-06	1.05E-04	EPI	7.04E+02	EPI	8.40E+02	CRC	SVOC	3.56E-02
Pentachlorophenol	-	1.40E+01	5.92E+02	-	2.45E-08	1.00E-06	PHYSPROP	5.83E+02	EPI	-		HERB	2.95E-02
Phenanthrene	-	1.15E+00	1.67E+04	1.00E+02	4.23E-05	1.73E-03	PHYSPROP	6.13E+02	PHYSPROP	8.69E+02	YAWS	PAH	3.45E-02
Phenol	-	8.28E+04	1.87E+02	-	3.33E-07	1.36E-05	PHYSPROP	4.55E+02	PHYSPROP	6.94E+02	CRC	SVOC	8.34E-02
Pyrene	-	1.35E-01	5.43E+04	3.26E+02	1.19E-05	4.87E-04	PHYSPROP	6.77E+02	PHYSPROP	9.36E+02	YAWS	PAH	2.78E-02
Tetrachloroethylene	1.66E+02	2.06E+02	9.49E+01	5.70E-01	1.77E-02	7.24E-01	PHYSPROP	3.94E+02	PHYSPROP	6.20E+02	YAWS	VOC	5.05E-02
Trichlorobenzene, 1,2,4-	4.04E+02	4.90E+01	1.36E+03	8.14E+00	1.42E-03	5.81E-02	PHYSPROP	4.87E+02	PHYSPROP	7.25E+02	YAWS	VOC	3.96E-02
Trichlorophenol, 2,4,5-	-	1.20E+03	1.60E+03	-	1.62E-06	6.62E-05	EPI	5.20E+02	PHYSPROP	7.80E+02	Approx. from Tcrit=1.5xTBoil	SVOC	3.14E-02
Trichlorophenol, 2,4,6-	-	8.00E+02	3.81E+02	-	2.60E-06	1.06E-04	EPI	5.19E+02	PHYSPROP	7.79E+02	Approx. from Tcrit=1.5xTBoil	SVOC	3.14E-02
Trichlorophenoxyacetic Acid, 2,4,5-	-	2.78E+02	1.07E+02	-	8.68E-09	3.55E-07	PHYSPROP	6.22E+02	EPI	-		HERB	2.89E-02
Trichlorophenoxypropionic acid, -2,4,5	-	7.10E+01	1.75E+02	-	9.06E-09	3.70E-07	PHYSPROP	6.26E+02	EPI	-		HERB	2.34E-02

Output generated 20MAY2022:15:00:00
Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; max = ceiling limit exceeded; sat = Csat exceeded.

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)
Acenaphthene	8.33E-06	6.72E-07	1.36E+09	1.41E+05	-	1.41E+05	-	-	-	-	2.35E+04	7.61E+04	-
Acenaphthylene	6.98E-06	3.70E-07	1.36E+09	1.89E+05	-	1.89E+05	-	-	-	-	-	-	-
Anthracene	7.85E-06	4.85E-08	1.36E+09	5.23E+05	-	5.23E+05	-	-	-	-	1.17E+05	3.80E+05	-
Aroclor 1016	6.56E-06	3.88E-08	1.36E+09	5.86E+05	-	5.86E+05	4.97E+01	1.26E+02	2.47E+03	3.51E+01	2.74E+01	8.24E+01	-
Aroclor 1221	7.23E-06	3.20E-07	1.36E+09	2.04E+05	-	2.04E+05	1.74E+00	4.41E+00	3.00E+01	1.20E+00	-	-	-
Aroclor 1232	7.52E-06	1.06E-06	1.36E+09	1.12E+05	-	1.12E+05	1.74E+00	4.41E+00	1.65E+01	1.16E+00	-	-	-
Aroclor 1242	6.11E-06	3.81E-08	1.36E+09	5.91E+05	-	5.91E+05	1.74E+00	4.41E+00	8.70E+01	1.23E+00	-	-	-
Aroclor 1248	6.18E-06	5.03E-08	1.36E+09	5.14E+05	-	5.14E+05	1.74E+00	4.41E+00	7.58E+01	1.23E+00	-	-	-
Aroclor 1254	6.10E-06	1.87E-08	1.36E+09	8.43E+05	-	8.43E+05	1.74E+00	4.41E+00	1.24E+02	1.23E+00	7.82E+00	2.35E+01	-
Aroclor 1260	5.61E-06	7.70E-09	1.36E+09	1.31E+06	-	1.31E+06	1.74E+00	4.41E+00	1.94E+02	1.24E+00	-	-	-
Arsenic, Inorganic	-	-	1.36E+09	-	-	-	3.86E+00	2.75E+01	2.66E+04	3.39E+00	1.96E+02	1.65E+03	6.38E+05
Benz[a]anthracene	6.75E-06	6.83E-10	1.36E+09	4.41E+06	-	4.41E+06	7.66E+00	2.29E+01	2.23E+03	5.73E+00	-	-	-
Benzo[a]pyrene	6.58E-06	-	1.36E+09	-	-	-	7.66E-01	2.29E+00	6.89E+04	5.74E-01	1.17E+02	3.80E+02	8.51E+04
Benzo[b]fluoranthene	6.43E-06	-	1.36E+09	-	-	-	7.66E+00	2.29E+01	6.89E+05	5.74E+00	-	-	-
Benzo[g,h,i]perylene	6.09E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Benzo[k]fluoranthene	6.43E-06	-	1.36E+09	-	-	-	7.66E+01	2.29E+02	6.89E+06	5.74E+01	-	-	-
Bis(2-chloro-1-methylethyl) ether	7.36E-06	1.09E-05	1.36E+09	3.50E+04	-	3.50E+04	-	-	-	-	1.56E+04	-	-
Bis(2-chloroethoxy)methane	7.15E-06	-	1.36E+09	-	-	-	-	-	-	-	1.17E+03	4.94E+03	-
Bis(2-chloroethyl)ether	8.71E-06	7.35E-06	1.36E+09	4.25E+04	-	4.25E+04	3.16E+00	-	1.09E+01	2.45E+00	-	-	-
Bis(2-ethylhexyl)phthalate	4.18E-06	-	1.36E+09	-	-	-	2.48E+02	8.83E+02	4.77E+07	1.94E+02	7.82E+03	3.30E+04	-
Bromodiphenyl Ether, p-	7.37E-06	3.84E-07	1.36E+09	1.86E+05	-	1.86E+05	-	-	-	-	-	-	-

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)
Butanoic acid, 4-(2,4-dichlorophenoxy)-	6.69E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Butyl Benzyl Phthalate	5.17E-06	-	1.36E+09	-	-	-	1.83E+03	6.50E+03	-	1.43E+03	7.82E+04	3.30E+05	-
Carbazole	7.45E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Chloro-4-methylphenol	-	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Chloroaniline, p-	1.03E-05	-	1.36E+09	-	-	-	1.74E+01	6.18E+01	-	1.36E+01	1.96E+02	8.24E+02	-
Chlorobenzene	9.48E-06	3.20E-04	1.36E+09	6.45E+03	-	6.45E+03	-	-	-	-	7.82E+03	-	1.01E+04
Chloronaphthalene, Beta-	7.73E-06	2.08E-06	1.36E+09	7.99E+04	-	7.99E+04	-	-	-	-	3.13E+04	1.01E+05	-
Chlorophenol, 2-	9.48E-06	6.89E-07	1.36E+09	1.39E+05	-	1.39E+05	-	-	-	-	1.96E+03	-	-
Chlorophenyl phenyl ether, 4-	6.96E-06	2.87E-07	1.36E+09	2.15E+05	-	2.15E+05	-	-	-	-	-	-	-
Chrysene	6.75E-06	-	1.36E+09	-	-	-	7.66E+02	2.29E+03	6.89E+07	5.74E+02	-	-	-
Cresol, o-	9.32E-06	-	1.36E+09	-	-	-	-	-	-	-	1.96E+04	8.24E+04	2.55E+10
Cresol, p-	9.24E-06	-	1.36E+09	-	-	-	-	-	-	-	7.82E+03	3.30E+04	2.55E+10
Dibenz[a,h]anthracene	6.02E-06	-	1.36E+09	-	-	-	7.66E-01	2.29E+00	6.89E+04	5.74E-01	-	-	-
Dibenzofuran	7.38E-06	5.49E-07	1.36E+09	1.56E+05	-	1.56E+05	-	-	-	-	3.91E+02	-	-
Dibutyl Phthalate	5.33E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+04	1.65E+05	-
Dichlorobenzene, 1,2-	8.92E-06	9.74E-05	1.36E+09	1.17E+04	-	1.17E+04	-	-	-	-	3.52E+04	-	7.31E+04
Dichlorobenzene, 1,3-	8.85E-06	1.35E-04	1.36E+09	9.93E+03	-	9.93E+03	-	-	-	-	-	-	-
Dichlorobenzene, 1,4-	8.68E-06	1.22E-04	1.36E+09	1.04E+04	-	1.04E+04	6.44E+02	-	8.00E+01	7.11E+01	2.74E+04	-	2.61E+05
Dichlorobenzidine, 3,3'-	5.55E-06	-	1.36E+09	-	-	-	7.72E+00	2.75E+01	3.37E+05	6.03E+00	-	-	-
Dichlorophenol, 2,4-	8.68E-06	-	1.36E+09	-	-	-	-	-	-	-	1.17E+03	4.94E+03	-
Dichlorophenoxy Acetic Acid, 2,4-	7.34E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+03	3.30E+04	-

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)
Diethyl Phthalate	6.72E-06	-	1.36E+09	-	-	-	-	-	-	-	3.13E+05	1.32E+06	-
Dimethylphenol, 2,4-	8.31E-06	-	1.36E+09	-	-	-	-	-	-	-	7.82E+03	3.30E+04	-
Dimethylphthalate	7.14E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Dinitro-o-cresol, 4,6-	6.53E-06	-	1.36E+09	-	-	-	-	-	-	-	3.13E+01	1.32E+02	-
Dinitrophenol, 2,4-	9.08E-06	-	1.36E+09	-	-	-	-	-	-	-	7.82E+02	3.30E+03	-
Dinitrotoluene, 2,4-	7.90E-06	-	1.36E+09	-	-	-	1.12E+01	3.91E+01	1.29E+06	8.71E+00	7.82E+02	3.23E+03	-
Dinitrotoluene, 2,6-	7.76E-06	-	1.36E+09	-	-	-	2.32E+00	8.32E+00	-	1.81E+00	1.17E+02	4.99E+02	-
Dinoseb	6.52E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+02	1.65E+03	-
Fluoranthene	7.18E-06	-	1.36E+09	-	-	-	-	-	-	-	1.56E+04	5.07E+04	-
Fluorene	7.89E-06	1.68E-07	1.36E+09	2.81E+05	-	2.81E+05	-	-	-	-	1.56E+04	5.07E+04	-
Hexachlorobenzene	7.85E-06	2.88E-06	1.36E+09	6.80E+04	-	6.80E+04	2.17E+00	-	1.24E+01	1.85E+00	3.91E+00	-	-
Hexachlorobutadiene	7.03E-06	1.14E-04	1.36E+09	1.08E+04	-	1.08E+04	4.46E+01	-	4.13E+01	2.14E+01	3.91E+02	-	-
Hexachlorocyclopentadiene	7.22E-06	1.83E-04	1.36E+09	8.51E+03	-	8.51E+03	-	-	-	-	2.35E+03	-	5.33E+01
Hexachloroethane	8.89E-06	2.07E-04	1.36E+09	8.01E+03	-	8.01E+03	8.69E+01	-	6.13E+01	3.59E+01	2.74E+02	-	7.51E+03
Indeno[1,2,3-cd]pyrene	6.37E-06	-	1.36E+09	-	-	-	7.66E+00	2.29E+01	6.89E+05	5.74E+00	-	-	-
Isophorone	7.53E-06	-	1.36E+09	-	-	-	3.66E+03	1.30E+04	-	2.86E+03	7.82E+04	3.30E+05	8.51E+10
Lead and Compounds	-	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 1-	7.85E-06	3.87E-06	1.36E+09	5.86E+04	-	5.86E+04	1.20E+02	3.28E+02	-	8.78E+01	2.74E+04	8.87E+04	-
Methylnaphthalene, 2-	7.78E-06	3.95E-06	1.36E+09	5.80E+04	-	5.80E+04	-	-	-	-	1.56E+03	5.07E+03	-
Naphthalene	8.38E-06	6.20E-06	1.36E+09	4.63E+04	-	4.63E+04	2.90E+01	7.92E+01	1.15E+02	1.79E+01	7.82E+03	2.54E+04	4.35E+03

Table A1-8
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Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	D_{iw} (cm^2/s)	D_A (cm^2/s)	Particulate Emission Factor (m^3/kg)	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	Ingestion SL TR=1E-06 (mg/kg)	Dermal SL TR=1E-06 (mg/kg)	Inhalation SL TR=1E-06 (mg/kg)	Carcinogenic SL TR=1E-06 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)
Nitroaniline, 2-	7.41E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+03	1.65E+04	2.13E+06
Nitroaniline, 3-	7.41E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Nitroaniline, 4-	9.75E-06	-	1.36E+09	-	-	-	1.74E+02	6.18E+02	-	1.36E+02	1.56E+03	6.59E+03	2.55E+08
Nitrobenzene	9.45E-06	2.48E-06	1.36E+09	7.32E+04	-	7.32E+04	-	-	1.54E+02	1.54E+02	7.82E+02	-	2.06E+04
Nitrophenol, 2-	9.17E-06	9.28E-07	1.36E+09	1.20E+05	-	1.20E+05	-	-	-	-	-	-	-
Nitrophenol, 4-	9.94E-06	-	1.36E+09	-	-	-	-	-	-	-	-	-	-
Nitroso-di-N-propylamine, N-	7.76E-06	-	1.36E+09	-	-	-	4.97E-01	1.77E+00	5.72E+04	3.88E-01	-	-	-
Nitrosodiphenylamine, N-	6.53E-06	-	1.36E+09	-	-	-	7.09E+02	2.52E+03	4.40E+07	5.54E+02	-	-	-
Octyl Phthalate, di-N-	4.15E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+03	1.65E+04	-
Pentachlorophenol	8.01E-06	-	1.36E+09	-	-	-	8.69E+00	1.24E+01	2.25E+07	5.10E+00	1.96E+03	3.30E+03	-
Phenanthrene	6.69E-06	3.21E-08	1.36E+09	6.43E+05	-	6.43E+05	-	-	-	-	-	-	-
Phenol	1.03E-05	-	1.36E+09	-	-	-	-	-	-	-	1.17E+05	4.94E+05	8.51E+09
Pyrene	7.25E-06	2.35E-09	1.36E+09	2.38E+06	-	2.38E+06	-	-	-	-	1.17E+04	3.80E+04	-
Tetrachloroethylene	9.46E-06	2.41E-03	1.36E+09	2.35E+03	-	2.35E+03	1.66E+03	-	7.61E+02	5.21E+02	2.35E+03	-	2.94E+03
Trichlorobenzene, 1,2,4-	8.40E-06	1.49E-05	1.36E+09	2.99E+04	-	2.99E+04	1.20E+02	-	-	1.20E+02	3.91E+03	-	1.87E+03
Trichlorophenol, 2,4,5-	8.09E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+04	1.65E+05	-
Trichlorophenol, 2,4,6-	8.09E-06	-	1.36E+09	-	-	-	3.16E+02	1.12E+03	3.69E+07	2.47E+02	3.91E+02	1.65E+03	-
Trichlorophenoxyacetic Acid, 2,4,5-	7.76E-06	-	1.36E+09	-	-	-	-	-	-	-	3.91E+03	1.65E+04	-
Trichlorophenoxypropionic acid, -2,4,5	5.92E-06	-	1.36E+09	-	-	-	-	-	-	-	3.13E+03	1.32E+04	-

Output generated 20MAY2022:15:00:00
Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; max = ceiling limit exceeded; sat = Csat exceeded.

Table A1-8
Site-Specific Recreator Screening Levels
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Acenaphthene	1.79E+04	2.50E+05	4.56E+05	-	1.62E+05	1.79E+04 nc
Acenaphthylene	-	-	-	-	-	
Anthracene	8.97E+04	1.25E+06	2.28E+06	-	8.08E+05	8.97E+04 nc
Aroclor 1016	2.05E+01	2.92E+02	4.94E+02	-	1.84E+02	2.05E+01 nc
Aroclor 1221	-	-	-	-	-	1.20E+00 ca
Aroclor 1232	-	-	-	-	-	1.16E+00 ca
Aroclor 1242	-	-	-	-	-	1.23E+00 ca
Aroclor 1248	-	-	-	-	-	1.23E+00 ca
Aroclor 1254	5.87E+00	8.34E+01	1.41E+02	-	5.24E+01	1.23E+00 ca
Aroclor 1260	-	-	-	-	-	1.24E+00 ca
Arsenic, Inorganic	1.75E+02	2.09E+03	9.88E+03	6.38E+05	1.72E+03	3.39E+00 ca
Benz[a]anthracene	-	-	-	-	-	5.73E+00 ca
Benzo[a]pyrene	8.96E+01	1.25E+03	2.28E+03	8.51E+04	8.00E+02	5.74E-01 ca
Benzo[b]fluoranthene	-	-	-	-	-	5.74E+00 ca
Benzo[g,h,i]perylene	-	-	-	-	-	
Benzo[k]fluoranthene	-	-	-	-	-	5.74E+01 ca
Bis(2-chloro-1-methylethyl) ether	1.56E+04	1.67E+05	-	-	1.67E+05	1.56E+04 nc sat
Bis(2-chloroethoxy)methane	9.48E+02	1.25E+04	2.96E+04	-	8.80E+03	9.48E+02 nc
Bis(2-chloroethyl)ether	-	-	-	-	-	2.45E+00 ca
Bis(2-ethylhexyl)phthalate	6.32E+03	8.34E+04	1.98E+05	-	5.87E+04	1.94E+02 ca
Bromodiphenyl Ether, p-	-	-	-	-	-	

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Chemical	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Butanoic acid, 4-(2,4-dichlorophenoxy)-	-	-	-	-	-	
Butyl Benzyl Phthalate	6.32E+04	8.34E+05	1.98E+06	-	5.87E+05	1.43E+03 ca
Carbazole	-	-	-	-	-	
Chloro-4-methylphenol	-	-	-	-	-	
Chloroaniline, p-	1.58E+02	2.09E+03	4.94E+03	-	1.47E+03	1.36E+01 ca
Chlorobenzene	4.41E+03	8.34E+04	-	1.01E+04	9.00E+03	4.41E+03 nc sat
Chloronaphthalene, Beta-	2.39E+04	3.34E+05	6.08E+05	-	2.15E+05	2.39E+04 nc
Chlorophenol, 2-	1.96E+03	2.09E+04	-	-	2.09E+04	1.96E+03 nc
Chlorophenyl phenyl ether, 4-	-	-	-	-	-	
Chrysene	-	-	-	-	-	5.74E+02 ca
Cresol, o-	1.58E+04	2.09E+05	4.94E+05	2.55E+10	1.47E+05	1.58E+04 nc
Cresol, p-	6.32E+03	8.34E+04	1.98E+05	2.55E+10	5.87E+04	6.32E+03 nc
Dibenz[a,h]anthracene	-	-	-	-	-	5.74E-01 ca
Dibenzofuran	3.91E+02	4.17E+03	-	-	4.17E+03	3.91E+02 nc
Dibutyl Phthalate	3.16E+04	4.17E+05	9.88E+05	-	2.93E+05	3.16E+04 nc
Dichlorobenzene, 1,2-	2.38E+04	3.75E+05	-	7.31E+04	6.12E+04	2.38E+04 nc sat
Dichlorobenzene, 1,3-	-	-	-	-	-	
Dichlorobenzene, 1,4-	2.48E+04	2.92E+05	-	2.61E+05	1.38E+05	7.11E+01 ca
Dichlorobenzidine, 3,3'-	-	-	-	-	-	6.03E+00 ca
Dichlorophenol, 2,4-	9.48E+02	1.25E+04	2.96E+04	-	8.80E+03	9.48E+02 nc
Dichlorophenoxy Acetic Acid, 2,4-	3.50E+03	4.17E+04	1.98E+05	-	3.44E+04	3.50E+03 nc

Table A1-8
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Site-specific Recreator Regional Screening Levels (RSLs)

Chemical	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Diethyl Phthalate	2.53E+05	3.34E+06	7.90E+06	-	2.35E+06	2.53E+05 nc max
Dimethylphenol, 2,4-	6.32E+03	8.34E+04	1.98E+05	-	5.87E+04	6.32E+03 nc
Dimethylphthalate	-	-	-	-	-	
Dinitro-o-cresol, 4,6-	2.53E+01	3.34E+02	7.90E+02	-	2.35E+02	2.53E+01 nc
Dinitrophenol, 2,4-	6.32E+02	8.34E+03	1.98E+04	-	5.87E+03	6.32E+02 nc
Dinitrotoluene, 2,4-	6.30E+02	8.34E+03	1.94E+04	-	5.83E+03	8.71E+00 ca
Dinitrotoluene, 2,6-	9.50E+01	1.25E+03	2.99E+03	-	8.83E+02	1.81E+00 ca
Dinoseb	3.16E+02	4.17E+03	9.88E+03	-	2.93E+03	3.16E+02 nc
Fluoranthene	1.20E+04	1.67E+05	3.04E+05	-	1.08E+05	1.20E+04 nc
Fluorene	1.20E+04	1.67E+05	3.04E+05	-	1.08E+05	1.20E+04 nc
Hexachlorobenzene	3.91E+00	4.17E+01	-	-	4.17E+01	1.85E+00 ca
Hexachlorobutadiene	3.91E+02	4.17E+03	-	-	4.17E+03	2.14E+01 ca sat
Hexachlorocyclopentadiene	5.21E+01	2.50E+04	-	5.33E+01	5.32E+01	5.21E+01 nc sat
Hexachloroethane	2.64E+02	2.92E+03	-	7.51E+03	2.10E+03	3.59E+01 ca
Indeno[1,2,3-cd]pyrene	-	-	-	-	-	5.74E+00 ca
Isophorone	6.32E+04	8.34E+05	1.98E+06	8.51E+10	5.87E+05	2.86E+03 ca
Lead and Compounds	-	-	-	-	-	
Methylnaphthalene, 1-	2.09E+04	2.92E+05	5.32E+05	-	1.89E+05	8.78E+01 ca
Methylnaphthalene, 2-	1.20E+03	1.67E+04	3.04E+04	-	1.08E+04	1.20E+03 nc
Naphthalene	2.52E+03	8.34E+04	1.52E+05	4.35E+03	4.02E+03	1.79E+01 ca

Table A1-8
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Chemical	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Nitroaniline, 2-	3.16E+03	4.17E+04	9.88E+04	2.13E+06	2.89E+04	3.16E+03 nc
Nitroaniline, 3-	-	-	-	-	-	
Nitroaniline, 4-	1.26E+03	1.67E+04	3.95E+04	2.55E+08	1.17E+04	1.36E+02 ca
Nitrobenzene	7.54E+02	8.34E+03	-	2.06E+04	5.94E+03	1.54E+02 ca
Nitrophenol, 2-	-	-	-	-	-	
Nitrophenol, 4-	-	-	-	-	-	
Nitroso-di-N-propylamine, N-	-	-	-	-	-	3.88E-01 ca
Nitrosodiphenylamine, N-	-	-	-	-	-	5.54E+02 ca
Octyl Phthalate, di-N-	3.16E+03	4.17E+04	9.88E+04	-	2.93E+04	3.16E+03 nc
Pentachlorophenol	1.23E+03	2.09E+04	1.98E+04	-	1.01E+04	5.10E+00 ca
Phenanthrene	-	-	-	-	-	
Phenol	9.48E+04	1.25E+06	2.96E+06	8.51E+09	8.80E+05	9.48E+04 nc
Pyrene	8.97E+03	1.25E+05	2.28E+05	-	8.08E+04	8.97E+03 nc
Tetrachloroethylene	1.30E+03	2.50E+04	-	2.94E+03	2.63E+03	5.21E+02 ca sat
Trichlorobenzene, 1,2,4-	1.27E+03	4.17E+04	-	1.87E+03	1.79E+03	1.20E+02 ca
Trichlorophenol, 2,4,5-	3.16E+04	4.17E+05	9.88E+05	-	2.93E+05	3.16E+04 nc
Trichlorophenol, 2,4,6-	3.16E+02	4.17E+03	9.88E+03	-	2.93E+03	2.47E+02 ca
Trichlorophenoxyacetic Acid, 2,4,5-	3.16E+03	4.17E+04	9.88E+04	-	2.93E+04	3.16E+03 nc
Trichlorophenoxypropionic acid, -2,4,5	2.53E+03	3.34E+04	7.90E+04	-	2.35E+04	2.53E+03 nc

Output generated 20MAY2022:15:00:00
Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; W = TEF applied; E = RPF applied; G = see user's guide; U = user provided; ca = cancer; nc = noncancer; max = ceiling limit exceeded; sat = Csat exceeded.

Attachment 2
Exposure Assessment

Table A2-1
Exposure Point Concentration Summary
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

COPC	Units	Detection Frequency [1]	Minimum Detection	Maximum Detection	KM Mean [2]	95% UCL (Distribution) [1,2]		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Surface Soil											
Metals - Methods SW6020/7471											
Arsenic	mg/kg	76/79	4.29	107	19.65	29.33	NP	29.33	mg/kg	UCL	(8)
Semi-Volatile Organic Compounds (SVOCs) - Method SW8270											
Benzo(a)anthracene	mg/kg	51/68	0.0124	8.99	0.663	1.294	L	1.294	mg/kg	UCL	(9)
Benzo(a)pyrene	mg/kg	49/68	0.0156	8.58	0.762	2.042	L	2.042	mg/kg	UCL	(9)
Benzo(b)fluoranthene	mg/kg	55/68	0.0088	15	1.299	2.031	G	2.031	mg/kg	UCL	(10)
Dibenz(a,h)anthracene	mg/kg	40/68	0.0098	1.3	0.17	0.241	G	0.241	mg/kg	UCL	(10)
Total Soil											
Metals - Methods SW6020/7471											
Arsenic	mg/kg	91/94	2.8	107	18.44	26.74	NP	26.74	mg/kg	UCL	(8)
Semi-Volatile Organic Compounds (SVOCs) - Method SW8270											
Benzo(a)anthracene	mg/kg	57/83	0.0124	8.99	0.585	0.914	G	0.914	mg/kg	UCL	(10)
Benzo(a)pyrene	mg/kg	55/83	0.0123	8.58	0.664	1.013	G	1.013	mg/kg	UCL	(10)
Benzo(b)fluoranthene	mg/kg	63/83	0.0088	15	1.158	1.764	G	1.764	mg/kg	UCL	(10)
Dibenz(a,h)anthracene	mg/kg	45/83	0.0098	1.3	0.145	0.205	G	0.205	mg/kg	UCL	(10)

Notes:
-- = Not Evaluated
COPC = Chemical of Potential Concern
KM = Kaplan-Meier
mg/kg = milligrams per kilogram
UCL = Upper Confidence Limit

Distribution Key:
Normal (N)
Gamma (G)
Lognormal (L)
Non-Parametric (NP)

(1) A minimum of five (5) samples with two (2) distinct detects are needed to calculate summary statistics and UCLs but may not be adequate to compute meaningful and reliable results. Therefore, summary statistics and UCLs are only shown if total samples are eight (8) or more.
(2) If the dataset contains nondetects, summary statistics and UCLs are estimated by the KM method.
(8) Goodness-of-Fit test indicates data have no discernible distribution.
(9) Goodness-of-Fit test indicates data are lognormally distributed.
(10) Goodness-of-Fit test indicates data are gamma distributed.

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Arsenic | 7440-38-2 | MET	15.4	1
SSS | Arsenic | 7440-38-2 | MET	16.9	1
SSS | Arsenic | 7440-38-2 | MET	7.1	1
SSS | Arsenic | 7440-38-2 | MET	10.1	1
SSS | Arsenic | 7440-38-2 | MET	23.9	1
SSS | Arsenic | 7440-38-2 | MET	5.8	1
SSS | Arsenic | 7440-38-2 | MET	10.5	1
SSS | Arsenic | 7440-38-2 | MET	4.6	0
SSS | Arsenic | 7440-38-2 | MET	7.2	1
SSS | Arsenic | 7440-38-2 | MET	14.7	1
SSS | Arsenic | 7440-38-2 | MET	12.3	1
SSS | Arsenic | 7440-38-2 | MET	10.2	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	1.95	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	2.14	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.29	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	4	1
SSS | Arsenic | 7440-38-2 | MET	8.2	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0156	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0169	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0361	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0074	0
SSS | Arsenic | 7440-38-2 | MET	6.3	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0173	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0266	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0092	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0092	0
SSS | Arsenic | 7440-38-2 | MET	8.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0124	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0088	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0079	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0079	0
SSS | Arsenic | 7440-38-2 | MET	7.1	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0161	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.204	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0725	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0898	1
SSS | Arsenic | 7440-38-2 | MET	6.3	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.105	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.34	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.219	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.55	1
SSS | Arsenic | 7440-38-2 | MET	78.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.123	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.139	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.323	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0492	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Arsenic | 7440-38-2 | MET	4.5	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0139	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0076	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0076	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0076	0
SSS | Arsenic | 7440-38-2 | MET	5.3	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0157	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0434	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0486	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0904	1
SSS | Arsenic | 7440-38-2 | MET	33.8	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.53	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.202	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.29	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.727	1
SSS | Arsenic | 7440-38-2 | MET	4.6	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0105	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0083	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0083	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0083	0
SSS | Arsenic | 7440-38-2 | MET	8.43	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	1.45	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	2.54	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2.59	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.834	1
SSS | Arsenic | 7440-38-2 | MET	13.3	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	1.7	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	1.47	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.37	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.294	1
SSS | Arsenic | 7440-38-2 | MET	10.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.435	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.613	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.911	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.16	1
SSS | Arsenic | 7440-38-2 | MET	27.6	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.108	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.108	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.108	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.108	0
SSS | Arsenic | 7440-38-2 | MET	16.8	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.695	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	1.21	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.58	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.345	1
SSS | Arsenic | 7440-38-2 | MET	22.3	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0598	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.11	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0576	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	0
SSS | Arsenic | 7440-38-2 | MET	9.84	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0743	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0743	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0743	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0743	0
SSS | Arsenic | 7440-38-2 | MET	8.28	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0852	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0573	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.084	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0852	0
SSS | Arsenic | 7440-38-2 | MET	12.6	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.101	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.101	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.101	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.101	0
SSS | Arsenic | 7440-38-2 | MET	12.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.121	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.141	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.205	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	0
SSS | Arsenic | 7440-38-2 | MET	16.2	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	5.38	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	8.58	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	11.5	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	1.3	1
SSS | Arsenic | 7440-38-2 | MET	23.8	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.133	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.133	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.133	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.133	0
SSS | Arsenic | 7440-38-2 | MET	61.7	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.128	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.15	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.217	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0891	0
SSS | Arsenic | 7440-38-2 | MET	20.9	0
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.281	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.281	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.281	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.281	0
SSS | Arsenic | 7440-38-2 | MET	8.82	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.414	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.5	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.709	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	1
SSS | Arsenic | 7440-38-2 | MET	6.11	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0809	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0809	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0809	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0809	0
SSS | Arsenic | 7440-38-2 | MET	7.36	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.082	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.082	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.082	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.082	0
SSS | Arsenic | 7440-38-2 | MET	62.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0789	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.111	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.252	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0853	0
SSS | Arsenic | 7440-38-2 | MET	23.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	1.26	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.899	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.65	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.201	1
SSS | Arsenic | 7440-38-2 | MET	13.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	8.99	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	7.17	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	15	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	1.28	1
SSS | Arsenic | 7440-38-2 | MET	7.01	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0551	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0528	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0859	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0923	0
SSS | Arsenic | 7440-38-2 | MET	6.31	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.447	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.569	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.693	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.12	1
SSS | Arsenic | 7440-38-2 | MET	5.41	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.26	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.25	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.251	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0468	1
SSS | Arsenic | 7440-38-2 | MET	4.29	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.427	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.347	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.678	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0952	1
SSS | Arsenic | 7440-38-2 | MET	23.8	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.749	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.687	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.982	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.161	1
SSS | Arsenic | 7440-38-2 | MET	9.98	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0812	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0812	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0699	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0812	0
SSS | Arsenic | 7440-38-2 | MET	9.92	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.134	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.134	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.134	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.134	0
SSS | Arsenic | 7440-38-2 | MET	13.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0837	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.1	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.139	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0837	0
SSS | Arsenic | 7440-38-2 | MET	5.94	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0861	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0861	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0861	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0861	0
SSS | Arsenic | 7440-38-2 | MET	17.1	0
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.174	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.168	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.214	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0862	0
SSS | Arsenic | 7440-38-2 | MET	10.3	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.736	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.927	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.36	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.232	1
SSS | Arsenic | 7440-38-2 | MET	52.8	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	2.48	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	2.54	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	3.25	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.558	1
SSS | Arsenic | 7440-38-2 | MET	29.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.051	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0496	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.103	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0924	0
SSS | Arsenic | 7440-38-2 | MET	10.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.421	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.434	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.776	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.121	1
SSS | Arsenic | 7440-38-2 | MET	107	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.503	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.649	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.29	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.23	1
SSS | Arsenic | 7440-38-2 | MET	10.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0846	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0846	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0846	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0846	0
SSS | Arsenic | 7440-38-2 | MET	16.8	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.659	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.881	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.37	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.185	1
SSS | Arsenic | 7440-38-2 | MET	12.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0917	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0917	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0917	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0917	0
SSS | Arsenic | 7440-38-2 | MET	19.5	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.963	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	1.24	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2.26	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.302	1
SSS | Arsenic | 7440-38-2 | MET	61.2	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	3.7	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	3.89	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	7.62	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.819	1
SSS | Arsenic | 7440-38-2 | MET	17.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.248	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.334	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.738	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0695	1
SSS | Arsenic | 7440-38-2 | MET	10.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.939	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.979	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.93	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.196	1

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GroupVar	Conc	D_Conc
SSS | Arsenic | 7440-38-2 | MET	34.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.547	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.614	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.18	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.158	1
SSS | Arsenic | 7440-38-2 | MET	47.6	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.105	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0965	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.18	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0193	1
SSS | Arsenic | 7440-38-2 | MET	17.7	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	3.09	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	3.82	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	7.18	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.765	1
SSS | Arsenic | 7440-38-2 | MET	80.6	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.203	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.233	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.463	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0537	1
SSS | Arsenic | 7440-38-2 | MET	29.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.642	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.705	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.41	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.165	1
SSS | Arsenic | 7440-38-2 | MET	18.4	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.673	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	1.08	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.237	1
SSS | Arsenic | 7440-38-2 | MET	8.41	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.213	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.296	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.639	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0832	1
SSS | Arsenic | 7440-38-2 | MET	21.2	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.302	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.404	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.865	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0941	1
SSS | Arsenic | 7440-38-2 | MET	13.9	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	1.56	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	2.3	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	4.93	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.486	1
SSS | Arsenic | 7440-38-2 | MET	11.4	1

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GroupVar	Conc	D_Conc
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.193	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.246	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.459	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0555	1
SSS | Arsenic | 7440-38-2 | MET	9.2	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.518	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.645	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.3	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.165	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0398	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.031	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0778	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0098	1
SSS | Arsenic | 7440-38-2 | MET	45.6	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.215	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.254	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.386	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0714	1
SSS | Arsenic | 7440-38-2 | MET	51.1	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0987	1
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.146	1
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.201	1
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.111	0
SSS | Arsenic | 7440-38-2 | MET	10.2	1
SSS | Benzo(a)anthracene | 56-55-3 | SVOC	0.103	0
SSS | Benzo(a)pyrene | 50-32-8 | SVOC	0.103	0
SSS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.103	0
SSS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.103	0
SSS | Arsenic | 7440-38-2 | MET	21.8	1
TS | Arsenic | 7440-38-2 | MET	15.4	1
TS | Arsenic | 7440-38-2 | MET	16.9	1
TS | Arsenic | 7440-38-2 | MET	7.1	1
TS | Arsenic | 7440-38-2 | MET	10.1	1
TS | Arsenic | 7440-38-2 | MET	23.9	1
TS | Arsenic | 7440-38-2 | MET	5.8	1
TS | Arsenic | 7440-38-2 | MET	10.5	1
TS | Arsenic | 7440-38-2 | MET	4.6	0
TS | Arsenic | 7440-38-2 | MET	7.2	1
TS | Arsenic | 7440-38-2 | MET	14.7	1
TS | Arsenic | 7440-38-2 | MET	12.3	1
TS | Arsenic | 7440-38-2 | MET	10.2	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.95	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	2.14	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.29	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	4	1
TS | Arsenic | 7440-38-2 | MET	7.3	1

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GroupVar	Conc	D_Conc
TS | Benzo(a)anthracene | 56-55-3 | SVOC	1.17	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.25	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.194	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2.51	1
TS | Arsenic | 7440-38-2 | MET	8.2	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0156	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0169	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0361	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0074	0
TS | Arsenic | 7440-38-2 | MET	6.3	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0173	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0266	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0092	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0092	0
TS | Arsenic | 7440-38-2 | MET	7.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0085	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0085	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0085	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0085	0
TS | Arsenic | 7440-38-2 | MET	8.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0124	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0088	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0079	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0079	0
TS | Arsenic | 7440-38-2 | MET	14.9	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	2.01	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.322	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	4.58	1
TS | Arsenic | 7440-38-2 | MET	7.1	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0161	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.204	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0725	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0898	1
TS | Arsenic | 7440-38-2 | MET	10.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0102	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0102	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0102	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0102	0
TS | Arsenic | 7440-38-2 | MET	6.3	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.105	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.34	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.219	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.55	1
TS | Arsenic | 7440-38-2 | MET	6.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0079	0

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GroupVar	Conc	D_Conc
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0079	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0079	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0079	0
TS | Arsenic | 7440-38-2 | MET	11.8	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0326	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0075	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0075	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0075	0
TS | Arsenic | 7440-38-2 | MET	11.3	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0079	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0079	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0079	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0079	0
TS | Arsenic | 7440-38-2 | MET	78.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.123	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.139	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.323	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0492	1
TS | Arsenic | 7440-38-2 | MET	4.5	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0139	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0076	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0076	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0076	0
TS | Arsenic | 7440-38-2 | MET	30.1	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.127	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.151	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.246	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0413	1
TS | Arsenic | 7440-38-2 | MET	11.8	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0088	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0077	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0077	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0077	0
TS | Arsenic | 7440-38-2 | MET	5.3	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0157	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0434	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0486	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0904	1
TS | Arsenic | 7440-38-2 | MET	2.8	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.018	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.185	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.071	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0839	1
TS | Arsenic | 7440-38-2 | MET	33.8	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.53	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.202	1

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GroupVar	Conc	D_Conc
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.29	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.727	1
TS | Arsenic | 7440-38-2 | MET	9.5	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0123	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0231	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0379	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0076	0
TS | Arsenic | 7440-38-2 | MET	4.6	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0105	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0083	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0083	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0083	0
TS | Arsenic | 7440-38-2 | MET	8.43	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	1.45	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	2.54	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2.59	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.834	1
TS | Arsenic | 7440-38-2 | MET	13.3	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	1.7	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.47	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.37	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.294	1
TS | Arsenic | 7440-38-2 | MET	10.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.435	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.613	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.911	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.16	1
TS | Arsenic | 7440-38-2 | MET	27.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.108	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.108	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.108	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.108	0
TS | Arsenic | 7440-38-2 | MET	16.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.695	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.21	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.58	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.345	1
TS | Arsenic | 7440-38-2 | MET	22.3	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0598	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.11	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0576	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	0
TS | Arsenic | 7440-38-2 | MET	9.84	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0743	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0743	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0743	0

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GroupVar	Conc	D_Conc
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0743	0
TS | Arsenic | 7440-38-2 | MET	8.28	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0852	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0573	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.084	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0852	0
TS | Arsenic | 7440-38-2 | MET	12.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.101	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.101	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.101	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.101	0
TS | Arsenic | 7440-38-2 | MET	12.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.121	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.141	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.205	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	0
TS | Arsenic | 7440-38-2 | MET	16.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	5.38	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	8.58	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	11.5	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	1.3	1
TS | Arsenic | 7440-38-2 | MET	23.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.133	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.133	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.133	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.133	0
TS | Arsenic | 7440-38-2 | MET	61.7	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.128	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.15	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.217	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0891	0
TS | Arsenic | 7440-38-2 | MET	20.9	0
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.281	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.281	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.281	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.281	0
TS | Arsenic | 7440-38-2 | MET	8.82	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.414	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.5	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.709	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.11	1
TS | Arsenic | 7440-38-2 | MET	6.11	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0809	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0809	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0809	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0809	0

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ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
TS | Arsenic | 7440-38-2 | MET	7.36	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.082	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.082	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.082	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.082	0
TS | Arsenic | 7440-38-2 | MET	62.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0789	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.111	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.252	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0853	0
TS | Arsenic | 7440-38-2 | MET	23.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	1.26	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.899	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.65	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.201	1
TS | Arsenic | 7440-38-2 | MET	13.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	8.99	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	7.17	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	15	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	1.28	1
TS | Arsenic | 7440-38-2 | MET	7.01	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0551	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0528	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0859	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0923	0
TS | Arsenic | 7440-38-2 | MET	6.31	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.447	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.569	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.693	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.12	1
TS | Arsenic | 7440-38-2 | MET	5.41	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.26	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.25	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.251	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0468	1
TS | Arsenic | 7440-38-2 | MET	4.29	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.427	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.347	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.678	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0952	1
TS | Arsenic | 7440-38-2 | MET	23.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.749	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.687	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.982	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.161	1
TS | Arsenic | 7440-38-2 | MET	9.98	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0812	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0812	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0699	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0812	0
TS | Arsenic | 7440-38-2 | MET	9.92	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.134	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.134	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.134	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.134	0
TS | Arsenic | 7440-38-2 | MET	13.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0837	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.1	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.139	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0837	0
TS | Arsenic | 7440-38-2 | MET	5.94	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0861	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0861	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0861	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0861	0
TS | Arsenic | 7440-38-2 | MET	17.1	0
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.174	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.168	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.214	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0862	0
TS | Arsenic | 7440-38-2 | MET	10.3	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.736	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.927	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.36	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.232	1
TS | Arsenic | 7440-38-2 | MET	52.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	2.48	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	2.54	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	3.25	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.558	1
TS | Arsenic | 7440-38-2 | MET	29.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.051	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0496	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.103	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0924	0
TS | Arsenic | 7440-38-2 | MET	10.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.421	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.434	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.776	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.121	1
TS | Arsenic | 7440-38-2 | MET	107	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.503	1

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ProUCL 5.1 Input
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GroupVar	Conc	D_Conc
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.649	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.29	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.23	1
TS | Arsenic | 7440-38-2 | MET	10.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0846	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0846	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0846	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0846	0
TS | Arsenic | 7440-38-2 | MET	16.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.659	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.881	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.37	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.185	1
TS | Arsenic | 7440-38-2 | MET	12.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0917	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0917	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0917	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0917	0
TS | Arsenic | 7440-38-2 | MET	19.5	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.963	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.24	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2.26	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.302	1
TS | Arsenic | 7440-38-2 | MET	61.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	3.7	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	3.89	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	7.62	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.819	1
TS | Arsenic | 7440-38-2 | MET	17.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.248	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.334	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.738	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0695	1
TS | Arsenic | 7440-38-2 | MET	10.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.939	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.979	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.93	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.196	1
TS | Arsenic | 7440-38-2 | MET	34.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.547	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.614	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.18	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.158	1
TS | Arsenic | 7440-38-2 | MET	47.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.105	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0965	1

Table A2-2
ProUCL 5.1 Input
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GroupVar	Conc	D_Conc
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.18	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0193	1
TS | Arsenic | 7440-38-2 | MET	17.7	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	3.09	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	3.82	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	7.18	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.765	1
TS | Arsenic | 7440-38-2 | MET	80.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.203	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.233	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.463	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0537	1
TS | Arsenic | 7440-38-2 | MET	29.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.642	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.705	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.41	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.165	1
TS | Arsenic | 7440-38-2 | MET	18.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.673	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	1.08	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	2	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.237	1
TS | Arsenic | 7440-38-2 | MET	8.41	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.213	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.296	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.639	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0832	1
TS | Arsenic | 7440-38-2 | MET	21.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.302	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.404	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.865	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0941	1
TS | Arsenic | 7440-38-2 | MET	13.9	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	1.56	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	2.3	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	4.93	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.486	1
TS | Arsenic | 7440-38-2 | MET	11.4	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.193	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.246	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.459	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0555	1
TS | Arsenic | 7440-38-2 | MET	9.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.518	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.645	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	1.3	1

Table A2-2
ProUCL 5.1 Input
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

GroupVar	Conc	D_Conc
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.165	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0079	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0079	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0079	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0079	0
TS | Arsenic | 7440-38-2 | MET	20.3	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.151	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.158	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.364	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0287	1
TS | Arsenic | 7440-38-2 | MET	13.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0398	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.031	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0778	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0098	1
TS | Arsenic | 7440-38-2 | MET	45.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0081	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0081	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0081	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0081	0
TS | Arsenic | 7440-38-2 | MET	14.6	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0077	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.0077	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.0077	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0077	0
TS | Arsenic | 7440-38-2 | MET	8.8	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.215	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.254	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.386	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.0714	1
TS | Arsenic | 7440-38-2 | MET	51.1	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.0987	1
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.146	1
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.201	1
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.111	0
TS | Arsenic | 7440-38-2 | MET	10.2	1
TS | Benzo(a)anthracene | 56-55-3 | SVOC	0.103	0
TS | Benzo(a)pyrene | 50-32-8 | SVOC	0.103	0
TS | Benzo(b)fluoranthene | 205-99-2 | SVOC	0.103	0
TS | Dibenz(a,h)anthracene | 53-70-3 | SVOC	0.103	0
TS | Arsenic | 7440-38-2 | MET	21.8	1

Table A2-3
ProUCL 5.1 Output
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.15/20/2022 3:56:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Conc (sss | arsenic | 7440-38-2 | met)

General Statistics

Total Number of Observations	79	Number of Distinct Observations	70
Number of Detects	76	Number of Non-Detects	3
Number of Distinct Detects	68	Number of Distinct Non-Detects	3
Minimum Detect	4.29	Minimum Non-Detect	4.6
Maximum Detect	107	Maximum Non-Detect	20.9
Variance Detects	398.3	Percent Non-Detects	3.797%
Mean Detects	20.11	SD Detects	19.96
Median Detects	12.35	CV Detects	0.993
Skewness Detects	2.297	Kurtosis Detects	5.545
Mean of Logged Detects	2.673	SD of Logged Detects	0.762

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.707	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.102	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	19.65	KM Standard Error of Mean	2.22
KM SD	19.6	95% KM (BCA) UCL	23.55
95% KM (t) UCL	23.35	95% KM (Percentile Bootstrap) UCL	23.5
95% KM (z) UCL	23.3	95% KM Bootstrap t UCL	23.91
90% KM Chebyshev UCL	26.31	95% KM Chebyshev UCL	29.33
97.5% KM Chebyshev UCL	33.52	99% KM Chebyshev UCL	41.75

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.03	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.151	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.104	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.669	k star (bias corrected MLE)	1.612

Theta hat (MLE)	12.04	Theta star (bias corrected MLE)	12.47
nu hat (MLE)	253.7	nu star (bias corrected)	245.1
Mean (detects)	20.11		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	19.56
Maximum	107	Median	12.1
SD	19.78	CV	1.011
k hat (MLE)	1.374	k star (bias corrected MLE)	1.33
Theta hat (MLE)	14.24	Theta star (bias corrected MLE)	14.71
nu hat (MLE)	217.1	nu star (bias corrected)	210.2
Adjusted Level of Significance (β)	0.047		
Approximate Chi Square Value (210.20, α)	177.6	Adjusted Chi Square Value (210.20, β)	177.1
95% Gamma Approximate UCL (use when n>=50)	23.15	95% Gamma Adjusted UCL (use when n<50)	23.22

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	19.65	SD (KM)	19.6
Variance (KM)	384	SE of Mean (KM)	2.22
k hat (KM)	1.006	k star (KM)	0.976
nu hat (KM)	158.9	nu star (KM)	154.2
theta hat (KM)	19.54	theta star (KM)	20.14
80% gamma percentile (KM)	31.69	90% gamma percentile (KM)	45.52
95% gamma percentile (KM)	59.38	99% gamma percentile (KM)	91.62

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (154.21, α)	126.5	Adjusted Chi Square Value (154.21, β)	126
95% Gamma Approximate KM-UCL (use when n>=50)	23.96	95% Gamma Adjusted KM-UCL (use when n<50)	24.04

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.001	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.102	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	19.64	Mean in Log Scale	2.643
SD in Original Scale	19.72	SD in Log Scale	0.771
95% t UCL (assumes normality of ROS data)	23.33	95% Percentile Bootstrap UCL	23.5
95% BCA Bootstrap UCL	24.55	95% Bootstrap t UCL	24.16
95% H-UCL (Log ROS)	22.63		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.646	KM Geo Mean	14.1
KM SD (logged)	0.759	95% Critical H Value (KM-Log)	2.036
KM Standard Error of Mean (logged)	0.0863	95% H-UCL (KM -Log)	22.41
KM SD (logged)	0.759	95% Critical H Value (KM-Log)	2.036

KM Standard Error of Mean (logged)	0.0863

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	19.61	Mean in Log Scale	2.638
SD in Original Scale	19.74	SD in Log Scale	0.778
95% t UCL (Assumes normality)	23.31	95% H-Stat UCL	22.69

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	29.33

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (sss | benzo(a)anthracene | 56-55-3 | svoc)

General Statistics

Total Number of Observations	68	Number of Distinct Observations	68
Number of Detects	51	Number of Non-Detects	17
Number of Distinct Detects	51	Number of Distinct Non-Detects	17
Minimum Detect	0.0124	Minimum Non-Detect	0.0076
Maximum Detect	8.99	Maximum Non-Detect	0.736
Variance Detects	2.418	Percent Non-Detects	25%
Mean Detects	0.867	SD Detects	1.555
Median Detects	0.302	CV Detects	1.793
Skewness Detects	3.64	Kurtosis Detects	15.61
Mean of Logged Detects	-1.151	SD of Logged Detects	1.474

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.561	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.663	KM Standard Error of Mean	0.169
KM SD	1.38	95% KM (BCA) UCL	0.964
95% KM (t) UCL	0.945	95% KM (Percentile Bootstrap) UCL	0.963
95% KM (z) UCL	0.941	95% KM Bootstrap t UCL	1.162
90% KM Chebyshev UCL	1.17	95% KM Chebyshev UCL	1.4
97.5% KM Chebyshev UCL	1.719	99% KM Chebyshev UCL	2.345

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.246	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.805	Detected Data Not Gamma Distributed at 5% Significance Level	

K-S Test Statistic	0.139	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.13	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.611	k star (bias corrected MLE)	0.588
Theta hat (MLE)	1.42	Theta star (bias corrected MLE)	1.475
nu hat (MLE)	62.32	nu star (bias corrected)	59.98
Mean (detects)	0.867		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.653
Maximum	8.99	Median	0.184
SD	1.395	CV	2.135
k hat (MLE)	0.412	k star (bias corrected MLE)	0.404
Theta hat (MLE)	1.584	Theta star (bias corrected MLE)	1.617
nu hat (MLE)	56.07	nu star (bias corrected)	54.93
Adjusted Level of Significance (β)	0.0465		
Approximate Chi Square Value (54.93, α)	38.9	Adjusted Chi Square Value (54.93, β)	38.61
95% Gamma Approximate UCL (use when n>=50)	0.922	95% Gamma Adjusted UCL (use when n<50)	0.929

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.663	SD (KM)	1.38
Variance (KM)	1.905	SE of Mean (KM)	0.169
k hat (KM)	0.231	k star (KM)	0.23
nu hat (KM)	31.38	nu star (KM)	31.33
theta hat (KM)	2.873	theta star (KM)	2.878
80% gamma percentile (KM)	0.933	90% gamma percentile (KM)	1.999
95% gamma percentile (KM)	3.287	99% gamma percentile (KM)	6.753

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.33, α)	19.54	Adjusted Chi Square Value (31.33, β)	19.34
95% Gamma Approximate KM-UCL (use when n>=50)	1.063	95% Gamma Adjusted KM-UCL (use when n<50)	1.074

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.989	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.962	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0626	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.66	Mean in Log Scale	-1.72
SD in Original Scale	1.391	SD in Log Scale	1.652
95% t UCL (assumes normality of ROS data)	0.942	95% Percentile Bootstrap UCL	0.96
95% BCA Bootstrap UCL	1.053	95% Bootstrap t UCL	1.157
95% H-UCL (Log ROS)	1.167		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.746	KM Geo Mean	0.174
KM SD (logged)	1.71	95% Critical H Value (KM-Log)	2.597
KM Standard Error of Mean (logged)	0.221	95% H-UCL (KM -Log)	1.294
KM SD (logged)	1.71	95% Critical H Value (KM-Log)	2.597
KM Standard Error of Mean (logged)	0.221		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.667	Mean in Log Scale	-1.654
SD in Original Scale	1.389	SD in Log Scale	1.63
95% t UCL (Assumes normality)	0.948	95% H-Stat UCL	1.19

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 1.294

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (sss | benzo(a)pyrene | 50-32-8 | svoc)

General Statistics

Total Number of Observations	68	Number of Distinct Observations	67
Number of Detects	49	Number of Non-Detects	19
Number of Distinct Detects	48	Number of Distinct Non-Detects	19
Minimum Detect	0.0156	Minimum Non-Detect	0.0076
Maximum Detect	8.58	Maximum Non-Detect	0.927
Variance Detects	2.867	Percent Non-Detects	27.94%
Mean Detects	1.04	SD Detects	1.693
Median Detects	0.5	CV Detects	1.627
Skewness Detects	3.113	Kurtosis Detects	10.58
Mean of Logged Detects	-0.883	SD of Logged Detects	1.432

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.596	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.126	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.762	KM Standard Error of Mean	0.183
KM SD	1.492	95% KM (BCA) UCL	1.076
95% KM (t) UCL	1.067	95% KM (Percentile Bootstrap) UCL	1.075
95% KM (z) UCL	1.062	95% KM Bootstrap t UCL	1.247

90% KM Chebyshev UCL	1.31	95% KM Chebyshev UCL	1.559
97.5% KM Chebyshev UCL	1.904	99% KM Chebyshev UCL	2.581

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.98	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.8	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.135	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.132	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.661	k star (bias corrected MLE)	0.634
Theta hat (MLE)	1.575	Theta star (bias corrected MLE)	1.642
nu hat (MLE)	64.74	nu star (bias corrected)	62.11
Mean (detects)	1.04		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.752
Maximum	8.58	Median	0.201
SD	1.507	CV	2.003
k hat (MLE)	0.401	k star (bias corrected MLE)	0.393
Theta hat (MLE)	1.875	Theta star (bias corrected MLE)	1.912
nu hat (MLE)	54.59	nu star (bias corrected)	53.51
Adjusted Level of Significance (β)	0.0465		
Approximate Chi Square Value (53.51, α)	37.71	Adjusted Chi Square Value (53.51, β)	37.42
95% Gamma Approximate UCL (use when n>=50)	1.068	95% Gamma Adjusted UCL (use when n<50)	1.076

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.762	SD (KM)	1.492
Variance (KM)	2.226	SE of Mean (KM)	0.183
k hat (KM)	0.261	k star (KM)	0.259
nu hat (KM)	35.44	nu star (KM)	35.21
theta hat (KM)	2.923	theta star (KM)	2.942
80% gamma percentile (KM)	1.119	90% gamma percentile (KM)	2.28
95% gamma percentile (KM)	3.648	99% gamma percentile (KM)	7.273

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.21, α)	22.63	Adjusted Chi Square Value (35.21, β)	22.41
95% Gamma Approximate KM-UCL (use when n>=50)	1.185	95% Gamma Adjusted KM-UCL (use when n<50)	1.196

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0686	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.126	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.76	Mean in Log Scale	-1.606
SD in Original Scale	1.503	SD in Log Scale	1.716
95% t UCL (assumes normality of ROS data)	1.064	95% Percentile Bootstrap UCL	1.073
95% BCA Bootstrap UCL	1.192	95% Bootstrap t UCL	1.249
95% H-UCL (Log ROS)	1.509		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.713	KM Geo Mean	0.18
KM SD (logged)	1.887	95% Critical H Value (KM-Log)	2.809
KM Standard Error of Mean (logged)	0.245	95% H-UCL (KM -Log)	2.042
KM SD (logged)	1.887	95% Critical H Value (KM-Log)	2.809
KM Standard Error of Mean (logged)	0.245		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.768	Mean in Log Scale	-1.58
SD in Original Scale	1.5	SD in Log Scale	1.78
95% t UCL (Assumes normality)	1.072	95% H-Stat UCL	1.801

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	2.042

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (sss | benzo(b)fluoranthene | 205-99-2 | svoc)

General Statistics

Total Number of Observations	68	Number of Distinct Observations	66
Number of Detects	55	Number of Non-Detects	13
Number of Distinct Detects	54	Number of Distinct Non-Detects	13
Minimum Detect	0.0088	Minimum Non-Detect	0.0743
Maximum Detect	15	Maximum Non-Detect	1.36
Variance Detects	7.867	Percent Non-Detects	19.12%
Mean Detects	1.589	SD Detects	2.805
Median Detects	0.693	CV Detects	1.765
Skewness Detects	3.272	Kurtosis Detects	11.73
Mean of Logged Detects	-0.712	SD of Logged Detects	1.742

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.573	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.119	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.299	KM Standard Error of Mean	0.315
KM SD	2.571	95% KM (BCA) UCL	1.906
95% KM (t) UCL	1.824	95% KM (Percentile Bootstrap) UCL	1.855
95% KM (z) UCL	1.816	95% KM Bootstrap t UCL	2.156
90% KM Chebyshev UCL	2.243	95% KM Chebyshev UCL	2.67
97.5% KM Chebyshev UCL	3.264	99% KM Chebyshev UCL	4.43

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.819	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.812	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.113	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.127	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.535	k star (bias corrected MLE)	0.518
Theta hat (MLE)	2.971	Theta star (bias corrected MLE)	3.069
nu hat (MLE)	58.84	nu star (bias corrected)	56.97
Mean (detects)	1.589		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0088	Mean	1.288
Maximum	15	Median	0.288
SD	2.595	CV	2.015
k hat (MLE)	0.387	k star (bias corrected MLE)	0.38
Theta hat (MLE)	3.326	Theta star (bias corrected MLE)	3.389
nu hat (MLE)	52.65	nu star (bias corrected)	51.66
Adjusted Level of Significance (β)	0.0465		
Approximate Chi Square Value (51.66, α)	36.15	Adjusted Chi Square Value (51.66, β)	35.87
95% Gamma Approximate UCL (use when n>=50)	1.84	95% Gamma Adjusted UCL (use when n<50)	1.854

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.299	SD (KM)	2.571
Variance (KM)	6.609	SE of Mean (KM)	0.315
k hat (KM)	0.255	k star (KM)	0.254
nu hat (KM)	34.72	nu star (KM)	34.52
theta hat (KM)	5.088	theta star (KM)	5.117
80% gamma percentile (KM)	1.896	90% gamma percentile (KM)	3.894
95% gamma percentile (KM)	6.259	99% gamma percentile (KM)	12.54

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.52, α)	22.08	Adjusted Chi Square Value (34.52, β)	21.86
95% Gamma Approximate KM-UCL (use when n>=50)	2.031	95% Gamma Adjusted KM-UCL (use when n<50)	2.051

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.967	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.266	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.119	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.296	Mean in Log Scale	-1.153
SD in Original Scale	2.591	SD in Log Scale	1.821
95% t UCL (assumes normality of ROS data)	1.82	95% Percentile Bootstrap UCL	1.843
95% BCA Bootstrap UCL	1.928	95% Bootstrap t UCL	2.148
95% H-UCL (Log ROS)	3.043		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.21	KM Geo Mean	0.298
KM SD (logged)	1.916	95% Critical H Value (KM-Log)	2.845
KM Standard Error of Mean (logged)	0.244	95% H-UCL (KM -Log)	3.635
KM SD (logged)	1.916	95% Critical H Value (KM-Log)	2.845
KM Standard Error of Mean (logged)	0.244		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.306	Mean in Log Scale	-1.101
SD in Original Scale	2.587	SD in Log Scale	1.791
95% t UCL (Assumes normality)	1.829	95% H-Stat UCL	2.983

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL 2.031

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (sss | dibenz(a,h)anthracene | 53-70-3 | svoc)

General Statistics

Total Number of Observations	68	Number of Distinct Observations	65
Number of Detects	40	Number of Non-Detects	28
Number of Distinct Detects	39	Number of Distinct Non-Detects	27
Minimum Detect	0.0098	Minimum Non-Detect	0.0074
Maximum Detect	1.3	Maximum Non-Detect	0.281
Variance Detects	0.0998	Percent Non-Detects	41.18%
Mean Detects	0.268	SD Detects	0.316
Median Detects	0.163	CV Detects	1.181

Skewness Detects	2.13	Kurtosis Detects	4.225
Mean of Logged Detects	-1.903	SD of Logged Detects	1.159

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.71	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.94	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.139	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.17	KM Standard Error of Mean	0.0329
KM SD	0.267	95% KM (BCA) UCL	0.23
95% KM (t) UCL	0.225	95% KM (Percentile Bootstrap) UCL	0.227
95% KM (z) UCL	0.224	95% KM Bootstrap t UCL	0.242
90% KM Chebyshev UCL	0.269	95% KM Chebyshev UCL	0.314
97.5% KM Chebyshev UCL	0.376	99% KM Chebyshev UCL	0.498

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.708	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.779	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.144	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.989	k star (bias corrected MLE)	0.932
Theta hat (MLE)	0.27	Theta star (bias corrected MLE)	0.287
nu hat (MLE)	79.14	nu star (bias corrected)	74.53
Mean (detects)	0.268		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0098	Mean	0.161
Maximum	1.3	Median	0.0515
SD	0.273	CV	1.689
k hat (MLE)	0.528	k star (bias corrected MLE)	0.515
Theta hat (MLE)	0.306	Theta star (bias corrected MLE)	0.314
nu hat (MLE)	71.85	nu star (bias corrected)	70.01
Adjusted Level of Significance (β)	0.0465		
Approximate Chi Square Value (70.01, α)	51.75	Adjusted Chi Square Value (70.01, β)	51.41
95% Gamma Approximate UCL (use when n>=50)	0.218	95% Gamma Adjusted UCL (use when n<50)	0.22

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.17	SD (KM)	0.267
Variance (KM)	0.0712	SE of Mean (KM)	0.0329
k hat (KM)	0.407	k star (KM)	0.398
nu hat (KM)	55.29	nu star (KM)	54.18

theta hat (KM)	0.418	theta star (KM)	0.427
80% gamma percentile (KM)	0.274	90% gamma percentile (KM)	0.481
95% gamma percentile (KM)	0.708	99% gamma percentile (KM)	1.279

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (54.18, α)	38.27	Adjusted Chi Square Value (54.18, β)	37.98
95% Gamma Approximate KM-UCL (use when n>=50)	0.241	95% Gamma Adjusted KM-UCL (use when n<50)	0.243

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.94	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0948	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.139	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.167	Mean in Log Scale	-2.693
SD in Original Scale	0.27	SD in Log Scale	1.34
95% t UCL (assumes normality of ROS data)	0.222	95% Percentile Bootstrap UCL	0.224
95% BCA Bootstrap UCL	0.234	95% Bootstrap t UCL	0.247
95% H-UCL (Log ROS)	0.236		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.753	KM Geo Mean	0.0637
KM SD (logged)	1.485	95% Critical H Value (KM-Log)	2.337
KM Standard Error of Mean (logged)	0.209	95% H-UCL (KM -Log)	0.294
KM SD (logged)	1.485	95% Critical H Value (KM-Log)	2.337
KM Standard Error of Mean (logged)	0.209		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.175	Mean in Log Scale	-2.541
SD in Original Scale	0.266	SD in Log Scale	1.336
95% t UCL (Assumes normality)	0.229	95% H-Stat UCL	0.273

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.241

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.15/20/2022 3:58:00 PM
From File	WorkSheet.xls

Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

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General Statistics

Total Number of Observations	94	Number of Distinct Observations	83
Number of Detects	91	Number of Non-Detects	3
Number of Distinct Detects	81	Number of Distinct Non-Detects	3
Minimum Detect	2.8	Minimum Non-Detect	4.6
Maximum Detect	107	Maximum Non-Detect	20.9
Variance Detects	347.5	Percent Non-Detects	3.191%
Mean Detects	18.78	SD Detects	18.64
Median Detects	11.8	CV Detects	0.993
Skewness Detects	2.528	Kurtosis Detects	7.006
Mean of Logged Detects	2.621	SD of Logged Detects	0.737

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.689	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0931	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18.44	KM Standard Error of Mean	1.905
KM SD	18.35	95% KM (BCA) UCL	21.78
95% KM (t) UCL	21.6	95% KM (Percentile Bootstrap) UCL	21.77
95% KM (z) UCL	21.57	95% KM Bootstrap t UCL	22.47
90% KM Chebyshev UCL	24.15	95% KM Chebyshev UCL	26.74
97.5% KM Chebyshev UCL	30.33	99% KM Chebyshev UCL	37.39

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.654	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.768	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.152	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.0952	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.753	k star (bias corrected MLE)	1.702
Theta hat (MLE)	10.72	Theta star (bias corrected MLE)	11.03
nu hat (MLE)	319	nu star (bias corrected)	309.8
Mean (detects)	18.78		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18.37
Maximum	107	Median	11.6
SD	18.49	CV	1.007
k hat (MLE)	1.476	k star (bias corrected MLE)	1.436
Theta hat (MLE)	12.45	Theta star (bias corrected MLE)	12.8
nu hat (MLE)	277.4	nu star (bias corrected)	269.9
Adjusted Level of Significance (β)	0.0474		
Approximate Chi Square Value (269.92, α)	232.9	Adjusted Chi Square Value (269.92, β)	232.3
95% Gamma Approximate UCL (use when n>=50)	21.29	95% Gamma Adjusted UCL (use when n<50)	21.34

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18.44	SD (KM)	18.35
Variance (KM)	336.9	SE of Mean (KM)	1.905
k hat (KM)	1.009	k star (KM)	0.984
nu hat (KM)	189.7	nu star (KM)	184.9
theta hat (KM)	18.27	theta star (KM)	18.74
80% gamma percentile (KM)	29.71	90% gamma percentile (KM)	42.62
95% gamma percentile (KM)	55.55	99% gamma percentile (KM)	85.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (184.94, α)	154.5	Adjusted Chi Square Value (184.94, β)	154.1
95% Gamma Approximate KM-UCL (use when n>=50)	22.07	95% Gamma Adjusted KM-UCL (use when n<50)	22.13

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.00394	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.1	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0931	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18.43	Mean in Log Scale	2.599
SD in Original Scale	18.45	SD in Log Scale	0.743
95% t UCL (assumes normality of ROS data)	21.59	95% Percentile Bootstrap UCL	21.65
95% BCA Bootstrap UCL	22.46	95% Bootstrap t UCL	22.08
95% H-UCL (Log ROS)	20.75		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.599	KM Geo Mean	13.45
KM SD (logged)	0.738	95% Critical H Value (KM-Log)	2.046
KM Standard Error of Mean (logged)	0.0768	95% H-UCL (KM -Log)	20.65
KM SD (logged)	0.738	95% Critical H Value (KM-Log)	2.046
KM Standard Error of Mean (logged)	0.0768		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18.41	Mean in Log Scale	2.594
SD in Original Scale	18.47	SD in Log Scale	0.75
95% t UCL (Assumes normality)	21.57	95% H-Stat UCL	20.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 26.74

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	83	Number of Distinct Observations	79
Number of Detects	57	Number of Non-Detects	26
Number of Distinct Detects	56	Number of Distinct Non-Detects	23
Minimum Detect	0.0124	Minimum Non-Detect	0.0075
Maximum Detect	8.99	Maximum Non-Detect	0.736
Variance Detects	2.225	Percent Non-Detects	31.33%
Mean Detects	0.839	SD Detects	1.492
Median Detects	0.29	CV Detects	1.778
Skewness Detects	3.723	Kurtosis Detects	16.71
Mean of Logged Detects	-1.185	SD of Logged Detects	1.473

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.117	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.585	KM Standard Error of Mean	0.142
KM SD	1.282	95% KM (BCA) UCL	0.838
95% KM (t) UCL	0.821	95% KM (Percentile Bootstrap) UCL	0.833
95% KM (z) UCL	0.818	95% KM Bootstrap t UCL	0.954
90% KM Chebyshev UCL	1.011	95% KM Chebyshev UCL	1.204
97.5% KM Chebyshev UCL	1.472	99% KM Chebyshev UCL	1.998

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.323	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.805	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.121	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.124	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.61	k star (bias corrected MLE)	0.59
Theta hat (MLE)	1.374	Theta star (bias corrected MLE)	1.422
nu hat (MLE)	69.6	nu star (bias corrected)	67.27
Mean (detects)	0.839		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.579
Maximum	8.99	Median	0.121
SD	1.292	CV	2.23
k hat (MLE)	0.387	k star (bias corrected MLE)	0.381
Theta hat (MLE)	1.498	Theta star (bias corrected MLE)	1.521
nu hat (MLE)	64.21	nu star (bias corrected)	63.22
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (63.22, α)	45.93	Adjusted Chi Square Value (63.22, β)	45.67
95% Gamma Approximate UCL (use when n>=50)	0.797	95% Gamma Adjusted UCL (use when n<50)	0.802

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.585	SD (KM)	1.282
Variance (KM)	1.644	SE of Mean (KM)	0.142
k hat (KM)	0.208	k star (KM)	0.209
nu hat (KM)	34.54	nu star (KM)	34.62
theta hat (KM)	2.811	theta star (KM)	2.804
80% gamma percentile (KM)	0.787	90% gamma percentile (KM)	1.769
95% gamma percentile (KM)	2.98	99% gamma percentile (KM)	6.294

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.62, α)	22.16	Adjusted Chi Square Value (34.62, β)	21.99
95% Gamma Approximate KM-UCL (use when n>=50)	0.914	95% Gamma Adjusted KM-UCL (use when n<50)	0.921

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.987	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.925	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0552	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.117	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.583	Mean in Log Scale	-2.073
SD in Original Scale	1.29	SD in Log Scale	1.835
95% t UCL (assumes normality of ROS data)	0.819	95% Percentile Bootstrap UCL	0.845
95% BCA Bootstrap UCL	0.909	95% Bootstrap t UCL	0.975
95% H-UCL (Log ROS)	1.285		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.155	KM Geo Mean	0.116
KM SD (logged)	1.958	95% Critical H Value (KM-Log)	3.312
KM Standard Error of Mean (logged)	0.225	95% H-UCL (KM -Log)	1.612
KM SD (logged)	1.958	95% Critical H Value (KM-Log)	3.312
KM Standard Error of Mean (logged)	0.225		

DL/2 Statistics

DL/2 Normal **DL/2 Log-Transformed**

Mean in Original Scale	0.59	Mean in Log Scale	-2.058
SD in Original Scale	1.288	SD in Log Scale	1.946
95% t UCL (Assumes normality)	0.826	95% H-Stat UCL	1.724

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL 0.914

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	83	Number of Distinct Observations	78
Number of Detects	55	Number of Non-Detects	28
Number of Distinct Detects	54	Number of Distinct Non-Detects	24
Minimum Detect	0.0123	Minimum Non-Detect	0.0075
Maximum Detect	8.58	Maximum Non-Detect	0.927
Variance Detects	2.624	Percent Non-Detects	33.73%
Mean Detects	0.989	SD Detects	1.62
Median Detects	0.434	CV Detects	1.637
Skewness Detects	3.231	Kurtosis Detects	11.69
Mean of Logged Detects	-0.968	SD of Logged Detects	1.482

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.597	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.119	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.664	KM Standard Error of Mean	0.153
KM SD	1.384	95% KM (BCA) UCL	0.948
95% KM (t) UCL	0.919	95% KM (Percentile Bootstrap) UCL	0.937
95% KM (z) UCL	0.916	95% KM Bootstrap t UCL	1.03
90% KM Chebyshev UCL	1.124	95% KM Chebyshev UCL	1.332
97.5% KM Chebyshev UCL	1.622	99% KM Chebyshev UCL	2.19

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.909	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.803	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogorov-Smirnov GOF**

5% K-S Critical Value	0.126	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.64	k star (bias corrected MLE)	0.617
Theta hat (MLE)	1.547	Theta star (bias corrected MLE)	1.604
nu hat (MLE)	70.36	nu star (bias corrected)	67.85
Mean (detects)	0.989		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.659
Maximum	8.58	Median	0.139
SD	1.395	CV	2.116
k hat (MLE)	0.374	k star (bias corrected MLE)	0.369
Theta hat (MLE)	1.761	Theta star (bias corrected MLE)	1.787
nu hat (MLE)	62.11	nu star (bias corrected)	61.2
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (61.20, α)	44.21	Adjusted Chi Square Value (61.20, β)	43.95
95% Gamma Approximate UCL (use when n>=50)	0.912	95% Gamma Adjusted UCL (use when n<50)	0.917

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.664	SD (KM)	1.384
Variance (KM)	1.916	SE of Mean (KM)	0.153
k hat (KM)	0.23	k star (KM)	0.23
nu hat (KM)	38.17	nu star (KM)	38.12
theta hat (KM)	2.887	theta star (KM)	2.89
80% gamma percentile (KM)	0.933	90% gamma percentile (KM)	2.002
95% gamma percentile (KM)	3.294	99% gamma percentile (KM)	6.773

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (38.12, α)	24.98	Adjusted Chi Square Value (38.12, β)	24.8
95% Gamma Approximate KM-UCL (use when n>=50)	1.013	95% Gamma Adjusted KM-UCL (use when n<50)	1.021

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.984	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.834	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0713	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.119	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.663	Mean in Log Scale	-1.983
SD in Original Scale	1.393	SD in Log Scale	1.901
95% t UCL (assumes normality of ROS data)	0.917	95% Percentile Bootstrap UCL	0.922
95% BCA Bootstrap UCL	0.989	95% Bootstrap t UCL	1.039
95% H-UCL (Log ROS)	1.655		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.137	KM Geo Mean	0.118
KM SD (logged)	2.098	95% Critical H Value (KM-Log)	3.488
KM Standard Error of Mean (logged)	0.24	95% H-UCL (KM -Log)	2.389
KM SD (logged)	2.098	95% Critical H Value (KM-Log)	3.488
KM Standard Error of Mean (logged)	0.24		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.671	Mean in Log Scale	-2.012
SD in Original Scale	1.39	SD in Log Scale	2.074
95% t UCL (Assumes normality)	0.925	95% H-Stat UCL	2.538

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL 1.013

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

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General Statistics

Total Number of Observations	83	Number of Distinct Observations	78
Number of Detects	63	Number of Non-Detects	20
Number of Distinct Detects	61	Number of Distinct Non-Detects	18
Minimum Detect	0.0088	Minimum Non-Detect	0.0077
Maximum Detect	15	Maximum Non-Detect	1.36
Variance Detects	7.208	Percent Non-Detects	24.1%
Mean Detects	1.514	SD Detects	2.685
Median Detects	0.639	CV Detects	1.774
Skewness Detects	3.329	Kurtosis Detects	12.52
Mean of Logged Detects	-0.837	SD of Logged Detects	1.818

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.581	**Normal GOF Test on Detected Observations Only**	
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.111	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.158	KM Standard Error of Mean	0.266
KM SD	2.406	95% KM (BCA) UCL	1.614

95% KM (t) UCL	1.601	95% KM (Percentile Bootstrap) UCL	1.628
95% KM (z) UCL	1.596	95% KM Bootstrap t UCL	1.821
90% KM Chebyshev UCL	1.956	95% KM Chebyshev UCL	2.318
97.5% KM Chebyshev UCL	2.82	99% KM Chebyshev UCL	3.806

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.775	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.816	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0993	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.119	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.506	k star (bias corrected MLE)	0.493
Theta hat (MLE)	2.989	Theta star (bias corrected MLE)	3.071
nu hat (MLE)	63.82	nu star (bias corrected)	62.11
Mean (detects)	1.514		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0088	Mean	1.151
Maximum	15	Median	0.214
SD	2.423	CV	2.104
k hat (MLE)	0.356	k star (bias corrected MLE)	0.351
Theta hat (MLE)	3.238	Theta star (bias corrected MLE)	3.282
nu hat (MLE)	59.03	nu star (bias corrected)	58.23
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (58.23, α)	41.69	Adjusted Chi Square Value (58.23, β)	41.44
95% Gamma Approximate UCL (use when n>=50)	1.608	95% Gamma Adjusted UCL (use when n<50)	1.618

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.158	SD (KM)	2.406
Variance (KM)	5.787	SE of Mean (KM)	0.266
k hat (KM)	0.232	k star (KM)	0.231
nu hat (KM)	38.45	nu star (KM)	38.39
theta hat (KM)	4.999	theta star (KM)	5.006
80% gamma percentile (KM)	1.632	90% gamma percentile (KM)	3.491
95% gamma percentile (KM)	5.733	99% gamma percentile (KM)	11.77

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (38.39, α)	25.2	Adjusted Chi Square Value (38.39, β)	25.01
95% Gamma Approximate KM-UCL (use when n>=50)	1.764	95% Gamma Adjusted KM-UCL (use when n<50)	1.777

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.964	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.142	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0927	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.111	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.155	Mean in Log Scale	-1.62
SD in Original Scale	2.421	SD in Log Scale	2.153
95% t UCL (assumes normality of ROS data)	1.597	95% Percentile Bootstrap UCL	1.618
95% BCA Bootstrap UCL	1.741	95% Bootstrap t UCL	1.836
95% H-UCL (Log ROS)	4.682		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.649	KM Geo Mean	0.192
KM SD (logged)	2.192	95% Critical H Value (KM-Log)	3.608
KM Standard Error of Mean (logged)	0.248	95% H-UCL (KM -Log)	5.085
KM SD (logged)	2.192	95% Critical H Value (KM-Log)	3.608
KM Standard Error of Mean (logged)	0.248		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.166	Mean in Log Scale	-1.528
SD in Original Scale	2.417	SD in Log Scale	2.129
95% t UCL (Assumes normality)	1.607	95% H-Stat UCL	4.793

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	1.764

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (ts | dibenz(a,h)anthracene | 53-70-3 | svoc)

General Statistics

Total Number of Observations	83	Number of Distinct Observations	75
Number of Detects	45	Number of Non-Detects	38
Number of Distinct Detects	44	Number of Distinct Non-Detects	32
Minimum Detect	0.0098	Minimum Non-Detect	0.0074
Maximum Detect	1.3	Maximum Non-Detect	0.281
Variance Detects	0.0922	Percent Non-Detects	45.78%
Mean Detects	0.251	SD Detects	0.304
Median Detects	0.161	CV Detects	1.209
Skewness Detects	2.246	Kurtosis Detects	4.937
Mean of Logged Detects	-1.992	SD of Logged Detects	1.183

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.252	**Lilliefors GOF Test**	

5% Lilliefors Critical Value	0.131	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.145	KM Standard Error of Mean	0.0278
KM SD	0.25	95% KM (BCA) UCL	0.192
95% KM (t) UCL	0.191	95% KM (Percentile Bootstrap) UCL	0.192
95% KM (z) UCL	0.191	95% KM Bootstrap t UCL	0.206
90% KM Chebyshev UCL	0.229	95% KM Chebyshev UCL	0.266
97.5% KM Chebyshev UCL	0.319	99% KM Chebyshev UCL	0.422

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.64	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.779	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.119	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.951	k star (bias corrected MLE)	0.902
Theta hat (MLE)	0.264	Theta star (bias corrected MLE)	0.278
nu hat (MLE)	85.59	nu star (bias corrected)	81.22
Mean (detects)	0.251		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0098	Mean	0.141
Maximum	1.3	Median	0.018
SD	0.253	CV	1.799
k hat (MLE)	0.515	k star (bias corrected MLE)	0.504
Theta hat (MLE)	0.273	Theta star (bias corrected MLE)	0.279
nu hat (MLE)	85.48	nu star (bias corrected)	83.73
Adjusted Level of Significance (β)	0.0471		
Approximate Chi Square Value (83.73, α)	63.64	Adjusted Chi Square Value (83.73, β)	63.33
95% Gamma Approximate UCL (use when n>=50)	0.185	95% Gamma Adjusted UCL (use when n<50)	0.186

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.145	SD (KM)	0.25
Variance (KM)	0.0626	SE of Mean (KM)	0.0278
k hat (KM)	0.336	k star (KM)	0.332
nu hat (KM)	55.79	nu star (KM)	55.11
theta hat (KM)	0.431	theta star (KM)	0.437
80% gamma percentile (KM)	0.227	90% gamma percentile (KM)	0.422
95% gamma percentile (KM)	0.642	99% gamma percentile (KM)	1.206

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (55.11, α)	39.05	Adjusted Chi Square Value (55.11, β)	38.81
95% Gamma Approximate KM-UCL (use when n>=50)	0.205	95% Gamma Adjusted KM-UCL (use when n<50)	0.206

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.105	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.131	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.143	Mean in Log Scale	-3.055
SD in Original Scale	0.252	SD in Log Scale	1.495
95% t UCL (assumes normality of ROS data)	0.189	95% Percentile Bootstrap UCL	0.187
95% BCA Bootstrap UCL	0.2	95% Bootstrap t UCL	0.204
95% H-UCL (Log ROS)	0.227		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-3.105	KM Geo Mean	0.0448
KM SD (logged)	1.589	95% Critical H Value (KM-Log)	2.865
KM Standard Error of Mean (logged)	0.19	95% H-UCL (KM -Log)	0.262
KM SD (logged)	1.589	95% Critical H Value (KM-Log)	2.865
KM Standard Error of Mean (logged)	0.19		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.151	Mean in Log Scale	-2.909
SD in Original Scale	0.249	SD in Log Scale	1.574
95% t UCL (Assumes normality)	0.197	95% H-Stat UCL	0.309

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.205

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Attachment 3

Forward Risk Calculations and Toxicity Data

Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{rec} (averaging time)	365	365

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Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	20678
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	85652
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	70
EF_{0-2} (exposure frequency) days/year	75	70
EF_{2-6} (exposure frequency) days/year	75	70
EF_{6-16} (exposure frequency) days/year	75	70
EF_{16-30} (exposure frequency) days/year	75	70
EF_{rec-a} (exposure frequency - adult) days/year	75	70
EF_{rec-c} (exposure frequency - child) days/year	75	70
ET_{rec} (exposure time - recreator) hours/day	1	4
ET_{0-2} (exposure time) hours/day	1	4
ET_{2-6} (exposure time) hours/day	1	4
ET_{6-16} (exposure time) hours/day	1	4
ET_{16-30} (exposure time) hours/day	1	4
ET_{rec-a} (adult exposure time) hours/day	1	4
ET_{rec-c} (child exposure time) hours/day	1	4
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7350
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	33366.667
IRS_{0-2} (soil intake rate) mg/day	200	200

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Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk

Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Arsenic, Inorganic	7440-38-2	No	No	3.00E-04	IRIS Current	1.50E-05	CALEPA	1.50E+00	IRIS Current	4.30E-03	IRIS Current	1	0.03
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	EPA/RPF	6.00E-05	EPA/RPF	1	0.13
Dibenz[a,h]anthracene	53-70-3	Yes	No	-		-		1.00E+00	EPA/RPF	6.00E-04	EPA/RPF	1	0.13
**Total Risk/HI*				-		-		-		-		-	-

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Site-specific Risk

Recreator for Soil/Sediment

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
-	-	-	-	1.36E+09	-	0.6	-	-		-	8.88E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	6.57E-07	2.69E-05	PHYSPROP	2.69E-05	7.16E+02	EPI
-	-	-	-	1.36E+09	-	1	1.41E-07	5.76E-06	EPI	5.76E-06	7.97E+02	PHYSPROP
-	-	-	-	-	-	-	-	-		-	-	

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Site-specific Risk

Recreator for Soil/Sediment

Critical Temperature T_C \ (K)	T_C \ Ref	D_{ia} \ (cm^2/s)	D_{iw} \ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
1.67E+03	CRC	-	-	29.33	4.50E-05	5.34E-06	6.90E-10	4.22E-06	8.91E-07
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	2.042	5.22E-06	1.61E-06	4.80E-11	4.90E-07	2.69E-07
9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	2.031	5.19E-06	1.60E-06	4.78E-11	4.87E-07	2.67E-07
9.90E+02	EPA 2001 Fact Sheet	2.36E-02	6.02E-06	0.241	6.16E-07	1.90E-07	5.67E-12	5.78E-08	3.17E-08
-		-	-	-	-	-	-	-	-

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Site-specific Risk

Recreator for Soil/Sediment

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
6.90E-10	1.36E-05	1.92E-06	6.90E-10	5.06E-06	7.12E-07	2.56E-07	**1.50E-01**	1.78E-02	4.60E-05
4.80E-11	1.58E-06	5.78E-07	4.80E-11	2.67E-06	8.90E-07	4.94E-08	1.74E-02	5.37E-03	2.40E-05
4.78E-11	1.57E-06	5.75E-07	4.78E-11	2.65E-06	8.85E-07	4.91E-08	-	-	-
5.67E-12	1.87E-07	6.83E-08	5.67E-12	3.15E-07	1.05E-07	5.83E-09	-	-	-
-	-	-	-	-	-	-	***1.67E-01***	*2.32E-02*	*7.00E-05*

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Site-specific Risk

Recreator for Soil/Sediment

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
1.68E-01	1.41E-02	2.97E-03	4.60E-05	1.71E-02	4.54E-02	6.39E-03	4.60E-05	5.19E-02	7.59E-06	1.07E-06	1.10E-09	8.66E-06
2.28E-02	1.63E-03	8.96E-04	2.40E-05	2.55E-03	5.27E-03	1.93E-03	2.40E-05	7.22E-03	2.67E-06	8.90E-07	2.96E-11	3.56E-06
-	-	-	-	-	-	-	-	-	2.65E-07	8.85E-08	2.95E-12	3.54E-07
-	-	-	-	-	-	-	-	-	3.15E-07	1.05E-07	3.50E-12	4.20E-07
1.91E-01	*1.57E-02*	*3.86E-03*	*7.00E-05*	*1.96E-02*	*5.07E-02*	*8.32E-03*	*7.00E-05*	*5.91E-02*	*1.08E-05*	*2.15E-06*	*1.14E-09*	*1.30E-05*

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Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{rec} (averaging time)	365	365

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	20678
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	85652
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	70
EF_{0-2} (exposure frequency) days/year	75	70
EF_{2-6} (exposure frequency) days/year	75	70
EF_{6-16} (exposure frequency) days/year	75	70
EF_{16-30} (exposure frequency) days/year	75	70
EF_{rec-a} (exposure frequency - adult) days/year	75	70
EF_{rec-c} (exposure frequency - child) days/year	75	70
ET_{rec} (exposure time - recreator) hours/day	1	4
ET_{0-2} (exposure time) hours/day	1	4
ET_{2-6} (exposure time) hours/day	1	4
ET_{6-16} (exposure time) hours/day	1	4
ET_{16-30} (exposure time) hours/day	1	4
ET_{rec-a} (adult exposure time) hours/day	1	4
ET_{rec-c} (child exposure time) hours/day	1	4
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7350
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	33366.667
IRS_{0-2} (soil intake rate) mg/day	200	200

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Arsenic, Inorganic	7440-38-2	No	No	3.00E-04	IRIS Current	1.50E-05	CALEPA	1.50E+00	IRIS Current	4.30E-03	IRIS Current	1	0.03
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	EPA/RPF	6.00E-05	EPA/RPF	1	0.13
Dibenz[a,h]anthracene	53-70-3	Yes	No	-		-		1.00E+00	EPA/RPF	6.00E-04	EPA/RPF	1	0.13
**Total Risk/HI*				-		-		-		-		-	-

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator for Soil/Sediment

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
-	-	-	-	1.36E+09	-	0.6	-	-		-	8.88E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	6.57E-07	2.69E-05	PHYSPROP	2.69E-05	7.16E+02	EPI
-	-	-	-	1.36E+09	-	1	1.41E-07	5.76E-06	EPI	5.76E-06	7.97E+02	PHYSPROP
-	-	-	-	-	-	-	-	-		-	-	

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator for Soil/Sediment

Critical Temperature T_C \ (K)	T_C \ Ref	D_{ia} \ (cm^2/s)	D_{iw} \ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
1.67E+03	CRC	-	-	26.74	4.10E-05	4.87E-06	6.29E-10	3.85E-06	8.12E-07
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	1.013	2.59E-06	7.99E-07	2.38E-11	2.43E-07	1.33E-07
9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	1.764	4.51E-06	1.39E-06	4.15E-11	4.23E-07	2.32E-07
9.90E+02	EPA 2001 Fact Sheet	2.36E-02	6.02E-06	0.205	5.24E-07	1.62E-07	4.82E-12	4.91E-08	2.70E-08
-		-	-	-	-	-	-	-	-

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator for Soil/Sediment

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
6.29E-10	1.24E-05	1.75E-06	6.29E-10	4.62E-06	6.49E-07	2.34E-07	**1.37E-01**	1.62E-02	4.19E-05
2.38E-11	7.85E-07	2.87E-07	2.38E-11	1.32E-06	4.41E-07	2.45E-08	8.63E-03	2.66E-03	1.19E-05
4.15E-11	1.37E-06	5.00E-07	4.15E-11	2.30E-06	7.69E-07	4.27E-08	-	-	-
4.82E-12	1.59E-07	5.81E-08	4.82E-12	2.68E-07	8.93E-08	4.96E-09	-	-	-
-	-	-	-	-	-	-	***1.45E-01***	*1.89E-02*	*5.38E-05*

Output generated 23MAY2022:14:22:44

Site-specific Risk

Recreator for Soil/Sediment

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
1.53E-01	1.28E-02	2.71E-03	4.19E-05	1.56E-02	4.14E-02	5.83E-03	4.19E-05	4.73E-02	6.92E-06	9.74E-07	1.00E-09	7.90E-06
1.13E-02	8.09E-04	4.44E-04	1.19E-05	1.27E-03	2.62E-03	9.56E-04	1.19E-05	3.58E-03	1.32E-06	4.41E-07	1.47E-11	1.76E-06
-	-	-	-	-	-	-	-	-	2.30E-07	7.69E-08	2.56E-12	3.07E-07
-	-	-	-	-	-	-	-	-	2.68E-07	8.93E-08	2.97E-12	3.57E-07
1.64E-01	*1.36E-02*	*3.15E-03*	*5.38E-05*	*1.68E-02*	*4.40E-02*	*6.78E-03*	*5.38E-05*	*5.09E-02*	*8.74E-06*	*1.58E-06*	*1.02E-09*	*1.03E-05*

Output generated 23MAY2022:14:22:44

Site-specific Risk

Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
ρ_b (dry soil bulk density) g/cm ^{3}	1.5	1.5
ρ_b (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
ρ_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ow} (skin adherence factor - outdoor worker) mg/cm ^{2}	0.12	0.12
AT_{ow} (averaging time - outdoor worker)	365	365
BW_{ow} (body weight - outdoor worker)	80	80
ED_{ow} (exposure duration - outdoor worker) yr	25	25
EF_{ow} (exposure frequency - outdoor worker) day/yr	225	225
ET_{ow} (exposure time - outdoor worker) hr	8	8

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
IRS_{ow} (soil ingestion rate - outdoor worker) mg/day	100	100
LT (lifetime) yr	70	70
SA_{ow} (surface area - outdoor worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref
Arsenic, Inorganic	7440-38-2	No	No	3.00E-04	IRIS Current	1.50E-05	CALEPA	1.50E+00	IRIS Current	4.30E-03	IRIS Current
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	EPA/RPF	6.00E-05	EPA/RPF
Dibenz[a,h]anthracene	53-70-3	Yes	No	-		-		1.00E+00	EPA/RPF	6.00E-04	EPA/RPF
**Total Risk/HI*				-		-		-		-	

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker for Soil

ABS_{gi}	ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)
1	0.03	-	-	-	-	1.36E+09	-	-	-		-
1	0.13	-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05
1	0.13	-	-	-	-	1.36E+09	-	6.57E-07	2.69E-05	PHYSPROP	2.69E-05
1	0.13	-	-	-	-	1.36E+09	-	1.41E-07	5.76E-06	EPI	5.76E-06
-	-	-	-	-	-	-	-	-	-		-

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker for Soil

Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)
8.88E+02	PHYSPROP	1.67E+03	CRC	-	-	29.33	1.36E-05	2.87E-06	4.43E-09
7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	2.042	1.57E-06	8.66E-07	3.09E-10
7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	2.031	1.56E-06	8.61E-07	3.07E-10
7.97E+02	PHYSPROP	9.90E+02	EPA 2001 Fact Sheet	2.36E-02	6.02E-06	0.241	1.86E-07	1.02E-07	3.64E-11
-		-		-	-	-	-	-	-

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker for Soil

Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
4.84E-06	1.02E-06	1.58E-06	4.52E-02	9.57E-03	2.96E-04	5.51E-02	7.26E-06	1.54E-06	6.81E-09	8.81E-06
5.62E-07	3.09E-07	1.10E-07	5.24E-03	2.89E-03	1.54E-04	8.28E-03	5.62E-07	3.09E-07	6.61E-11	8.71E-07
5.59E-07	3.08E-07	1.10E-07	-	-	-	-	5.59E-08	3.08E-08	6.58E-12	8.67E-08
6.63E-08	3.65E-08	1.30E-08	-	-	-	-	6.63E-08	3.65E-08	7.81E-12	1.03E-07
-	-	-	*5.04E-02*	*1.25E-02*	*4.50E-04*	*6.33E-02*	*7.95E-06*	*1.91E-06*	*6.89E-09*	*9.87E-06*

Output generated 23MAY2022:14:25:17

Site-specific Risk

Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
ρ_b (dry soil bulk density) g/cm ^{3}	1.5	1.5
ρ_b (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
ρ_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ow} (skin adherence factor - outdoor worker) mg/cm ^{2}	0.12	0.12
AT_{ow} (averaging time - outdoor worker)	365	365
BW_{ow} (body weight - outdoor worker)	80	80
ED_{ow} (exposure duration - outdoor worker) yr	25	25
EF_{ow} (exposure frequency - outdoor worker) day/yr	225	225
ET_{ow} (exposure time - outdoor worker) hr	8	8

Output generated 23MAY2022:14:26:53

Site-specific Risk

Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
IRS_{ow} (soil ingestion rate - outdoor worker) mg/day	100	100
LT (lifetime) yr	70	70
SA_{ow} (surface area - outdoor worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 23MAY2022:14:26:53

Site-specific Risk

Outdoor Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	Chronic RfD (mg/kg-day)	RfD Ref	Chronic RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref
Arsenic, Inorganic	7440-38-2	No	No	3.00E-04	IRIS Current	1.50E-05	CALEPA	1.50E+00	IRIS Current	4.30E-03	IRIS Current
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	EPA/RPF	6.00E-05	EPA/RPF
Dibenz[a,h]anthracene	53-70-3	Yes	No	-		-		1.00E+00	EPA/RPF	6.00E-04	EPA/RPF
**Total Risk/HI*				-		-		-		-	

Output generated 23MAY2022:14:26:53

Site-specific Risk

Outdoor Worker for Soil

ABS_{gi}	ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)
1	0.03	-	-	-	-	1.36E+09	-	-	-		-
1	0.13	-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05
1	0.13	-	-	-	-	1.36E+09	-	6.57E-07	2.69E-05	PHYSPROP	2.69E-05
1	0.13	-	-	-	-	1.36E+09	-	1.41E-07	5.76E-06	EPI	5.76E-06
-	-	-	-	-	-	-	-	-	-		-

Output generated 23MAY2022:14:26:53

Site-specific Risk

Outdoor Worker for Soil

Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)
8.88E+02	PHYSPROP	1.67E+03	CRC	-	-	26.74	1.24E-05	2.62E-06	4.04E-09
7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	1.013	7.81E-07	4.29E-07	1.53E-10
7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	1.764	1.36E-06	7.48E-07	2.67E-10
7.97E+02	PHYSPROP	9.90E+02	EPA 2001 Fact Sheet	2.36E-02	6.02E-06	0.205	1.58E-07	8.69E-08	3.10E-11
-		-		-	-	-	-	-	-

Output generated 23MAY2022:14:26:53

Site-specific Risk

Outdoor Worker for Soil

Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
4.42E-06	9.34E-07	1.44E-06	4.12E-02	8.72E-03	2.69E-04	5.02E-02	6.62E-06	1.40E-06	6.21E-09	8.03E-06
2.79E-07	1.53E-07	5.47E-08	2.60E-03	1.43E-03	7.66E-05	4.11E-03	2.79E-07	1.53E-07	3.28E-11	4.32E-07
4.85E-07	2.67E-07	9.52E-08	-	-	-	-	4.85E-08	2.67E-08	5.71E-12	7.53E-08
5.64E-08	3.10E-08	1.11E-08	-	-	-	-	5.64E-08	3.10E-08	6.64E-12	8.75E-08
-	-	-	*4.38E-02*	*1.02E-02*	*3.46E-04*	*5.43E-02*	*7.01E-06*	*1.61E-06*	*6.25E-09*	*8.63E-06*

Output generated 23MAY2022:14:26:53

Virginia Department of Environmental Quality

VURAM

Virginia Unified Risk Assessment Model

VERSION: 3.2

Construction Worker Quantitative Risk Assessment Report

Site Name: Cheat River Rail Trail

Program: RCRA Corrective Action

By submitting this report to the Virginia DEQ, the user confirms that VURAM's default exposure parameters have not been altered, unless a complete unaltered VURAM analysis is provided and all modifications are detailed explicitly in an accompanying narrative or documentation that shows DEQ's prior concurrence with specific changes.

Chemical Specific Notes displayed as applicable

All Report Pages are Required for Risk Assessment Submission

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Soil

Analyte: Arsenic, Inorganic
CAS: 7440-38-2

Concentration mg/kg:	2.93E+01
RfDo:	3.00E-04
RfCi:	1.50E-05
SFO:	1.50E+00
IUR:	4.30E-03
Mutagen:	
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:	1.73E-01	Ingestion:	1.07E-06
Dermal:	2.77E-02	Dermal:	1.71E-07
Inhalation:	3.68E-04	Inhalation:	3.25E-10
Total:	2.01E-01	Total:	1.24E-06

% Contribution to Media Risk 87.54% 89.69%

Analyte: Benzo[a]pyrene
CAS: 50-32-8

Concentration mg/kg:	2.04E+00
RfDo:	3.00E-04
RfCi:	2.00E-06
SFO:	1.00E+00
IUR:	6.00E-04
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:	2.01E-02	Ingestion:	8.24E-08
Dermal:	8.36E-03	Dermal:	3.44E-08
Inhalation:	1.92E-04	Inhalation:	3.16E-12
Total:	2.86E-02	Total:	1.17E-07

% Contribution to Media Risk 12.46% 8.47%

Analyte: Benzo[b]fluoranthene
CAS: 205-99-2

Concentration mg/kg:	2.03E+00
RfDo:	
RfCi:	
SFO:	1.00E-01
IUR:	6.00E-05
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:		Ingestion:	8.20E-09
Dermal:		Dermal:	3.42E-09
Inhalation:		Inhalation:	3.14E-13
Total:	0.00E+00	Total:	1.16E-08

% Contribution to Media Risk 0.00% 0.84%

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Soil

Analyte: Dibenz[a,h]anthracene
CAS: 53-70-3

Concentration mg/kg:	2.41E-01
RfDo:	
RfCi:	
SFO:	1.00E+00
IUR:	6.00E-04
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

	Non-Cancer Adult	Cancer
Ingestion:		9.73E-09
Dermal:		4.05E-09
Inhalation:		3.72E-13
Total:	0.00E+00	1.38E-08
% Contribution to Media Risk	0.00%	1.00%

Total Calculated Hazard Index/Risk for Soil

	Non-Cancer Adult	Cancer
Ingestion:	1.93E-01	1.17E-06
Dermal:	3.61E-02	2.13E-07
Inhalation:	5.60E-04	3.29E-10
Total:	2.30E-01	1.38E-06

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Report Summary

Hazard/risk values of zero (0.00+00) are reflective of non-calculated values. Hazard/risk for zero value analytes must be evaluated outside of quantitative risk assessment.

Hazard/Risk Summary for Soil

Analyte	CAS	Hazard	Risk
Arsenic, Inorganic	7440-38-2	2.01E-01	1.24E-06
Benzo[a]pyrene	50-32-8	2.86E-02	1.17E-07
Benzo[b]fluoranthene	205-99-2	0.00E+00	1.16E-08
Dibenz[a,h]anthracene	53-70-3	0.00E+00	1.38E-08

Total Hazard Index/Risk for All Media

Non-Cancer Adult		Cancer	
Ingestion:	1.93E-01	Ingestion:	1.17E-06
Dermal:	3.61E-02	Dermal:	2.13E-07
Inhalation:	5.60E-04	Inhalation:	3.29E-10
Total:	2.30E-01	**Total:**	1.38E-06
does not exceed hazard index		*does not exceed cumulative risk*	

Construction Exposure Default Values

Symbol	Description	Value	Units
A	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	14.0111	(unitless)
AFcw	Construction Worker Soil Adherence Factor	0.3	(mg/cm2)
As	Areal extent of the site or contamination	0.5	(acres)
ATcw	Construction Worker Averaging Time: 365 x LT	25550	(days)
ATcw	Construction Worker Averaging Time	365	(days/yr)
ATcw-a	Construction Worker Averaging Time: EWcw x 7 x EDcw	350	(days)
B	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	19.6154	(unitless)
BWcw	Construction Worker Body Weight	80	(kg)
C	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	225.3397	(unitless)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

DWcw	Construction Worker Days Worked	5	(days/week)
EDcw	Construction Worker Exposure Duration	1	(yrs)
EFcw	Construction Worker Exposure Frequency	250	(days/yrs)
EFcw-a	Construction Worker Air Exposure Frequency	250	(days/yr)
EFcw-s	Construction Worker Soil Exposure Frequency	250	(days/yr)
EFcw-vrp	Construction Worker Soil Exposure Frequency - VRP ONLY - Virginia DEQ	125	(days/yr)
ETcw	Construction Worker Exposure Time	8	(hrs/day)
ETcw-s	Construction Worker Soil Exposure Time	8	(hrs/day)
EWcw	Construction Worker Weeks Worked	50	(weeks/yr)
F(x)	Function Dependent on 0.886 × (Ut/Um)	0.194	(unitless)
Fd	Dispersion Correction Factor	0.185	(unitless)
IRcw	Construction Worker Soil Ingestion Rate	330	(mg/day)
n	Total soil porosity: 1-(ρb/ρs)	0.433962264150943	(unitless)
PEFsc	Particulate Emission Factor Subchronic - Virginia DEQ calculated	1266503136.97919	(m3/kg)
Q/C	Inverse of the ratio of the 1-h geometric mean concentration to the emission flux along a straight road segment bisecting a square site - Virginia DEQ	87.3689772162309	(g/m2-s per kg/m)
SAcw	Construction Worker Surface Area	3527	(cm2/day)
Tc	Total time over which construction occurs: EDcw*EWcw*7days/wk*24hrs/day*3600s/hr	30240000	(s)
TR-ACH	Trench Air Changes per Hour - Virginia DEQ	2	(h)-1
TR-ACvad	Trench Advection Coefficient Groundwater greater than 15ft - Virginia DEQ	0.25	(cm3/cm3)
TR-CF1	Trench Conversion Factor-1	0.001	(L/cm3)
TR-CF2	Trench Conversion Factor-2	10000	(cm2/m2)
TR-CF3	Trench Conversion Factor-3	3600	(s/hr)
TR-CF4	Trench Conversion Factor-4	1000000	(cm3/m3)
TR-D-dir	Trench Depth - groundwater less Than 15ft - Virginia DEQ	2.44	(m)
TR-D-ind	Trench Depth - groundwater greater than 15ft - Virginia DEQ	4.57	(m)
TR-Dsg	Trench - Depth to soil gas vapor source - Virginia DEQ	1	(cm)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

TR-EFcw	Trench Construction Worker Exposure Frequency - Virginia DEQ	125	(days/yr)
TR-ETcw	Trench Construction Worker Exposure Time - Virginia DEQ	4	(hrs/day)
TR-EVcw	Trench Construction Worker Events - Virginia DEQ	1	(events/day)
TR-F	Trench Fraction of floor through which contaminant can enter - Virginia DEQ	1	(unitless)
TR-HV	Trench Thickness of Vadose Zone - groundwater greater than 15 ft - Virginia DEQ	30	(cm)
TR-IRcw	Trench Construction Worker Groundwater Ingestion Rate - Virginia DEQ	0.02	(L/day)
TR-KGH2O	Trench Gas-phase mass transfer coefficient of water vapor at 25deg C - Virginia DEQ	0.833	(cm/s)
TR-KLO2	Trench Liquid-phase mass transfer coefficient of oxygen at 25deg C - Virginia DEQ	0.002	(cm/s)
TR-L	Trench Length - Virginia DEQ	2.44	(m)
TR-Lgw	Trench Depth to groundwater - Virginia DEQ	488	(cm)
TR-MWH2O	Trench Molecular Weight of Water - Virginia DEQ	18	(unitless)
TR-MWO2	Trench Molecular Weight of Oxygen - Virginia DEQ	32	(unitless)
TR-Porvad	Trench Porosity in Vadose Zone - groundwater greater than 15ft - Virginia DEQ	0.44	(cm3/cm3)
TR-R	Trench Ideal Gas Constant - Virginia DEQ	0.000082	(atm-m3/mol-K)
TR-Temp-F	Trench Temperature Fahrenheit - Virginia DEQ	77	(F)
TR-Temp-K	Trench Temperature - Virginia DEQ	298	(K)
TR-W	Trench Width - Virginia DEQ	0.91	(m)
TR-W/D	Trench Width to Depth Ratio - Virginia DEQ	0.38	(unitless)
Um	Mean Annual Wind Speed	4.69	(m/s)
Ut	Equivalent Threshold Value of Wind Speed at 7m	11.32	(m/s)
V	V Fraction of Vegetative Cover	0.5	(unitless)
Θa	Air filled soil porosity: n-Θw	0.133962264150943	(unitless)
Θw	Water filled soil porosity	0.3	(unitless)
ρb	Dry soil bulk density	1.5	(kg/L)
ρs	Soil particle density	2.65	(kg/L)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

END OF REPORT

Virginia Department of Environmental Quality

VURAM

Virginia Unified Risk Assessment Model

VERSION: 3.2

Construction Worker Quantitative Risk Assessment Report

Site Name: Cheat River Rail Trail

Program: RCRA Corrective Action

By submitting this report to the Virginia DEQ, the user confirms that VURAM's default exposure parameters have not been altered, unless a complete unaltered VURAM analysis is provided and all modifications are detailed explicitly in an accompanying narrative or documentation that shows DEQ's prior concurrence with specific changes.

Chemical Specific Notes displayed as applicable

All Report Pages are Required for Risk Assessment Submission

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Soil

Analyte: Arsenic, Inorganic
CAS: 7440-38-2

Concentration mg/kg:	2.67E+01
RfDo:	3.00E-04
RfCi:	1.50E-05
SFO:	1.50E+00
IUR:	4.30E-03
Mutagen:	
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:	1.58E-01	Ingestion:	9.71E-07
Dermal:	2.53E-02	Dermal:	1.56E-07
Inhalation:	3.35E-04	Inhalation:	2.96E-10
Total:	1.83E-01	Total:	1.13E-06

% Contribution to Media Risk 92.81% 93.39%

Analyte: Benzo[a]pyrene
CAS: 50-32-8

Concentration mg/kg:	1.01E+00
RfDo:	3.00E-04
RfCi:	2.00E-06
SFO:	1.00E+00
IUR:	6.00E-04
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:	9.95E-03	Ingestion:	4.09E-08
Dermal:	4.15E-03	Dermal:	1.70E-08
Inhalation:	9.52E-05	Inhalation:	1.57E-12
Total:	1.42E-02	Total:	5.79E-08

% Contribution to Media Risk 7.19% 4.80%

Analyte: Benzo[b]fluoranthene
CAS: 205-99-2

Concentration mg/kg:	1.76E+00
RfDo:	
RfCi:	
SFO:	1.00E-01
IUR:	6.00E-05
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

Non-Cancer Adult		Cancer	
Ingestion:		Ingestion:	7.12E-09
Dermal:		Dermal:	2.97E-09
Inhalation:		Inhalation:	2.73E-13
Total:	0.00E+00	Total:	1.01E-08

% Contribution to Media Risk 0.00% 0.84%

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Soil

Analyte: Dibenz[a,h]anthracene
CAS: 53-70-3

Concentration mg/kg:	2.05E-01
RfDo:	
RfCi:	
SFO:	1.00E+00
IUR:	6.00E-04
Mutagen:	Y
VOC:	

Calculated Hazard/Risk

	Non-Cancer Adult	Cancer
Ingestion:		8.27E-09
Dermal:		3.45E-09
Inhalation:		3.17E-13
Total:	0.00E+00	1.17E-08
% Contribution to Media Risk	0.00%	0.97%

Total Calculated Hazard Index/Risk for Soil

	Non-Cancer Adult	Cancer
Ingestion:	1.68E-01	1.03E-06
Dermal:	2.94E-02	1.79E-07
Inhalation:	4.30E-04	2.98E-10
Total:	1.97E-01	1.21E-06

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

Report Summary

Hazard/risk values of zero (0.00+00) are reflective of non-calculated values. Hazard/risk for zero value analytes must be evaluated outside of quantitative risk assessment.

Hazard/Risk Summary for Soil

Analyte	CAS	Hazard	Risk
Arsenic, Inorganic	7440-38-2	1.83E-01	1.13E-06
Benzo[a]pyrene	50-32-8	1.42E-02	5.79E-08
Benzo[b]fluoranthene	205-99-2	0.00E+00	1.01E-08
Dibenz[a,h]anthracene	53-70-3	0.00E+00	1.17E-08

Total Hazard Index/Risk for All Media

Non-Cancer Adult		Cancer	
Ingestion:	1.68E-01	Ingestion:	1.03E-06
Dermal:	2.94E-02	Dermal:	1.79E-07
Inhalation:	4.30E-04	Inhalation:	2.98E-10
Total:	1.97E-01	**Total:**	1.21E-06
does not exceed hazard index		*does not exceed cumulative risk*	

Construction Exposure Default Values

Symbol	Description	Value	Units
A	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	14.0111	(unitless)
AFcw	Construction Worker Soil Adherence Factor	0.3	(mg/cm2)
As	Areal extent of the site or contamination	0.5	(acres)
ATcw	Construction Worker Averaging Time: 365 x LT	25550	(days)
ATcw	Construction Worker Averaging Time	365	(days/yr)
ATcw-a	Construction Worker Averaging Time: EWcw x 7 x EDcw	350	(days)
B	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	19.6154	(unitless)
BWcw	Construction Worker Body Weight	80	(kg)
C	Construction Worker Soil Inhalation Dispersion Constant - Philadelphia	225.3397	(unitless)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

DWcw	Construction Worker Days Worked	5	(days/week)
EDcw	Construction Worker Exposure Duration	1	(yrs)
EFcw	Construction Worker Exposure Frequency	250	(days/yrs)
EFcw-a	Construction Worker Air Exposure Frequency	250	(days/yr)
EFcw-s	Construction Worker Soil Exposure Frequency	250	(days/yr)
EFcw-vrp	Construction Worker Soil Exposure Frequency - VRP ONLY - Virginia DEQ	125	(days/yr)
ETcw	Construction Worker Exposure Time	8	(hrs/day)
ETcw-s	Construction Worker Soil Exposure Time	8	(hrs/day)
EWcw	Construction Worker Weeks Worked	50	(weeks/yr)
F(x)	Function Dependent on 0.886 × (Ut/Um)	0.194	(unitless)
Fd	Dispersion Correction Factor	0.185	(unitless)
IRcw	Construction Worker Soil Ingestion Rate	330	(mg/day)
n	Total soil porosity: 1-(ρb/ρs)	0.433962264150943	(unitless)
PEFsc	Particulate Emission Factor Subchronic - Virginia DEQ calculated	1266503136.97919	(m3/kg)
Q/C	Inverse of the ratio of the 1-h geometric mean concentration to the emission flux along a straight road segment bisecting a square site - Virginia DEQ	87.3689772162309	(g/m2-s per kg/m)
SAcw	Construction Worker Surface Area	3527	(cm2/day)
Tc	Total time over which construction occurs: EDcw*EWcw*7days/wk*24hrs/day*3600s/hr	30240000	(s)
TR-ACH	Trench Air Changes per Hour - Virginia DEQ	2	(h)-1
TR-ACvad	Trench Advection Coefficient Groundwater greater than 15ft - Virginia DEQ	0.25	(cm3/cm3)
TR-CF1	Trench Conversion Factor-1	0.001	(L/cm3)
TR-CF2	Trench Conversion Factor-2	10000	(cm2/m2)
TR-CF3	Trench Conversion Factor-3	3600	(s/hr)
TR-CF4	Trench Conversion Factor-4	1000000	(cm3/m3)
TR-D-dir	Trench Depth - groundwater less Than 15ft - Virginia DEQ	2.44	(m)
TR-D-ind	Trench Depth - groundwater greater than 15ft - Virginia DEQ	4.57	(m)
TR-Dsg	Trench - Depth to soil gas vapor source - Virginia DEQ	1	(cm)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

TR-EFcw	Trench Construction Worker Exposure Frequency - Virginia DEQ	125	(days/yr)
TR-ETcw	Trench Construction Worker Exposure Time - Virginia DEQ	4	(hrs/day)
TR-EVcw	Trench Construction Worker Events - Virginia DEQ	1	(events/day)
TR-F	Trench Fraction of floor through which contaminant can enter - Virginia DEQ	1	(unitless)
TR-HV	Trench Thickness of Vadose Zone - groundwater greater than 15 ft - Virginia DEQ	30	(cm)
TR-IRcw	Trench Construction Worker Groundwater Ingestion Rate - Virginia DEQ	0.02	(L/day)
TR-KGH2O	Trench Gas-phase mass transfer coefficient of water vapor at 25deg C - Virginia DEQ	0.833	(cm/s)
TR-KLO2	Trench Liquid-phase mass transfer coefficient of oxygen at 25deg C - Virginia DEQ	0.002	(cm/s)
TR-L	Trench Length - Virginia DEQ	2.44	(m)
TR-Lgw	Trench Depth to groundwater - Virginia DEQ	488	(cm)
TR-MWH2O	Trench Molecular Weight of Water - Virginia DEQ	18	(unitless)
TR-MWO2	Trench Molecular Weight of Oxygen - Virginia DEQ	32	(unitless)
TR-Porvad	Trench Porosity in Vadose Zone - groundwater greater than 15ft - Virginia DEQ	0.44	(cm3/cm3)
TR-R	Trench Ideal Gas Constant - Virginia DEQ	0.000082	(atm-m3/mol-K)
TR-Temp-F	Trench Temperature Fahrenheit - Virginia DEQ	77	(F)
TR-Temp-K	Trench Temperature - Virginia DEQ	298	(K)
TR-W	Trench Width - Virginia DEQ	0.91	(m)
TR-W/D	Trench Width to Depth Ratio - Virginia DEQ	0.38	(unitless)
Um	Mean Annual Wind Speed	4.69	(m/s)
Ut	Equivalent Threshold Value of Wind Speed at 7m	11.32	(m/s)
V	V Fraction of Vegetative Cover	0.5	(unitless)
Θa	Air filled soil porosity: n-Θw	0.133962264150943	(unitless)
Θw	Water filled soil porosity	0.3	(unitless)
ρb	Dry soil bulk density	1.5	(kg/L)
ρs	Soil particle density	2.65	(kg/L)

Risk Based Performance Criteria

Default Hazard Index	Default Risk Individual Chemical	Default Cumulative Risk-All Chemicals
1	1.00E-05	1.00E-05

END OF REPORT

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Chemical Abstracts Service (CAS) Number	7440-38-2
Chemical Type	Inorganics
Inhalation Unit Risk	0.0043
Inhalation Unit Risk EPA Cancer Classification	A
Inhalation Unit Risk Method	Absolute-risk linear model
Inhalation Unit Risk Notes	NA
Inhalation Unit Risk Route	NA
Inhalation Unit Risk Species	Human
Inhalation Unit Risk Study Date	NA
Inhalation Unit Risk Target Organ	Lung
Inhalation Unit Risk Treatment Duration	NA
Inhalation Unit Risk Tumor Type	Cancer
Inhalation Chronic Reference Concentration (mg/m^3)	0.000015
Inhalation Chronic Reference Concentration Basis	NA
Inhalation Chronic Reference Concentration Confidence Level	NA
Inhalation Chronic Reference Concentration Critical Effect	NA
Inhalation Chronic Reference Concentration Modifying Factor	NA
Inhalation Chronic Reference Concentration Notes	NA
Inhalation Chronic Reference Concentration Route	NA
Inhalation Chronic Reference Concentration Species	NA
Inhalation Chronic Reference Concentration Study Date	NA
Inhalation Chronic Reference Concentration Target Organ	NA
Inhalation Chronic Reference Concentration Study Duration	NA
Inhalation Chronic Reference Concentration Uncertainty Factor	NA
Inhalation Subchronic Reference Concentration (mg/m^3)	

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Inhalation Subchronic Reference Concentration Basis	
Inhalation Subchronic Reference Concentration Confidence Level	
Inhalation Subchronic Reference Concentration Critical Effect	
Inhalation Subchronic Reference Concentration Modifying Factor	
Inhalation Subchronic Reference Concentration Notes	
Inhalation Subchronic Reference Concentration Route	
Inhalation Subchronic Reference Concentration Species	
Inhalation Subchronic Reference Concentration Study Date	
Inhalation Subchronic Reference Concentration Target Organ	
Inhalation Subchronic Reference Concentration Study Duration	
Inhalation Subchronic Reference Concentration Uncertainty Factor	
Oral Chronic Reference Dose (mg/kg-day)	0.0003
Oral Chronic Reference Dose Basis	NOAEL: 0.0008 mg/kg-day
Oral Chronic Reference Dose Confidence Level	Medium
Oral Chronic Reference Dose Critical Effect	Hyperpigmentation, keratosis and possible vascular complications
Oral Chronic Reference Dose Modifying Factor	1
Oral Chronic Reference Dose Notes	NA
Oral Chronic Reference Dose Route	NA
Oral Chronic Reference Dose Species	Human
Oral Chronic Reference Dose Study Date	1977
Oral Chronic Reference Dose Target Organ	Skin and blood
Oral Chronic Reference Dose Study Duration	NA
Oral Chronic Reference Dose Uncertainty Factor	3
Oral Subchronic Chronic Reference Dose (mg/kg-day)	0.005
Oral Subchronic Reference Dose Basis	LOAEL: .05 mg/kg-day

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Oral Subchronic Reference Dose Confidence Level	NA
Oral Subchronic Reference Dose Critical Effect	Hyperpigmentation and hyperkeratosis
Oral Subchronic Reference Dose Modifying Factor	NA
Oral Subchronic Reference Dose Notes	NA
Oral Subchronic Reference Dose Route	Oral
Oral Subchronic Reference Dose Species	Human
Oral Subchronic Reference Dose Study Date	2002
Oral Subchronic Reference Dose Target Organ	Skin
Oral Subchronic Reference Dose Study Duration	1-2 days
Oral Subchronic Reference Dose Uncertainty Factor	10
Oral Slope Factor (mg/kg-day)^-1	1.5
Oral Slope EPA Cancer Classification	A
Oral Slope Factor Method	Time- and dose-related formulation of the multistage model
Oral Slope Factor Notes	NA
Oral Slope Factor Route	NA
Oral Slope Factor Species	Human
Oral Slope Factor Study Date	NA
Oral Slope Factor Target Organ	Skin
Oral Slope Factor Treatment Duration	NA
Oral Slope Factor Tumor Type	Skin cancer

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Chemical Abstracts Service (CAS) Number	50-32-8
Chemical Type	Organics
Inhalation Unit Risk	0.0006
Inhalation Unit Risk EPA Cancer Classification	Carcinogenic to humans
Inhalation Unit Risk Method	Time-to-tumor dose-response model with linear extrapolation from the POD (BMCL10HED) associated with 10% extra cancer risk.
Inhalation Unit Risk Notes	NA
Inhalation Unit Risk Route	NA
Inhalation Unit Risk Species	Hamster
Inhalation Unit Risk Study Date	2017
Inhalation Unit Risk Target Organ	Gastrointestinal, Respiratory
Inhalation Unit Risk Treatment Duration	NA
Inhalation Unit Risk Tumor Type	Squamous cell neoplasia in the larynx, pharynx, trachea, nasal cavity, esophagus, and forestomach.
Inhalation Chronic Reference Concentration (mg/m^3)	0.000002
Inhalation Chronic Reference Concentration Basis	LOAEL: 0.0046
Inhalation Chronic Reference Concentration Confidence Level	Low/medium
Inhalation Chronic Reference Concentration Critical Effect	Decreased embryo/fetal survival
Inhalation Chronic Reference Concentration Modifying Factor	1
Inhalation Chronic Reference Concentration Notes	NA
Inhalation Chronic Reference Concentration Route	NA
Inhalation Chronic Reference Concentration Species	Rat
Inhalation Chronic Reference Concentration Study Date	2017
Inhalation Chronic Reference Concentration Target Organ	Developmental
Inhalation Chronic Reference Concentration Study Duration	NA
Inhalation Chronic Reference Concentration Uncertainty Factor	3000
Inhalation Subchronic Reference Concentration (mg/m^3)	

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Inhalation Subchronic Reference Concentration Basis	
Inhalation Subchronic Reference Concentration Confidence Level	
Inhalation Subchronic Reference Concentration Critical Effect	
Inhalation Subchronic Reference Concentration Modifying Factor	
Inhalation Subchronic Reference Concentration Notes	
Inhalation Subchronic Reference Concentration Route	
Inhalation Subchronic Reference Concentration Species	
Inhalation Subchronic Reference Concentration Study Date	
Inhalation Subchronic Reference Concentration Target Organ	
Inhalation Subchronic Reference Concentration Study Duration	
Inhalation Subchronic Reference Concentration Uncertainty Factor	
Oral Chronic Reference Dose (mg/kg-day)	0.0003
Oral Chronic Reference Dose Basis	BMDL 1SD (HED): 0.092
Oral Chronic Reference Dose Confidence Level	Medium
Oral Chronic Reference Dose Critical Effect	Neurobehavioral changes
Oral Chronic Reference Dose Modifying Factor	1
Oral Chronic Reference Dose Notes	NA
Oral Chronic Reference Dose Route	NA
Oral Chronic Reference Dose Species	Rat
Oral Chronic Reference Dose Study Date	2017
Oral Chronic Reference Dose Target Organ	Developmental
Oral Chronic Reference Dose Study Duration	NA
Oral Chronic Reference Dose Uncertainty Factor	300
Oral Subchronic Chronic Reference Dose (mg/kg-day)	
Oral Subchronic Reference Dose Basis	

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Oral Subchronic Reference Dose Confidence Level	
Oral Subchronic Reference Dose Critical Effect	
Oral Subchronic Reference Dose Modifying Factor	
Oral Subchronic Reference Dose Notes	
Oral Subchronic Reference Dose Route	
Oral Subchronic Reference Dose Species	
Oral Subchronic Reference Dose Study Date	
Oral Subchronic Reference Dose Target Organ	
Oral Subchronic Reference Dose Study Duration	
Oral Subchronic Reference Dose Uncertainty Factor	
Oral Slope Factor (mg/kg-day)^-1	1
Oral Slope EPA Cancer Classification	Carcinogenic to humans
Oral Slope Factor Method	Time-to-tumor dose-response model with linear extrapolation from the POD (BMDL10HED) associated with 10% extra cancer risk.
Oral Slope Factor Notes	NA
Oral Slope Factor Route	NA
Oral Slope Factor Species	Mouse
Oral Slope Factor Study Date	2017
Oral Slope Factor Target Organ	Gastrointestinal
Oral Slope Factor Treatment Duration	NA
Oral Slope Factor Tumor Type	forestomach, esophagus, tongue, and larynx tumors

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene	Dibenz[a,h]anthracene
Chemical Abstracts Service (CAS) Number	205-99-2	53-70-3
Chemical Type	Organics	Organics
Inhalation Unit Risk	0.00006	0.0006
Inhalation Unit Risk EPA Cancer Classification	Carcinogenic to humans	Carcinogenic to humans
Inhalation Unit Risk Method	NA	NA
Inhalation Unit Risk Notes	EPA/RPF	EPA/RPF
Inhalation Unit Risk Route	NA	NA
Inhalation Unit Risk Species	NA	NA
Inhalation Unit Risk Study Date	NA	NA
Inhalation Unit Risk Target Organ	NA	NA
Inhalation Unit Risk Treatment Duration	NA	NA
Inhalation Unit Risk Tumor Type	NA	NA
Inhalation Chronic Reference Concentration (mg/m^3)		
Inhalation Chronic Reference Concentration Basis		
Inhalation Chronic Reference Concentration Confidence Level		
Inhalation Chronic Reference Concentration Critical Effect		
Inhalation Chronic Reference Concentration Modifying Factor		
Inhalation Chronic Reference Concentration Notes		
Inhalation Chronic Reference Concentration Route		
Inhalation Chronic Reference Concentration Species		
Inhalation Chronic Reference Concentration Study Date		
Inhalation Chronic Reference Concentration Target Organ		
Inhalation Chronic Reference Concentration Study Duration		
Inhalation Chronic Reference Concentration Uncertainty Factor		
Inhalation Subchronic Reference Concentration (mg/m^3)		

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene	Dibenz[a,h]anthracene
Inhalation Subchronic Reference Concentration Basis		
Inhalation Subchronic Reference Concentration Confidence Level		
Inhalation Subchronic Reference Concentration Critical Effect		
Inhalation Subchronic Reference Concentration Modifying Factor		
Inhalation Subchronic Reference Concentration Notes		
Inhalation Subchronic Reference Concentration Route		
Inhalation Subchronic Reference Concentration Species		
Inhalation Subchronic Reference Concentration Study Date		
Inhalation Subchronic Reference Concentration Target Organ		
Inhalation Subchronic Reference Concentration Study Duration		
Inhalation Subchronic Reference Concentration Uncertainty Factor		
Oral Chronic Reference Dose (mg/kg-day)		
Oral Chronic Reference Dose Basis		
Oral Chronic Reference Dose Confidence Level		
Oral Chronic Reference Dose Critical Effect		
Oral Chronic Reference Dose Modifying Factor		
Oral Chronic Reference Dose Notes		
Oral Chronic Reference Dose Route		
Oral Chronic Reference Dose Species		
Oral Chronic Reference Dose Study Date		
Oral Chronic Reference Dose Target Organ		
Oral Chronic Reference Dose Study Duration		
Oral Chronic Reference Dose Uncertainty Factor		
Oral Subchronic Chronic Reference Dose (mg/kg-day)		
Oral Subchronic Reference Dose Basis		

Table A3-1
Chemical Toxicity Data
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene	Dibenz[a,h]anthracene
Oral Subchronic Reference Dose Confidence Level		
Oral Subchronic Reference Dose Critical Effect		
Oral Subchronic Reference Dose Modifying Factor		
Oral Subchronic Reference Dose Notes		
Oral Subchronic Reference Dose Route		
Oral Subchronic Reference Dose Species		
Oral Subchronic Reference Dose Study Date		
Oral Subchronic Reference Dose Target Organ		
Oral Subchronic Reference Dose Study Duration		
Oral Subchronic Reference Dose Uncertainty Factor		
Oral Slope Factor (mg/kg-day)^-1	0.1	1
Oral Slope EPA Cancer Classification	Carcinogenic to humans	Carcinogenic to humans
Oral Slope Factor Method	NA	NA
Oral Slope Factor Notes	EPA/RPF	EPA/RPF
Oral Slope Factor Route	NA	NA
Oral Slope Factor Species	NA	NA
Oral Slope Factor Study Date	NA	NA
Oral Slope Factor Target Organ	NA	NA
Oral Slope Factor Treatment Duration	NA	NA
Oral Slope Factor Tumor Type	NA	NA

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Chemical Abstracts Service (CAS) Number	7440-38-2
Acentric Factor	-0.368
Acentric Factor Reference	YAWS
State at Ambient Soil Temperature	solid
State at Ambient Soil Temperature Reference	Cutoff established by apparent MP value presented in SSL Table 4. Physical State of Organic SSL Chemicals
Beef Transfer Coefficient (day/kg)	0.002
BTF Reference	Baes, C. F., III, Sharp, R. D., Sjoreen, A. L., and Shor, R. W. 1984. A Review and Analysis of Parameters for Assessing Transpor
Boiling Point (degree Celsius)	615
BP Reference	PHYSPROP
Soil-to-Dry Plant Uptake	0.04
BV Dry Reference	Baes, C. F., III, Sharp, R. D., Sjoreen, A. L., and Shor, R. W. 1984. A Review and Analysis of Parameters for Assessing Transpor
Soil-to-Wet Plant Uptake	0.01
BV Wet Reference	Baes, C. F., III, Sharp, R. D., Sjoreen, A. L., and Shor, R. W. 1984. A Review and Analysis of Parameters for Assessing Transpor
Compressibility Factor	0.056
Compressibility Factor Reference	YAWS
Density (g/cm^3)	4.9
Density Reference	CRC
Critical Density	2.1406
Critical Density Reference	YAWS
Diffusivity in Air (cm^2/s)	
Dia Reference	
Diffusivity in Water (cm^2/s)	
Diw Reference	
RAGSE Effective Predictive Domain	1
RAGSE Effective Predictive Domain Reference	Calculated from RAGSE limits
RAGS Part E Fraction of Chemical that is Ultimately Absorbed	1
RAGS Part E Fraction of Chemical that is Ultimately Absorbed Reference	Calculated from RAGSE limits
Fish Bioavailability Factor (L/kg)	
BAF Reference	
Fish Bioconcentration Factor (L/kg)	300
BCF Reference	User's Manual for RESRAD Version 6, ANL/EAD-4, 2001

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Flashpoint (degree Celsius)	
Flashpoint Reference	
Enthalpy of Vaporization at 25 degrees C	
Enthalpy of Vaporization at 25 degrees C Reference	
Enthalpy of Vaporization at Normal Boiling Point	7627.868064
Enthalpy of Vaporization at Normal Boiling Point Reference	YAWS
Unitless Henry's Law Constant	
H` Reference	
Henry's Law Constant	
Henry's Law Constant Reference	
Autoignition Temperature (degree Celsius)	
Autoignition Temperature Reference	
Soil-Water Partition Coefficient (cm^3/g)	29
Kd Reference	SSL
Organic Carbon Partition Coefficient (L/kg)	
Koc Reference	
Skin Permeability Constant (cm/hr)	0.001
Kp Reference	RAGSE
Lower Explosive Limit (percent by volume)	
LEL Reference	
Log Fish Bioavailability Factor	
Log BAF Reference	
Log Fish Bioconcentration Factor	
Log BCF Reference	
Log Octanol Air Partition Coefficient	
Log Octanol Air Partition Coefficient Reference	
Log Organic Carbon Partition Coefficient	
Log Organic Carbon Partition Coefficient Reference	
Log Octanol Water Partition Coefficient (unitless)	
Log Octanol Water Partition Coefficient Reference	
Dairy Transfer Coefficient (day/kg)	0.00006
Dairy BTF Reference	Baes, C. F., III, Sharp, R. D., Sjoreen, A. L., and Shor, R. W. 1984. A Review and Analysis of Parameters for Assessing Transpor
Melting Point (degree Celsius)	270
MP Reference	CRC

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Arsenic, Inorganic
Molecular Weight (g/mol)	74.922
MW Reference	CRC
Critical Pressure (Mpa)	22.3
Critical Pressure Reference	CRC
RAGS Part E Dermal Absorption Factor	0.03
RAGS Part E ABS Reference	RAGSE
RAGS Part E Gastrointestinal Absorption Factor	1
RAGS Part E GIABS Reference	RAGSE
Relative Bioavailability (RBA)	0.6
RBA Reference	OSWER Directive 9200.1-113
Water Solubility (mg/L)	
S Reference	
Critical Temperature (K)	1673
Critical Temperature (K) Reference	CRC
Upper Explosive Limit (percent by volume)	
UEL Reference	
Critical Volume (cubic centimeters per mol)	35
Critical Volume Reference	CRC
Vapor Pressure (mm Hg)	
Vapor Pressure Reference	

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Chemical Abstracts Service (CAS) Number	50-32-8
Acentric Factor	
Acentric Factor Reference	
State at Ambient Soil Temperature	solid
State at Ambient Soil Temperature Reference	Cutoff established by apparent MP value presented in SSL Table 4. Physical State of Organic SSL Chemicals
Beef Transfer Coefficient (day/kg)	0.033724072
BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Boiling Point (degree Celsius)	495
BP Reference	PHYSPROP
Soil-to-Dry Plant Uptake	0.010716692
BV Dry Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Soil-to-Wet Plant Uptake	0.002143338
BV Wet Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Compressibility Factor	
Compressibility Factor Reference	
Density (g/cm^3)	1.351
Density Reference	IRIS Profile
Critical Density	
Critical Density Reference	
Diffusivity in Air (cm^2/s)	0.025476438
Dia Reference	WATER9 (U.S. EPA, 2001)
Diffusivity in Water (cm^2/s)	6.58406E-06
Diw Reference	WATER9 (U.S. EPA, 2001)
RAGSE Effective Predictive Domain	0
RAGSE Effective Predictive Domain Reference	Calculated from RAGSE limits
RAGS Part E Fraction of Chemical that is Ultimately Absorbed	1
RAGS Part E Fraction of Chemical that is Ultimately Absorbed Reference	RAGSE
Fish Bioavailability Factor (L/kg)	395.5958
BAF Reference	EPI
Fish Bioconcentration Factor (L/kg)	5147
BCF Reference	EPI

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Flashpoint (degree Celsius)	
Flashpoint Reference	
Enthalpy of Vaporization at 25 degrees C	
Enthalpy of Vaporization at 25 degrees C Reference	
Enthalpy of Vaporization at Normal Boiling Point	14412.52389
Enthalpy of Vaporization at Normal Boiling Point Reference	YAWS
Unitless Henry's Law Constant	1.86836E-05
H` Reference	PHYSPROP
Henry's Law Constant	0.000000457
Henry's Law Constant Reference	PHYSPROP
Autoignition Temperature (degree Celsius)	
Autoignition Temperature Reference	
Soil-Water Partition Coefficient (cm^3/g)	
Kd Reference	
Organic Carbon Partition Coefficient (L/kg)	587400
Koc Reference	EPI
Skin Permeability Constant (cm/hr)	0.713
Kp Reference	EPI
Lower Explosive Limit (percent by volume)	
LEL Reference	
Log Fish Bioavailability Factor	2.5973
Log BAF Reference	EPI
Log Fish Bioconcentration Factor	3.71
Log BCF Reference	EPI
Log Octanol Air Partition Coefficient	10.859
Log Octanol Air Partition Coefficient Reference	EPI
Log Organic Carbon Partition Coefficient	5.7689
Log Organic Carbon Partition Coefficient Reference	EPI
Log Octanol Water Partition Coefficient (unitless)	6.13
Log Octanol Water Partition Coefficient Reference	PHYSPROP
Dairy Transfer Coefficient (day/kg)	0.010656807
Dairy BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Melting Point (degree Celsius)	176.5
MP Reference	PHYSPROP

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[a]pyrene
Molecular Weight (g/mol)	252.32
MW Reference	PHYSPROP
Critical Pressure (Mpa)	
Critical Pressure Reference	
RAGS Part E Dermal Absorption Factor	0.13
RAGS Part E ABS Reference	RAGSE
RAGS Part E Gastrointestinal Absorption Factor	1
RAGS Part E GIABS Reference	RAGSE
Relative Bioavailability (RBA)	1
RBA Reference	
Water Solubility (mg/L)	0.00162
S Reference	PHYSPROP
Critical Temperature (K)	969.27
Critical Temperature (K) Reference	EPA 2001 Fact Sheet
Upper Explosive Limit (percent by volume)	
UEL Reference	
Critical Volume (cubic centimeters per mol)	
Critical Volume Reference	
Vapor Pressure (mm Hg)	5.49E-09
Vapor Pressure Reference	EPI

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene
Chemical Abstracts Service (CAS) Number	205-99-2
Acentric Factor	
Acentric Factor Reference	
State at Ambient Soil Temperature	solid
State at Ambient Soil Temperature Reference	Cutoff established by apparent MP value presented in SSL Table 4. Physical State of Organic SSL Chemicals
Beef Transfer Coefficient (day/kg)	0.01506399
BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Boiling Point (degree Celsius)	442.75
BP Reference	EPI
Soil-to-Dry Plant Uptake	0.017102545
BV Dry Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Soil-to-Wet Plant Uptake	0.003420509
BV Wet Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Compressibility Factor	
Compressibility Factor Reference	
Density (g/cm^3)	1.3
Density Reference	ChemSrc
Critical Density	
Critical Density Reference	
Diffusivity in Air (cm^2/s)	0.025022432
Dia Reference	WATER9 (U.S. EPA, 2001)
Diffusivity in Water (cm^2/s)	6.43379E-06
Diw Reference	WATER9 (U.S. EPA, 2001)
RAGSE Effective Predictive Domain	0
RAGSE Effective Predictive Domain Reference	Calculated from RAGSE limits
RAGS Part E Fraction of Chemical that is Ultimately Absorbed	1
RAGS Part E Fraction of Chemical that is Ultimately Absorbed Reference	RAGSE
Fish Bioavailability Factor (L/kg)	1165.0775
BAF Reference	EPI
Fish Bioconcentration Factor (L/kg)	3024
BCF Reference	EPI

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene
Flashpoint (degree Celsius)	
Flashpoint Reference	
Enthalpy of Vaporization at 25 degrees C	
Enthalpy of Vaporization at 25 degrees C Reference	
Enthalpy of Vaporization at Normal Boiling Point	14412.52389
Enthalpy of Vaporization at Normal Boiling Point Reference	YAWS
Unitless Henry's Law Constant	2.68602E-05
H` Reference	PHYSPROP
Henry's Law Constant	0.000000657
Henry's Law Constant Reference	PHYSPROP
Autoignition Temperature (degree Celsius)	
Autoignition Temperature Reference	
Soil-Water Partition Coefficient (cm^3/g)	
Kd Reference	
Organic Carbon Partition Coefficient (L/kg)	599400
Koc Reference	EPI
Skin Permeability Constant (cm/hr)	0.417
Kp Reference	EPI
Lower Explosive Limit (percent by volume)	
LEL Reference	
Log Fish Bioavailability Factor	3.0664
Log BAF Reference	EPI
Log Fish Bioconcentration Factor	3.48
Log BCF Reference	EPI
Log Octanol Air Partition Coefficient	10.351
Log Octanol Air Partition Coefficient Reference	EPI
Log Organic Carbon Partition Coefficient	5.7777
Log Organic Carbon Partition Coefficient Reference	EPI
Log Octanol Water Partition Coefficient (unitless)	5.78
Log Octanol Water Partition Coefficient Reference	PHYSPROP
Dairy Transfer Coefficient (day/kg)	0.004760221
Dairy BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Melting Point (degree Celsius)	168
MP Reference	PHYSPROP

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Benzo[b]fluoranthene
Molecular Weight (g/mol)	252.32
MW Reference	PHYSPROP
Critical Pressure (Mpa)	
Critical Pressure Reference	
RAGS Part E Dermal Absorption Factor	0.13
RAGS Part E ABS Reference	RAGSE
RAGS Part E Gastrointestinal Absorption Factor	1
RAGS Part E GIABS Reference	RAGSE
Relative Bioavailability (RBA)	1
RBA Reference	
Water Solubility (mg/L)	0.0015
S Reference	PHYSPROP
Critical Temperature (K)	969.27
Critical Temperature (K) Reference	EPA 2001 Fact Sheet
Upper Explosive Limit (percent by volume)	
UEL Reference	
Critical Volume (cubic centimeters per mol)	
Critical Volume Reference	
Vapor Pressure (mm Hg)	0.0000005
Vapor Pressure Reference	PHYSPROP

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Dibenz[a,h]anthracene
Chemical Abstracts Service (CAS) Number	53-70-3
Acentric Factor	
Acentric Factor Reference	
State at Ambient Soil Temperature	solid
State at Ambient Soil Temperature Reference	Cutoff established by apparent MP value presented in SSL Table 4. Physical State of Organic SSL Chemicals
Beef Transfer Coefficient (day/kg)	0.140585331
BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Boiling Point (degree Celsius)	524
BP Reference	PHYSPROP
Soil-to-Dry Plant Uptake	0.004682316
BV Dry Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Soil-to-Wet Plant Uptake	0.000936463
BV Wet Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Compressibility Factor	
Compressibility Factor Reference	
Density (g/cm^3)	1.282
Density Reference	PubChem
Critical Density	
Critical Density Reference	
Diffusivity in Air (cm^2/s)	0.023619333
Dia Reference	WATER9 (U.S. EPA, 2001)
Diffusivity in Water (cm^2/s)	6.01507E-06
Diw Reference	WATER9 (U.S. EPA, 2001)
RAGSE Effective Predictive Domain	0
RAGSE Effective Predictive Domain Reference	Calculated from RAGSE limits
RAGS Part E Fraction of Chemical that is Ultimately Absorbed	0.6
RAGS Part E Fraction of Chemical that is Ultimately Absorbed Reference	RAGSE
Fish Bioavailability Factor (L/kg)	2862.5822
BAF Reference	EPI
Fish Bioconcentration Factor (L/kg)	9596
BCF Reference	EPI

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Dibenz[a,h]anthracene
Flashpoint (degree Celsius)	
Flashpoint Reference	
Enthalpy of Vaporization at 25 degrees C	
Enthalpy of Vaporization at 25 degrees C Reference	
Enthalpy of Vaporization at Normal Boiling Point	17341.30018
Enthalpy of Vaporization at Normal Boiling Point Reference	YAWS
Unitless Henry's Law Constant	5.76451E-06
H` Reference	EPI
Henry's Law Constant	0.000000141
Henry's Law Constant Reference	EPI
Autoignition Temperature (degree Celsius)	
Autoignition Temperature Reference	
Soil-Water Partition Coefficient (cm^3/g)	
Kd Reference	
Organic Carbon Partition Coefficient (L/kg)	1912000
Koc Reference	EPI
Skin Permeability Constant (cm/hr)	0.953
Kp Reference	EPI
Lower Explosive Limit (percent by volume)	
LEL Reference	
Log Fish Bioavailability Factor	3.4568
Log BAF Reference	EPI
Log Fish Bioconcentration Factor	3.98
Log BCF Reference	EPI
Log Octanol Air Partition Coefficient	11.779
Log Octanol Air Partition Coefficient Reference	EPI
Log Organic Carbon Partition Coefficient	6.2814
Log Organic Carbon Partition Coefficient Reference	EPI
Log Octanol Water Partition Coefficient (unitless)	6.75
Log Octanol Water Partition Coefficient Reference	PHYSPROP
Dairy Transfer Coefficient (day/kg)	0.044424965
Dairy BTF Reference	McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463
Melting Point (degree Celsius)	269.5
MP Reference	PHYSPROP

Table A3-2
Chemical-Specific Parameters
Human Health Risk Assessment
Cheat River Rail-Trail Corridor, West Virginia

Chemical	Dibenz[a,h]anthracene
Molecular Weight (g/mol)	278.36
MW Reference	PHYSPROP
Critical Pressure (Mpa)	
Critical Pressure Reference	
RAGS Part E Dermal Absorption Factor	0.13
RAGS Part E ABS Reference	RAGSE
RAGS Part E Gastrointestinal Absorption Factor	1
RAGS Part E GIABS Reference	RAGSE
Relative Bioavailability (RBA)	1
RBA Reference	
Water Solubility (mg/L)	0.00249
S Reference	PHYSPROP
Critical Temperature (K)	990.41
Critical Temperature (K) Reference	EPA 2001 Fact Sheet
Upper Explosive Limit (percent by volume)	
UEL Reference	
Critical Volume (cubic centimeters per mol)	
Critical Volume Reference	
Vapor Pressure (mm Hg)	9.55E-10
Vapor Pressure Reference	EPI

Data from United States Department of Energy Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database outputs (May 2022)